# ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABUS

# ARTIFICIAL INTEL LIGENCE & MACHINE LEARNING

## COURSE STRUCTURE AND SYLLABUS (R20)

***(Applicable for batches admitted from 2020-2021)***

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

**(Autonomous)**

**Approved by AICTE, Permanently Affiliated to JNTUK,**

**NAAC Accredited with 'A' Grade, ISO 9001:2015 Certified**

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh–522508

## About Institute

Vasireddy Venkatadri Institute of Technology (VVIT) was established in the year 2007, with an intake of 240 students in four B.Tech. programs under Social Educational Trust in Nambur village, Guntur, AP, by Er. Vasireddy Vidya Sagar. It is located strategically between Guntur and Vijayawada in the capital region of Amravati, AP. In a short span of ten years, with an annual intake capacity of 1260 and 81 students into B.Tech. (CE, EEE, ME, ECE, CSE, IT, CSM, AIM, CSO, CIC and AID) and M. Tech (CSE, VLSI&ES, PEED, MD, SE) programs respectively, today almost 4000 students, 345 teaching staff and 225 non-teaching staff strive to fulfill the vision of VVIT.

VVIT has emerged as one of the top ten Engineering Colleges from the 200 engineering colleges affiliated to JNTU Kakinada. The Institute signed MOU's with Industry and Training & Placement Companies like Infosys, Tech Mahindra, Social Agro, Efftronics, EPAM, Virtusa, CTS, AMCAT and Cocubes. Centre of Excellence (CoE) by Siemens India was established in the year 2016 by APSSDC to promote Industry Institute interface and strengthen employability skills in students, Google Inc. USA for establishing Google Code labs, University Innovative Fellowship (UIF) program by Stanford University USA and VDC established by Northeastern University

On achieving permanent affiliation to JNTUK, Kakinada, NAAC 'A" grade certification (CGPA 3.09) and B. Tech programs (CE, EEE, ME, ECE, CSE, IT) accredited by NBA, VVIT has set its sight on centrally funded research projects with 10 completed and 6 running DST projects and consultancy service from other departments. VVIT as part of its commitment to research, has published 13 patents, 16 books and nearly 690 journal papers and also has a 'Research Centre affiliated to JNTUK'.

## Institute Vision

To impart quality education through exploration and experimentation and generate socially conscious engineers, embedding ethics and values, for the advancement in science and technology.

## Institute Mission

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve over all development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

## Department Vision

Providing quality education to enable the generation of socially conscious software engineers who can contribute to the advancement in the field of computer science and engineering.

## Department Mission

- To equip the graduates with the knowledge and skills required to enable them to be industry ready.
- To train socially responsible, disciplined engineers who work with good leadership skills and can contribute for nation building.
- To make our graduates proficient in cutting edge technologies through student centric teaching-learning process and empower them to contribute significantly to the software industry
- To shape the department into a center of academic and research excellence

## Program Educational Objectives (PEOs)

**PEO 1 :** To provide the graduates with **solid foundation** in Computer Science and Engineering along with the fundamentals of Mathematics and Sciences with a view to impart in them **high quality technical skills** like **modelling, analysing, designing, programming and implementation** with **global competence** and helps the graduates for **life-long learning**.

**PEO 2 :** To prepare and motivate graduates with **recent technological developments related to core subjects** like Programming, Databases, Design of Compilers and Network Security aspects and future technologies so as to contribute effectively for Research & Development by participating in professional activities like publishing and seeking copy rights.

**PEO 3 :** To train graduates to choose a **decent career option either in high degree of employability/Entrepreneur or, in higher education** by empowering students with ethical administrative acumen, ability to handle critical situations and training to excel in competitive examinations.

**PEO 4 :** To train the graduates to have basic **interpersonal skills** and **sense of social responsibility** that paves them a way to become good team members and leaders.

## Program Outcomes (POs)

**PO1 : Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2 : Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3 : Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4 : Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5 : Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6 : The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7 : Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8 : Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9 : Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10 : Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11 : Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12 : Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Program Specific Outcomes (PSOs)

**PSO-1: Professional Skills:** The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

**PSO-2: Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and a zest for higher studies/employability in the field of Computer Science & Engineering.

# ACADEMIC REGULATIONS (R20) FOR B. TECH (REGULAR)

**Applicable for the students of B.Tech. from the Academic Year 2020 – 21 onwards**

### 1.Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

- Pursues a course of study in not less than four and not more than eight academic years.
- After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.
- Registers for 160 credits and must secure all the 160 credits.
- A student shall be eligible for the award of **B.Tech. degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.**

2. **Courses of Study:** The following courses of study are offered at present as specializations for the B. Tech. Courses

| S. No. | Branch | Branch Short Form | Branch Code |
|---|---|---|---|
| 1 | Civil Engineering | CIV | 01 |
| 2 | Electrical and Electronics Engineering | EEE | 02 |
| 3 | Mechanical Engineering | MEC | 03 |
| 4 | Electronics and Communication Engineering | ECE | 04 |
| 5 | Computer Science and Engineering | CSE | 05 |
| 6 | Information Technology | INF | 12 |
| 7 | CS (Artificial Intelligence and Machine Learning) | CSM | 42 |
| 8 | CSE (Internet of Things and Cyber Security with Block Chain Technology) | CIC | 47 |
| 9 | CSE (Internet of Things) | CSO | 49 |
| 10 | Artificial Intelligence and Data Science | AID | 54 |
| 11 | Artificial Intelligence and Machine Learning | AIM | 61 |

3. **Medium of Instruction:** The medium of instruction of the entire B. Tech. under-graduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

4. **Admissions:** Admission to the B. Tech Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or on the basis of any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

5. **Structure of the Undergraduate Engineering program:** Every course of B. Tech. Program shall be placed in one of the nine categories as listed in table below:

| S.No. | Category | Breakup of Credits |
|---|---|---|
| 1 | Humanities and social science including Management courses | 10.5 - 12 |
| 2 | Basic Science courses | 21 - 25 |
| 3 | Engineering science courses | 24 |
| 4 | Professional core Courses | 48 - 51 |
| 5 | Open Elective Courses | 12 - 18 |
| 6 | Professional Elective Courses | 15 - 18 |
| 7 | Internship, seminar, project wok | 15 – 16.5 |
| 8 | Mandatory courses | NC |
| 9 | Skill Oriented Courses | ---- |
| | Total Credits | 160 |

** Breakup of Credits based on AICTE /APSCHE

Assigning of Credits

- Hr. Lecture (L) per week - 1 credit

- Hr. Tutorial (T) per week - 1 credit
- Hr. Practical (P) per week - 0.5 credits

## 6. Programme Pattern

i. Total duration of the of B. Tech (Regular) Programme is four (three for lateral entry) academic years

ii. Each Academic year of study is divided in to two semesters.

iii. Minimum number of instruction days in each semester is 90.

iv. Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

v. The total credits for the Programme are 160.

vi. A three-week induction program is mandatory for all first year UG students (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc.,) and shall be conducted as per AICTE/UGC/APSCHE guidelines.

vii. Student is introduced to "Choice Based Credit System (CBCS)".

viii. A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

ix. A student has to register for all courses in a semester.

x. All the registered credits will be considered for the calculation of final CGPA.

xi. Each semester has - Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

xii. A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.

xiii. All students shall be mandatorily registered for NCC/NSS activities. A student will be required to participate in an activity for two hours in a week during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

xiv. Courses like Environmental Sciences, Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

xv. College shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies / GATE / other competitive exams etc.

xvi. Departments may swap some of the courses between first and second semesters to balance the work load.

xvii. The concerned Board of studies can assign tutorial hours to such courses wherever it is necessary, but without change in the total number of credits already assigned for semester.

**8. Registration for Courses**

i. The college shall invite registration forms from the students at the beginning of the semester for the registration for courses each semester. The registration process shall be closed within one week. If any student wishes to withdraw the registration, he/she shall submit a letter to the principal through the class teacher/instructor and HOD. The principal shall communicate the registration and withdraw details courses of each student in a consolidated form to the college examination section and University without fail.

ii. There are four open electives in each branch. All Open Electives are offered to students of all branches in general. A student shall choose an open elective, by consulting the HOD/advisor, from the list in such a manner that he/she has not studied the same course in any form during the Programme. The college shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

iii. A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the programme. Students are advised to register for only for minimum 12 weeks in duration MOOCs courses. Student has to pursue and acquire a certificate for a MOOC course only from the SWAY/NPTE through online with the approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester. The details of the MOOCs courses registered by the students shall be submitted to the University examination center as well as college examination center. The Head of the Department shall appoint a mentor for each of the MOOC subjects registered by the students to monitor the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

iv. Two summer internships each with a minimum of six weeks duration shall be mandatorily done/completed respectively at the end of second and third years (during summer vacations). The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. After completing the summer internship, the students shall register in the immediate respective odd semester and it will be evaluated at the end of the semester as per norms of the autonomy. The student has to produce the summer

internship satisfactory report and certificate taken from the organization to be considered for evaluation. The College shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

v. In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

vi. Curricular Framework for Skill oriented courses

a. There are five (05) skill-oriented courses shall be offered during III to VII semesters and students must register and pass the courses successfully.

b. For skill oriented/skill advanced course, one theory and 2 practical hours (1-0-2) or two theory hours (2-0-0) may be allotted as per the decision of concerned BOS.

c. Out of the five skill courses; (i) two shall be skill-oriented courses from the same domain and shall be completed in second year (ii) Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining two shall be skill-advanced courses either from the same domain or job-oriented skill courses, which can be of inter disciplinary nature.

d. Students may register the interdisciplinary job-oriented skill courses based on the prerequisites and eligibility in consultation with HoD of the college.

e. The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies. However, the department has to assign mentors in the college to monitor the performance of the students.

f. If a student chooses to take a certificate course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the department, then the department shall mark overall attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate. However, the student is deemed to have fulfilled the attendance requirement of the course, if the external agency issues a certificate with satisfactory condition. If the certificate issued by external agency is marked with unsatisfactory condition, then the student shall repeat the course either in the college or at external agency. The credits will be awarded to the student upon producing the successful course completion certificate from the agency/professional bodies and after passing in the viva-voce examination conducted at college as per BoS norms at the end of the semester.

**9. Attendance Requirements**:

i. A student is eligible to write the semester-end examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

ii. Shortage of Attendance below 65% in aggregate shall in NO case be condoned. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end semester examination of that class and their registration shall stand cancelled.

iii. Condonation for shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iv. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

v. A student will be promoted to the next semester if he satisfies the(a) attendance requirement of the present semester and (b) minimum required credits (from V$^{th}$ Semester onwards).

vi. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vii. For induction programme attendance shall be maintained as per AICTE norms.

viii. For non-credit mandatory courses the students shall maintain the attendance similar to credit courses.

**10. Evaluation-Distribution and Weightage of marks**

Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council of the institute from time to time.

i. A student is deemed to have satisfied the minimum academic requirements if he/she has earned the credits allotted to each theory/practical design/drawing subject/ project etc. by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the total of the internal marks and end semester examination marks together.

ii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

iii. **Distribution and Weightage of marks:** The assessment of the student's performance in each course will be based on Continuous Internal Evaluation (CIE) and Semester-End Examination (SEE). The performance of a student in each semester shall be evaluated subject–wise with a maximum of 100 marks for theory subject, 50 marks for practical subject/Mini Project/Internship/Industrial Training/ Skill Development Programmes/Research Project, and 200 marks for end Project Work.

**iv. Guide lines for Continuous Internal Evaluation (CIE)**

a. For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (ii) one descriptive examination (iii) one assignment and (iv) one Subject Seminar. The online examination (objective) shall be 10 marks with duration of 20 minutes, descriptive examination shall be for 10 marks with a duration of 1 hour 30 minutes, assignment test shall be 5 marks with duration of 50 minutes (Open book system with questions of L4 standard on Bloom's scale) and Subject Seminar 5 marks.

b. The first online examination (objective) is set with 20 multiple choice questions for 10 marks (20 questions x 1/2 marks) from first two and half units (50% of the syllabus).

c. The descriptive examination is set with 3 full questions for 10 marks each from first two and half units (50% of the syllabus), the student has to answer all questions.

d. The Assignment Test from first two and half units conducted for 20 Marks and will be scaled down to 5 Marks. The test is open book system and the duration of the exam is 50 minutes. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.

e. For the subject seminar 5 marks, each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.

f. For the subject having design and / or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests).

In the similar lines, the mid-2 examinations shall be conducted on the rest of the syllabus.

f. For practical subjects there shall be continuous evaluation during the semester for 15 marks. The internal 15 marks shall be awarded as follows: day to day work 5 marks, record 5 marks and the remaining 5 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.

g. The mid marks submitted to the examination section shall be displayed in the concerned department notice boards for the benefit of the students. If any discrepancy found in the displayed Mid marks, it shall be brought to the notice of examination section within two working days from the date of display.

h. Internal marks can be calculated with 80% weightage for better of the two mids and 20% Weightage for another mid exam.

Example:

Mid-1 marks = Marks secured in (online examination-1+descriptive examination-1 +one assignment-1 + Seminar-1)

Mid-2 marks = Marks secured in (online examination-2+descriptive examination-2 +one assignment-2 + Seminar-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

v. **Semester End Examinations Evaluation:**

a. The semester end examinations for theory subjects will be conducted autonomous examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one 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.

b. For practical subjects shall be conducted for 35 marks by the teacher concerned and external examiner appointed by Chief superintendent/ Controller of Examinations (CoE), VVIT. All the laboratory records and internal test papers shall be preserved in respective departments as per autonomous norms and shall be produced to the Committees as and when they ask for.

c. Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme. Students shall pursue this internship during summer vacation just before its offering as per course structure. The minimum duration of this course shall be at least 6 weeks. The student shall register for the internship as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the academic regulations. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner appointed by Chief superintendent/ CoE; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% weightages respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the examination section.

d. The job-oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the list skills learned. If the student completes job-oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external (appointed by the Chief superintendent/ CoE) and internal examiner (course instructor or mentor). There are no internal marks for the job-oriented skill courses.

e. Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc. non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the department internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

f. Procedure for Conduct and Evaluation of MOOC: There shall be a Discipline

Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL/etc., through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM/NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be passed.

g. Major Project (Project - Project work, seminar and internship in industry): In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner. Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the Chief superintendent/ CoE and is evaluated for 140 marks.

vi. Recounting/ Revaluation/ Revaluation by Challenge in the End Semester Examination: A student can request for recounting/ revaluation/ revaluation by challenge of his/her answer book on payment of a prescribed fee as per autonomous norms.

vii. Supplementary Examinations: A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the examination section.

viii. Malpractices in Examinations: Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the academic council.

ix. If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

**11. Promotion Rules**:

i. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

ii. A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year - II semester.

iii. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year - II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

12. **Course Pattern**

i. The entire course of study is for four academic years; all years are on semester pattern.

ii. A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

iii. When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

**13.Grading**:

The grade points and letter grade will be awarded to each course based on students' performance as per the grading system shown in the following Table.

| % of Marks | Letter Grade | Level | Grade Points |
|---|---|---|---|
| ≥ 90 | **A+** | Outstanding | 10 |
| 80 to 89 | **A** | Excellent | 9 |
| 70 to 79 | **B** | Very Good | 8 |
| 60 to 69 | **C** | Good | 7 |
| 50 to 59 | **D** | Fair | 6 |
| 40 to 49 | **E** | Satisfactory | 5 |
| <40 | **F** | Fail | 0 |
| ABSENT | **Ab** | Absent | 0 |

**14. Computation of SGPA and CGPA**

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$SGPA(S_i) = \Sigma (C_i \times G_i) / \Sigma C_i$

where, $C_i$ is the number of credits of the $i^{th}$ subject and $G_i$ is the grade point scored by the student in the $i^{th}$course

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$CGPA = \Sigma (C_i \times Si) / \Sigma Ci$

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

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

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

vi. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E and F.

vii. As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

Equivalent Percentage = (CGPA – 0.75) x 10

viii. Illustration of Computation of SGPA and CGPA

**Illustration for SGPA:** Let us assume there are 6 subjects in a semester. The grades obtained as follows:

| Course | Credit | Grade Obtained | Grade point | Credit x Grade Point |
|---|---|---|---|---|
| Subject 1 | 3 | B | 8 | 3 X 8 = 24 |
| Subject 2 | 4 | C | 7 | 4 X 7 = 28 |
| Subject 3 | 3 | D | 6 | 3 X 6 = 18 |
| Subject 4 | 3 | $A^+$ | 10 | 3 X 10 = 30 |
| Subject 5 | 3 | E | 5 | 3 X 5 = 15 |
| Subject 6 | 4 | D | 6 | 4 X 6 = 24 |
| | 20 | | | 139 |

Thus, SGPA ($S_i$) =139/20 =6.95=6.9 (approx.)

**Illustration for CGPA:**

| | **Sem-1** | **Sem-2** | **Sem-3** | **Sem-4** | **Sem-5** | **Sem-6** | **Sem-7** | **Sem-8** |
|---|---|---|---|---|---|---|---|---|
| **Credits** | 20 | 22 | 25 | 26 | 26 | 25 | 21 | 23 |
| **SGPA** | 6.9 | 7.8 | 5.6 | 6.0 | 6.3 | 8.0 | 6.4 | 7.5 |

$$\boldsymbol{CGPA} = \frac{\mathbf{20\ X6.9 + 22X7.8 + 25X5.6 + 26X6.0 + 26X6.3 + 25X8.0 + 21X6.4 + 23X7.5}}{\mathbf{188}}$$

$$= \frac{\mathbf{1276.3}}{\mathbf{188}} = \mathbf{6.78}$$

**15. Award of Class**:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. degree, he/she shall be placed in one of the following:

| Class Awarded | CGPA to be secured |
|---|---|
| First Class with distinction* | ≥7.5 |
| First Class | ≥6.5 &<7.5 |
| Second Class | ≥5.5 &<6.5 |
| Pass Class | ≥4 &<5.5 |
| Fail | <4 |

* Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates

The students who are approved for break in study for entrepreneurships / startups will also be considered for award of first class with distinction

For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall been considered

**16.Gap - Year**:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

**17. Transitory Regulations**

A candidate, who is detained or discontinued a semester, on re-admission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by Board of Studies and ratified by Academic Council.

**18.Curricular Framework for Honors Programme**

i. Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

ii. A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA up to the end of 2$^{nd}$ semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4$^{th}$ semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

iii. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

iv. In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

v. Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

vi. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

vii. The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

viii. Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

ix. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.

x. The concerned BoS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

xi. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech. degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

**19. Curricular Framework for Minor Programme**

i. Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

ii. Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech. Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

iii. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc., or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

iv. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

v. There shall be no limit on the number of programs offered under Minor. The college can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

vi. The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vii. A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) up to the end of 2$^{nd}$ semester without any history of backlogs. It is expected that the 3$^{rd}$ semester results may be announced after the commencement of the 4$^{th}$ semester. If a student fails to acquire 8 SGPA up to 3$^{rd}$ semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

viii. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 160 credits).

ix. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

x. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the University/academic council.

xi. Student can opt for the industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

xii. A committee should be formed at the level of college / department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

xiii. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript or None of the courses done under the dropped Minor will be shown in the transcript.

xiv. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xv. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

**20. Industrial Collaborations (Case Study)**

Institution-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge. It involves the collaboration of Industries and Universities in various areas that would foster the research ecosystem in the country and enhance growth of economy, industry and society at large.

The Institutions are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the Institutions can plan to have industrial collaborations in designing the minor tracks and to develop the content and certificate programs. Industry giants such as IBM, TCS, WIPRO etc., may be contacted to develop such collaborations. The Institutions shall also explore the possibilities of collaborations with major industries in the core sectors and professional bodies to create specialized domain skills.

21. **Amendments to Regulations:** The college may from time-to-time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies with the approval of Academic Council and Governing Body of the college.

22. **Transferred Students:** The students seeking transfer to VVIT from various Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by the Academic Council. Only the internal marks obtained in the previous institution will be considered for evaluation of failed subjects.

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## ACADEMIC REGULATIONS (R20) FOR B. TECH.

## (LATERAL ENTRY SCHEME)

Applicable for the students admitted into II-year B. Tech. from the Academic Year 2021-22 onwards

**1. Award of B. Tech. Degree:** A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years.
- The candidate shall register for 121 credits and secure all the 121 credits.
- A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 121 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

**2.** The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech Lateral Entry Students.

**3. Promotion Rule**

- A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

**4. Award of Class**

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

| Class Awarded | CGPA to be secured |
|---|---|
| First Class with distinction* | ≥7.5 |
| First Class | ≥6.5 &<7.5 |
| Second Class | ≥5.5 &<6.5 |
| Pass Class | ≥4 &<5.5 |
| Fail | <4 |

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

## MALPRACTICE RULES

## DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

| S.No. | Nature of Malpractices/Improper conduct | Punishment |
|---|---|---|
| 1. (a) | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| (b) | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 2. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University. |
| 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 and project work) already appeared |

| | | |
|---|---|---|
| | | and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University 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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of the performance in that subject. |
| 6. | Refuses to obey the orders of the Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. |

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

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

# Ragging

# Prohibition of ragging in educational institutions Act 26 of 1997

## Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

| | Imprisonment upto | | Fine Upto |
|---|---|---|---|
| Teasing, Embarrassing and Humiliation | 6 Months | + | Rs. 1,000/- |
| Assaulting or Using Criminal force or Criminal intimidation | 1 Year | + | Rs. 2,000/- |
| Wrongfully restraining or confining or causing hurt | 2 Years | + | Rs. 5,000/- |
| Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence | 5 Years | + | Rs. 10,000/- |
| Causing death or abetting suicide | 10 Months | + | Rs. 50,000/- |

**In case any emergency call Toll Free No. 1800 425 1288**

**LET US MAKE VVIT A RAGGING FREE CAMPUS**


# ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

**In case any emergency call Toll Free No. 1800 425 1288**
**LET US MAKE VVIT A RAGGING FREE CAMPUS**

# COURSE STRUCTURE

**Definition of Credit (C)**

| | |
|---|---|
| 1 Hour Lecture (L) per week | 1 Credit |
| 1 Hour Tutorial (T) per week | 1 Credit |
| 1 Hour Practical (P) per week | 0.5 Credit |

## Structure of B. Tech program Regulation R20

| S.No. | Category | Code | Suggested Breakup of Credits by AICTE | Suggested Breakup of Credits by APSCHE | Breakup of Credits |
|---|---|---|---|---|---|
| **1** | Humanities and Social Sciences including Management courses | HS | 12 | 10.5 | 10.5 |
| **2** | Basic Science courses | BS | 25 | 21 | 21 |
| **3** | Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc. | ES | 24 | 24 | 22.5 |
| **4** | Professional core courses | PC | 48 | 51 | 52.5 |
| **5** | Professional Elective courses relevant to chosen specialization/ branch | PE | 18 | 15 | 15 |
| **6** | Open subjects – Electives from other technical and /or emerging subjects | OE | 18 | 12 | 12 |
| **7** | Project work, seminar and internship in industry or elsewhere | PR | 15 | 16.5 | 16.5 |
| **8** | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge] | NC | Non-Credit | Non-Credit | Non-Credit |
| **9** | Skill Oriented Courses | SC | -- | 10 | 10 |
| **Total** | | | **160** | **160** | **160** |

## SEMESTER-WISE STRUCTURE OF CURRICULUM

### I Year I Semester

| S No. | Subject Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BS1101 | Mathematics-I | 2 | 1 | 0 | 3 |
| 2 | BS1102 | Applied Chemistry | 3 | 0 | 0 | 3 |
| 3 | ES1101 | Basic Electrical and Electronics Engineering | 2 | 1 | 0 | 3 |
| 4 | ES1102 | Computer Engineering Workshop | 1 | 0 | 4 | 3 |
| 5 | ES1103 | Problem Solving using C | 2 | 1 | 0 | 3 |
| 6 | BS1102L | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 7 | ES1101L | Basic Electrical and Electronics Engineering Lab | 0 | 0 | 3 | 1.5 |
| 8 | ES1102L | Problem Solving using C Lab | 0 | 0 | 3 | 1.5 |
| 9 | VVITLS | Life Skills-1 | 2 | 0 | 0 | 0 |
| | | | | | **Total Credits** | **19.5** |

| Category | | Credits |
|---|---|---|
| BS | Basic Science Courses | 3+3+1.5=7.5 |
| ES | Engineering Science Courses | 3+3+3+1.5+1.5=12 |
| **Total Credits** | | **19.5** |

### I Year II Semester

| S.No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BS1201 | Mathematics – II | 2 | 1 | 0 | 3 |
| 2 | BS1202 | Applied Physics | 2 | 1 | 0 | 3 |
| 3 | HS1201 | Communicative English | 2 | 1 | 0 | 3 |
| 4 | ES1201 | Problem Solving using Python | 2 | 1 | 0 | 3 |
| 5 | ES1202 | Digital Logic Design | 2 | 1 | 0 | 3 |
| 6 | BS1202L | Applied Physics and Virtual Lab | 0 | 0 | 3 | 1.5 |
| 7 | HS1201L | Communicative English Lab | 0 | 0 | 3 | 1.5 |
| 8 | ES1201L | Problem Solving using Python Lab | 0 | 0 | 3 | 1.5 |
| 9 | MC1201 | Environmental Science | 2 | 0 | 0 | 0 |
| 10 | VVITLS | Life Skills-2 | 2 | 0 | 0 | 0 |
| | | | | | **Total** | **19.5** |

| Category | | Credits |
|---|---|---|
| BS | Basic Science Courses | 3+3+1.5=7.5 |
| HS | Humanities and Social Science Courses | 3+1.5=4.5 |
| ES | Engineering Science Courses | 3+3+1.5=7.5 |
| | **Total Credits** | **19.5** |

**II Year I Semester**

| S.No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BS2101 | Mathematics – III | 2 | 1 | 0 | 3 |
| 2 | PC2101 | Mathematical Foundations of Computer Science | 2 | 1 | 0 | 3 |
| 3 | PC2102 | Data Structures | 2 | 1 | 0 | 3 |
| 4 | PC2103 | Java Programming | 2 | 1 | 0 | 3 |
| 5 | PC2104 | Software Engineering | 3 | 0 | 0 | 3 |
| 6 | PC2101L | Data Structures Lab | 0 | 0 | 3 | 1.5 |
| 7 | PC2102L | Java Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | PC2103L | Software Engineering Lab | 0 | 0 | 3 | 1.5 |
| 9 | SOC2101 | Advanced Python Programming | 1 | 0 | 2 | 2 |
| 10 | MC2101 | Essence of Indian Tradition and Knowledge | 2 | 0 | 0 | 0 |
| 11 | VVITLS | Life Skills-3 | 2 | 0 | 0 | 0 |
| | | | | | **Total** | **21.5** |

| Category | | Credits |
|---|---|---|
| BS | Basic Science Courses | 3 |
| PC | Professional core courses | 3+3+3+3+1.5+1.5+1.5=16.5 |
| SOC | Skill Oriented Course | 2 |
| | **Total Credits** | **21.5** |

**II Year II Semester**

| S No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BS2201 | Probability and Statistics | 2 | 1 | 0 | 3 |
| 2 | ES2201 | Computer Organization | 2 | 1 | 0 | 3 |
| 3 | PC2201 | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 4 | PC2202 | Database Management Systems | 2 | 1 | 0 | 3 |
| 5 | PC2203 | Operating Systems | 2 | 1 | 0 | 3 |
| 6 | PC2201L | Artificial Intelligence Lab | 0 | 0 | 3 | 1.5 |
| 7 | PC2202L | Database Management Systems Lab | 0 | 0 | 3 | 1.5 |
| 8 | PC2203L | Operating Systems Lab | 0 | 0 | 3 | 1.5 |
| 9 | SOC2201 | R-Programming | 1 | 0 | 2 | 2 |
| 10 | VVITLS | Life Skills-4 | 2 | 0 | 0 | 0 |
| 11 | | Internship/Community Service Project<br>2 Months (Mandatory) during summer vacation | | | | |
| | | **Total** | | | | **21.5** |
| | | Honors/Minor courses | 3 | 1 | 0 | 4 |

| Category | | Credits |
|---|---|---|
| BS | Basic Science Courses | 3 |
| ES | Engineering Science Courses | 3 |
| PC | Professional core courses | 3+3+3+1.5+1.5+1.5=13.5 |
| SOC | Skill Oriented Course | 2 |
| | **Total Credits** | **21.5** |

**III Year I Semester**

| S.No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | PC3101 | Automata and Compiler Design | 3 | 0 | 0 | 3 |
| 2 | PC3102 | Machine Learning | 2 | 1 | 0 | 3 |
| 3 | PC3103 | Computer Networks | 2 | 1 | 0 | 3 |
| 4 | OE3101 | Introduction to Image Processing | 3 | 0 | 0 | 3 |
| 5 | PE3101 | Professional Elective - 1<br>• Artificial Neural Networks<br>• Software Project Management<br>• Computer Graphics<br>• Image Processing | 2 | 1 | 0 | 3 |
| 6 | PC3101L | Unix Network Programming Lab | 0 | 0 | 3 | 1.5 |
| 7 | PC3102L | Machine Learning Lab | 0 | 0 | 3 | 1.5 |
| 8 | SAC3101 | .Net Programming | 1 | 0 | 2 | 2 |
| 9 | MC3101 | Indian Constitution | 2 | 0 | 0 | 0 |
| 10 | PR/INTERN | Summer Internship / Community Service Project<br>2 Months (Mandatory) after second year<br>(to be evaluated during V semester) | 0 | 0 | 0 | 1.5 |
| 11 | VVITLS | Life Skills-5 | 2 | 0 | 0 | 0 |
| | | | | | **Total** | **21.5** |
| | | Honors/Minor courses | 3 | 0 | 2 | 4 |

| Category | | Credits |
|---|---|---|
| PC | Professional Core Courses | 3+3+3+1.5+1.5=12 |
| PE | Professional Elective Courses | 3 |
| OE | Open Elective Courses/Job Oriented Elective Courses | 3 |
| SAC | Skill Advanced Course/Soft Skills Course | 2 |
| PR/INTERN | Summer Internship | 1.5 |
| MC | Mandatory Course | 0 |
| | **Total Credits** | **21.5** |

**III Year II Semester**

| S No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | PC3201 | Deep Learning | 3 | 0 | 0 | 3 |
| 2 | PC3202 | Natural Language Processing | 3 | 0 | 0 | 3 |
| 3 | HS3201 | Engineering Economics & Management | 3 | 0 | 0 | 3 |
| 4 | PE3201 | Professional Elective-2<br>• Cloud Computing<br>• Distributed Systems<br>• Design and Analysis of Algorithms<br>• MOOCS | | | | |
| 4 | OE3201 | Testing & Automation | 3 | 0 | 0 | 3 |
| 5 | PC3201L | Deep Learning Lab | 0 | 0 | 3 | 1.5 |
| 6 | PC3202L | Cloud Computing | 0 | 0 | 3 | 1.5 |
| 7 | PC3203L | Full Stack Lab | 0 | 0 | 3 | 1.5 |
| 8 | SAC3201 | Soft Skills | 1 | 0 | 2 | 2 |
| 9 | MC3201 | Entrepreneurial Skill Development | 2 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | **Total** | **21.5** |
| | | Industrial/Research Internship<br>2 Months (Mandatory) during summer vacation | | | | |
| | | Honors/Minor courses | 3 | 0 | 2 | 4 |

| **Category** | | **Credits** |
|---|---|---|
| PC | Professional Core Courses | 3+3+1.5+1.5+1.5=10.5 |
| HS | Humanities & Sciences | 3 |
| PE | Professional Elective Courses | 3 |
| OE | Open Elective Courses/Job Oriented Elective Courses | 3 |
| SAC | Skill Advanced Course/Soft Skills Course | 2 |
| | **Total Credits** | **21.5** |

**IV Year I Semester (Semester-7)**

| S.No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | PE4101 | Professional Elective-3<br>• Insights of Big Data<br>• Concurrent and Parallel Programming<br>• Software Architecture and Design Patterns<br>• Predictive Analysis<br>• Spatial Temporal Data Analysis | 3 | 0 | 0 | 3 |
| 2 | PE4102 | Professional Elective-4<br>• Cyber Security<br>• Statistical Machine Learning<br>• Computer Vision<br>• Software Testing Methodologies<br>• Soft Computing | 3 | 0 | 0 | 3 |
| 3 | PE4103 | Professional Elective-5<br>• Cloud DevOPs<br>• Pattern Recognition Algorithms<br>• Speech Processing<br>• Digital Interaction Design<br>• Design of AI Products | 3 | 0 | 0 | 3 |
| 4 | OE4101 | Open Elective-3<br>• Operations Research | 3 | 0 | 0 | 3 |
| 5 | OE4102 | Open Elective-4<br>• Green Buildings | 3 | 0 | 0 | 3 |
| 6 | HSE4101 | Universal Human Values-2: Understanding Harmony | 3 | 0 | 0 | 3 |
| 7 | SAC4101 | System Design using UML | 1 | 0 | 2 | 2 |
| 8 | PR/INTERN | Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester) | 0 | 0 | 0 | 3 |
| | | | | | **Total** | **23** |
| | | Honors/Minor courses | 3 | 0 | 2 | 4 |

| Category | | Credits |
|---|---|---|
| HS | Humanities and Social Science Courses | 3 |
| PE | Professional Elective Courses | 3+3+3=9 |
| OE | Open Elective Courses/Job Oriented Elective Courses | 3+3=6 |
| SAC | Skill Advanced Course | 2 |
| INTERN | Summer Internship | 3 |
| | **Total Credits** | **23** |

**IV Year II Semester**

| S. No | Subject code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | PROJ4201 | Major Project - Viva Voce | 0 | 0 | 0 | 8 |
| 2 | CSP01 | Community Service Project | 0 | 0 | 0 | 4 |
| Internship (6 months) | | | | | | |
| | | **Total Credits** | | | | **12** |

*CSP (Community Service Project) is evaluated in Final Year and 4 credits will be awarded by splitting the credits from IV Year-II Semester major project as per the proceedings no. JNTUK/DAP-CSP-Distribution of Credits/2022 dated on 24-09-2022

## General Minor degree courses offered by CS-AIML department:

1. Python Programming
2. Database Management Systems
3. Deep Learning
4. Insights of Big Data
5. Artificial Intelligence
6. Machine Learning
7. Introduction to Image Processing
8. No-SQL Databases
9. Design of Artificial Intelligence Products
10. Dimensionality Reduction and Model Validation Techniques

**Note:**

A Student can select four subjects from the above 10 subjects @ 3-0-2-4 credits per subject.

**Courses for Honors degree**

| POOL-1 | POOL-2 | POOL-3 | POOL-4 |
|---|---|---|---|
| Node JS | Social Mobile Analytics & Cloud | Information Assurance & Security | FOG Computing |
| Advanced OS | Security Governance, Risk and Compliance | UI and Security Frameworks | Network Security |
| Robotics and Intelligent Systems | Network Programming | Storage Area Networks | Open Source Software Systems |

| | | | |
|---|---|---|---|
| Database Security | Software Design & System Integration | Software Defined Networking | Mobile Computing 4G |
| MOOC-1* (NPTEL/SWAYAM) Duration: 12 Weeks minimum | | | |
| MOOC-2* (NPTEL/SWAYAM) Duration: 12 Weeks minimum | | | |

*Course/subject title can't be repeated

**Note:**

1. **Students has to acquire 16 credits with minimum one subject from each pool**
2. **Compulsory MOOC/NPTEL course for 4 credits (2 course, each 2 credited)**

## VVIT Life skill courses

The following courses are admitted to be the **courses beyond curriculum** to improve individual life skills. These courses will be demonstrated in the class room with an internal assessment for satisfactory.

| S.No. | Year & Semester | Course Name |
|---|---|---|
| 1 | I Year I Semester (Semester-1) | Quantitative Aptitude |
| 2 | I Year II Semester (Semester-2) | Verbal Ability |
| 3 | II Year I Semester (Semester-3) | Understanding Self for Effectiveness |
| 4 | II Year II Semester (Semester-4) | Design Thinking |
| 5 | III Year I Semester (Semester-5) | Stress and Coping Strategies |
| 6 | III Year II Semester (Semester-6) | Research Skills |

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1101 | Mathematics -I | 2 | 1 | 0 | 3 |

**Course Objectives**

1. This course will illuminate the students in the concepts of calculus.
2. To enlighten the learners in the concept of differential equations and multivariable calculus.
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

**Unit-1**

**Differential equations of first order and first degree**

Linear differential equations-Bernoulli's equations - Exact equations and equations reducible to exact form.

**Applications**: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

**Unit-2**

**Linear differential equations of higher order**

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type $e^{ax}$, $\sin ax$, $\cos ax$, polynomials in $x^n$ , $e^{ax}V(x)$ and $x^n V(x)$ - Method of Variation of Parameters.

**Applications**: LCR circuit – Simple harmonic motion

**Unit-3**

**Mean value theorems**

Mean value theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

**Unit-4**

**Partial differentiation**

Introduction – Homogeneous function – Euler's theorem **-** Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.

**Applications**: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

**Unit-5**

**Multiple integrals**

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.

**Applications**: Areas by double integrals and Volumes by triple integrals.

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

**CO1.** Solve the differential equations related to various engineering fields.
**CO2.** Utilize mean value theorems to real life problems.
**CO3.** Familiarize with functions of several variables which is useful in optimization.
**CO4.** Apply double integration techniques in evaluating areas bounded by region.
**CO5.** Learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

**TEXT BOOKS**


1. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.


**REFERENCE BOOKS**


1. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
2. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.


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| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1102 | Applied Chemistry | 3 | 0 | 0 | 3 |

**Pre-Requisites:**

Knowledge of basic concepts of chemistry for engineering students will help them as professional engineers later in design and material selection as well as utilizing the available resources.

**Course Objectives**

1. Significance of various types of plastic materials in household appliances and composites (FRP) in aerospace and automotive industries.
2. Understand the basic concepts of electrochemistry, which are useful to construct the electrochemical cells, batteries and fuel cells.
   Illustrate the theories and mechanism of corrosion and its prevention.
3. Importance of advanced materials and their engineering applications.
4. Make use of molecular machines in supramolecular chemistry and need of green chemistry.
5. Design and construction of advanced instrumental techniques and recall their importance.

**Unit-I**

**POLYMER TECHNOLOGY**

**Polymerisation**: Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

**Plastics**: Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

**Elastomers**: Natural rubber-Drawbacks-Vulcanization-Preparation-Properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

**Composite Materials**: Fiber reinforced plastics-CFRP and GFRP

**Conducting polymers**: Polyacetylene, doped conducting polymers -p-type and n-type doping.

**Bio degradable polymers:** Biopolymers and biomedical polymers.

**Unit II**

**ELECTROCHEMICAL CELLS AND CORROSION**

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-$H_2$ –$O_2$, $CH_3OH$-$O_2$, phosphoric acid, molten carbonate.

***Corrosion****:* Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing, cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

**Unit III**

**MATERIAL CHEMISTRY**

***Non-elemental semiconducting materails***: Stoichiometric, controlled valency & chalcogen photo/semiconductors-preparation of semiconductors (distillation, zone refining, Czochralski crystal pulling technique) – Semiconductor devices (p-n junction diode as rectifier, junction transistor)

***Nano materials****:* Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene-carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser abalation methods.

***Liquid crystals****:* Introduction-types-applications.

***Superconductors***: Meissner effect, type- I and type- II superconductors, characteristics and applications.

**Unit IV**

**ADVANCED CONCEPTS AND GREEEN CHEMISTRY**

***Molecular switches and machines***: Introduction to supramolecular chemistry, characteristics of molecular motors and machines. Rotaxanes and Catenanes as artificial molecular machines. Protypes linear motions in Rotaxanes, and acid-base controlled molecular shuttle, a molecular elevator, an autonomous light –powered molecular motors, natural molecular motors and machine.

***Green chemistry:*** Principles of green chemistry, green synthesis – aqueous phase, microwave assisted chemical reactions and phase transfer catalysis (PTC).

**Unit V**

**SPECTROSCOPIC TECHNIQUES & NON-CONVENTIONAL ENERGY SOURCES**

***Spectroscopic Techniques:*** Electromagneticspectrum-types of molecular spectra and their absorption criteria.

***UV***-visible spectroscopy (electronic spectroscopy), Frank-Condon principle, Beer-Lambert's law and its limitations, chromophores and auxochromes – *applications of UV visible spectroscopy.

***IR*** spectroscopy – functional group and finger print region – molecular vibrations – stretching and bending vibrations – *applications of IR.

***NMR*** (Nuclear magnetic resonance): Working principle and instrumentation of NMR – chemical shift(δ) – *applications of NMR.

(*only general applications – without any spectroscopic problems regarding quantitative and qualitative analysis.)

***Non-conventional energy sources***: Design, working, schematic diagram, advantages and disadvantages of photovoltaic cell, organic photo-voltaic, hydropower, geothermal power, tidal, ocean thermal energy conversion (OTEC) – open cycle OTEC, closed cycle OTEC and hybrid cycle OTEC.

**REFERENCE BOOKS**


1. A text book of Engineering Chemistry by S.S. Dara, S. S. Umare; S. Chand & Co., Ltd., Latest Edition.
2. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co., Latest Edition.


**TEXT BOOKS**


1. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publicating Co., Latest Edition

2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 Edition.
3. Engineering Chemistry by Prasanth Rath, B. Ramadevi, Ch. Venkata Ramana Reddy, Subendu Chakravarthy; Cengage Publications, 2019 Edition.

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

**CO1.** **Explain** the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
**CO2.** **Know** the importance of various materials and their uses in the construction of batteries and fuel cells.
**CO3.** **Know** the applications of advanced materials in various industries.
**CO4.** **Apply** the principles of supramolecular chemistry in the applications of molecular machines, need of green chemistry.
**CO5.** **Explain** the principles of spectrometry such as UV, IR, and NMR.

| I-Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1101 | Basic Electrical and Electronics Engineering | 2 | 1 | 0 | 3 |

**Course Objectives**

1. To introduce basics of electric circuits and to teach DC and AC electrical circuit analysis.
2. To explain the working principles DC machines and speed control of various DC motors.
3. To explain the working principles of transformers and AC machines and its applications.
4. To introduce the basics of semiconductor physics and operation and applications of Diodes.
5. To introduce the basics of transistors and explain the transistor configurations

**Unit-I**

**DC & AC Circuits**

**DC Circuits:** Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only] **AC Circuits:** Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor. [Elementary treatment only]

**Unit II**

**DC Machines**

**DC Generator:** Construction-Principle and operation of DC Generator - EMF equation -Types– Applications [Elementary treatment only] **DC Motor**: Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test- Swinburne's test-Applications. [Elementary treatment only]

**Unit III**

**AC Machines**

**Single Phase Transformer:** Construction, Principle and operation of Single-Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only]

**Three Phase Induction Motor**: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].

**Unit IV**

**Semiconductor Devices**

Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

**Unit V**

**Bipolar Junction Transistors**

Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.

**Text Books**


1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

**References**


1. L. S. Bobrow- “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.


**Course Outcomes:**

**CO1.** Apply concepts of KVL/KCL in solving DC circuits.(Apply, Find, Solve)
**CO2.** Choose correct machine for a specific application. (Understand, Apply)
**CO3.** Illustrate working principles of DC and AC Machines. (Understand, Apply)
**CO4.** Describe working principles of diodes and transistors. (Understand, Apply)
**CO5.** Understand the applications of diodes and transistors. (Understand, Analyze)

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1102 | Computer Engineering Workshop | 1 | 0 | 4 | 3 |

**Course Objectives**

1. To make the students aware of the basic hardware components of a computer and installation of operating system.
2. To introduce Raptor Tool for flowchart creation.
3. Each student will familiar with Productivity tool: LaTeX and Microsoft (MS) office
4. To get knowledge in awareness of cyber hygiene that is 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.

**Unit-1**

Simple Computer System: Central processing unit, the further need of secondary storage, Types of memory, Hardware, Software and people. Peripheral Devices: Input, Output and storage, Data Preparation, Factors affecting input, Input devices, Output devices, Secondary devices, Communication between the CPU and Input/ Output devices.

**Unit-2**

Problem Solving and Programming: Algorithm development, Flowcharts, Looping, some programming features, Pseudo code, the one-zero game, some structured programming concepts, documents. Programming Languages: Machine Language and assembly language, high -level and low-level languages, Assemblers, Compilers, and Interpreters

**Unit-3**

Operating systems: Introduction, Evolution of operating systems, Command Interpreter, Popular operating systems- Microsoft DOS, Microsoft Windows, UNIX and Linux.
Introduction to Unix Shell Commands, directory management commands, file operations, user's commands, Time and Date commands.

**Unit-4**

Computer Networks: Introduction to computer Networks, Network Topologies-Bus topology, star topology, Ring topology, Mesh topology, Hybrid topology, Types of Networks: Local area Network, Wide Area Networks, Metropolitan Networks, Campus/ Corporate Area Network, Personal Area Network, Network Devices- Hub, Repeater, Switch, Bridge, Router, Gateway, Network interface Card, Basic Networking Commands.

**Unit-5**

Introduction to HTML: Basics in Web Design, Brief History of Internet, World Wide Web Why create a web site ,Web Standards, HTML Documents ,Basic structure of an HTML document Creating an HTML document ,Mark up Tags ,Heading-Paragraphs ,Line Breaks ,HTML Tags. Elements of HTML: Introduction to elements of HTML, Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

**List of Tasks**

**TASK 1: PC Hardware:** PC Hardware introduces the students 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. In addition, hardware and software level troubleshooting process, tips and tricks would be covered.

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.

**TASK 2: 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 fix it to get the computer back to working condition.

**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.

**TASK 3**: **Drawing flowcharts (Raptor Tool)**

1. Create flowcharts for take-off landing of an Aeroplan.
2. Create a flowchart to validate an email id entered by user.
3. Create flowchart to print first 50 prime numbers.

**TASK 4: Productivity tool:LaTeX and Microsoft (MS) office:** Importance of MS office, Details of the three tasks and features that should be covered in each, MS word, Power Point, Excel.

**TASK 5: Operating System Installation:** 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.

**TASK 6: Basic Commands:** Unix Shell Commands, directory management commands, file operations, users commands, Time and Date commands.

**TASK 7: 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.

**TASK 8:** Networking Commands:

ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp, wget, route

**TASK 9: Basic HTML tags**

1. Head Section and Elements of Head Section, Paragraphs, Formatting Styles.

2. Colour tags, Creating Hyperlinks, Images, Tables, lists

3. HTML Forms, Form Attributes, Form Elements.

**TASK 10:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured. 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.

**TASK 11: 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.

**Text Books**


1. Fundamentals of Computers –Reema Thareja-Oxford higher education
2. Computer Fundamentals, Anita Goel, Pearson Education, 2017
3. PC Hardware Trouble Shooting Made Easy, TMH
4. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013.


**Reference Books**


1. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning, 2003.
2. An Introduction to Computer studies –Noel Kalicharan-Cambridge


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

**CO1.** Identify various hardware components of a system and apply their knowledge about computer peripherals to identify / rectify problems onboard.
**CO2.** Assemble the computer.
**CO3.** Use various Microsoft tools.
**CO4.** Integrate the PCs into local area network and re-install operating system and various application programs.
**CO5.** Manage data backup and restore operations on computer and update application software.

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1103 | Problem Solving Using C | 2 | 1 | 0 | 3 |

## Course objectives

1. To familiarize to notion of an algorithm, editing and executing programs in Linux.
2. To Understanding branching, iteration.
3. To represent Data using arrays.
4. To use Modular programming and recursive solution formulation.
5. To familiarize pointers and dynamic memory allocation.
6. To handle data through files

**Unit-1**

**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

**Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

**Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

**Unit-2**

**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

**Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions

**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

**Unit-3**

**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

**Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

**Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

**Unit-4**

**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value

**Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application

**Processor Commands**: Processor Commands

**Unit-5**

**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

**Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input /Output Functions, Character Input / Output Functions

**Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**TEXT BOOKS**


1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2e, Pearson


**REFERENCES**


1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD


**Course Outcomes:** After completing this course, Students will be able to-

**CO1.** **Comprehend** algorithms and basic terminology of C
**CO2.** **Solve** problems using control structures and modular approach
**CO3.** **Demonstrate** 1D and 2D arrays along with strings for linear data handling
**CO4.** **Determine** the use of pointers and structures
**CO5.** **Implement** various operations on data files.

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1102L | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2. To expose the students in practical aspects of the theoritical concepts like pH, hardness of water etc.
3. To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

**List of Experiments**

Students should do any 10 experiments listed below

1. Determination of HCl using standard $Na_2CO_3$ solution.
2. Determination of alkalinity of a sample containing $Na_2CO_3$ and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Copper (II) using standard EDTA solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Iron (III) by colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9. Determination of concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of $Mg^{+2}$ present in an antacid.
12. Determination of $CaCO_3$ presence in an egg shell.
13. Estimation of vitamin- C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Prepatation of nylon-6, 6 and Bakelite (demonstration only)

**Reference Books:**

A Text Book of Quantitative Analysis, Arthur J. Vogel.

**Course Outcomes:** At the end of the course, the students will be able

**CO1.** To estimate the amount of metal ions present in different solutions (L4 & L3)
**CO2.** To analyze the quality parameters of water (L4)
**CO3.** To determine the strength of different solutions by using different instrumentation techniques (L3)

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1101L | Basic Electrical Engineering Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. To Verify Kirchhoff's laws, Voltage and Current division rules.
2. To learn speed control and testing of DC Shunt Motor.
3. To learn and understand the operation of induction motor.
4. To learn applications of diodes and transistors.

**List of Experiments**

**Cycle-1**

1. Verification of Kirchhoff laws.
2. Verification of Voltage division rule and current division rule.
3. Speed control of DC Shunt Motor.
4. Perform Brake test on DC Shunt Motor.
5. Conduct Swinburne's test on DC Shunt Motor.
6. Brake test on 3-phase Induction Motor.

**Cycle-1I**

1. V-I characteristics of P-N Junction Diode.
2. Understand Zener Diode Characteristics.
3. Understand Half wave rectifier and Full wave rectifier with and without filter.
4. Characteristics of BJT in Common Base Configuration.
5. Characteristics of BJT in Common Emitter Configuration.
6. Zener diode as voltage regulator.

**Text Books**

1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

**References**

3. L. S. Bobrow- "Fundamentals of Electrical Engineering" – Oxford University Press – 2011.
4. E. Hughes – "Electrical and Electronics Technology" – Pearson – 2010.

**Course Outcomes:** Able to

**CO1.** Verify Kirchhoff's Laws and voltage and current division rules for DC supply.
**CO2.** Analyze the performance of AC and DC Machines by testing.
**CO3.** Perform speed control of DC shunt motor.
**CO4.** Perform the half wave and full wave rectifier.

| I- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1102L | Problem Solving Using C Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. Apply the principles of C language in problem solving.
2. To design flowcharts, algorithms and knowing how to debug programs.
3. To design & develop of C programs using arrays, strings pointers & functions.
4. To review the file operations, pre-processor commands.

**Exercise 1**

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.

2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.

3. Write a C program to display multiple variables.

**Exercise 2**

1. Write a C program to calculate the distance between the two points.

2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

**Exercise 3**

1. Write a C program to convert a string to a long integer.

2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.

3. Write a C program to calculate the factorial of a given number.

**Exercise 4**

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum.1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

**Exercise 5**

1. Write a program in C to print all unique elements in an array.

2. Write a program in C to separate odd and even integers in separate arrays.

3. Write a program in C to sort elements of array in ascending order.

**Exercise 6**

1. Write a program in C for multiplication of two square Matrices.

2. Write a program in C to find transpose of a given matrix.

**Exercise 7**

1. Write a program in C to search an element in a row wise and column wise sorted matrix.

2. Write a program in C to print individual characters of string in reverse order.

**Exercise 8**

1. Write a program in C to compare two strings without using string library functions.

2. Write a program in C to copy one string to another string.

**Exercise 9**

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation

2. Write a program in C to demonstrate how to handle the pointers in the program.

**Exercise 10**

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.

2. Write a program in C to add two numbers using pointers.

**Exercise 11**

1. Write a program in C to add numbers using call by reference.

2. Write a program in C to find the largest element using Dynamic Memory Allocation.

**Exercise 12**

1. Write a program in C to swap elements using call by reference.

2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

**Exercise 13**

1. Write a program in C to show how a function returning pointer.

2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc() function.

**Exercise 14**

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand & write the difference.

2. Write a program in C to convert decimal number to binary number using the function.

**Exercise 15**

1. Write a program in C to check whether a number is a prime number or not using the function.

2. Write a program in C to get the largest element of an array using the function.

**Exercise 16**

1. Write a program in C to append multiple lines at the end of a text file.

2. Write a program in C to copy a file in another name.

3. Write a program in C to remove a file from the disk.

**Course Outcomes:** By the end of the Lab, the student able to

**CO1.** **Comprehend** the various concepts of a C language
**CO2.** **Develop** algorithms and flowcharts
**CO3.** **Design** and development of C problem solving skills.
**CO4.** **Acquire** modular programming skills.

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1201 | Mathematics-II | 2 | 1 | 0 | 3 |

**Course Objectives**

1. To elucidate the different numerical methods to solve nonlinear algebraic equations
2. To disseminate the use of different numerical techniques for carrying out numerical integration
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

**Unit-1**

**Iterative methods**

Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

**Unit-2**

**Interpolation**

Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for

Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

**Unit-3**

**Numerical integration and solution of ordinary difference equations**

Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's method–Runge-Kutta method (second and fourth order).

**Unit-4**

**Laplace Transforms**

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)

Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

**Unit-5**

**Fourier series and Fourier Transforms**

Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

**Text Books**

1. **B.S. Grewal,** Higher Engineering Mathematics, $44^{th}$ Edition, Khanna Publishers.

**Reference Books**


1. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.


**Course Outcomes**

**CO1.** Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)

**CO2.** Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals (SOLVE, APPLY, FIND)

**CO3.** Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations (SOLVE, APPLY, FIND)

**CO4.** Find or compute the Fourier series of periodic signals (SOLVE, APPLY, FIND, ANALYSE)

**CO5.** Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE, APPLY, FIND)

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1202 | Applied Physics | 2 | 1 | 0 | 3 |

**Course Objectives**

Applied Physics curriculum which is re-oriented to the needs of Circuital branches of graduate engineering courses offered by Vasireddy Venkatadri Institute of Technology, which serves as a transit to understand the branch specific advanced topics. The course is designed to:

1. Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
2. Understand the physics of Semiconductors and their working mechanism for their utility in electronic devices.
3. Impart the knowledge of materials with characteristic utility in appliances.

**Unit-1**

**Wave Optics**

**Interference:** Principle of Superposition-Interference of light – Conditions for sustained Interference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry) **Diffraction:** Fraunhofer Diffraction:- Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

**Unit-2**

**LASERs and Holography**

**LASERs:** Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

**Holography:** Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

**Unit-3**

**Magnetism and Dielectrics**

**Magnetism**: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr Magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

**Dielectrics:** Introduction- Dielectric Polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field- Claussius – Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

**Unit-4**

**Quantum Mechanics**

Introduction– matter waves – de Broglie's hypothesis – Davisson-Germer experiment – G. P. Thomson experiment – Heisenberg's Uncertainty Principle–Schrödinger time independent and time dependent wave equations – physical significance of Schrödinger wave function – Particle in a potential box (determination of energy).

**Unit-5**

**Semiconductor Physics**

Origin of energy bands (qualitative) –Classification of solids based on energy bands–Intrinsic semiconductors-density of charge carriers –Electrical conductivity-Fermi level – extrinsic semiconductors-P-type & N-type – Density of charge carriers- Dependence of Fermi energy on carrier concentration and temperature- Hall effect-Hall coefficient- Applications of Hall effect-Drift and Diffusion currents - Einstein's equation.

**TEXT BOOKS**

1. "Engineering Physics" by B. K. Pandey, S. Chaturvedi - Cengage Publications, 2012
2. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand, 2017.
3. "Engineering Physics" by D. K. Bhattacharya and Poonam Tandon, Oxford press (2015).
4. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

**REFERENCE BOOKS**

1. "Engineering Physics" by M. R. Srinivasan, New Age international publishers (2009).
2. "Optics" by Ajoy Ghatak, 6th Edition McGraw Hill Education, 2017.
3. "Solid State Physics" by A. J. Dekker, Mc Millan Publishers (2011).

**Course Outcomes**

**CO1. Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.
**CO2. Learn** the basic concepts of LASER light Sources and Apply them to holography
**CO3. Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
**CO4. Learn** the fundamental concepts of Quantum behavior of matter.
**CO5. Identify** the type of semiconductors using Hall Effect.

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| HS1201 | Communicative English | 3 | 0 | 0 | 3 |

**Course Objectives**

1. Adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

**Unit 1**

**Detailed Study: A Proposal to Girdle the Earth (Excerpt) by Nellie Bly**
**Theme: Exploration**
**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.
**Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.
**Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.
**Non-Detailed Study:**
**1. "How to Fashion Your Own Brand of Success" by Howard Whitman**
**2. "How to Recognize Your Failure Symptoms" by Dorothea Brande**

**Unit 2**
**Detailed Study: An excerpt from The District School as It Was by One Who Went to It by Warren Burton**
**Theme: On Campus**
**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts.
**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks.
**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
**Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
**Grammar and Vocabulary:** Cohesive devices - linkers, signposts and transition signals; use of articles and zero article; prepositions.

**Non-detailed Study:**
**3. "How to Conquer the Ten Most Common Causes of Failure" by Louis Binstock**
**4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz**

**Unit 3**
**Detailed Study: The Future of Work?**
**Theme: Working Together**
**Listening:** Listening for global comprehension and summarizing what is listened to.
**Speaking:**Discussing specific topics in pairs or small groups and reporting what is discussed
**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
**Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.
**Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.
**Non-Detailed Study:**
**5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand**
**6. "How to Raise Your Self-Esteem and Develop Self-confidence" by James W Newman**

**Unit 4**
**Detailed Study: H.G Wells and the Uncertainties of Progress by Peter J. Bowler**
**Theme: Fabric of Change**
**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
**Speaking:** Role-plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.
**Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.
**Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms
**Non-Detailed Study**
**7. "How to Win Your War against Negative Feelings" by Dr Maxwell Maltz**
**8. "How to Find the Courage to Take Risks" by Drs. Tom Rusk and Randy Read**

**Unit 5**
**Detailed Study: Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far**
**Theme: Tools for Life**
**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides.
**Reading:** Reading for comprehension.
**Writing:** Writing structured essays on specific topics using suitable claims and evidences
**Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
**Non-Detailed Study**
**9. "How to Become a Self-Motivator" by Charles T Jones**
**10. "How to Eliminate Your Bad Habits" by OgMandin**

**Text Books**

1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

**Reference Books**

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skilful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

**Course Outcomes**

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

**CO1.** Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and formulate sentences using proper grammatical structures and correct word forms **(Describe, relate, tell, find L-3)**

**CO2.** Speak clearly on a specific topic using suitable discourse markers in informal discussions **(Discuss, outline, explain, predict – L3)**

**CO3.** Write summaries based on global comprehension of reading/listening texts **(Use, categorize, complete, solve L-3)**

**CO4.** Produce a coherent paragraph interpreting a figure/graph/chart/table **(Identify, compare, explain, illustrate- L4)**

**CO5.** Take notes while listening to a talk/lecture to answer questions **(explain, relate, outline, complete -L3)**

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1201 | Problem Solving using Python | 3 | 0 | 0 | 3 |

**Course Objectives**

1. To learn about Python programming language syntax, semantics, and the runtime environment
2. To be familiarized with universal computer programming concepts like data types, containers
3. To be familiarized with general computer programming concepts like conditional execution, loops & functions
4. To be familiarized with general coding techniques and object-oriented programming

**Unit-1**

**Introduction:** Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

**Data Types, and Expression:** Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

**Decision Structures and Boolean Logic:** if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

**Unit-2**

**Control Statement:** Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration, While Loop

**Strings and Text Files:** Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

**Unit-3**

**List and Dictionaries:** Lists, Defining Simple Functions, Dictionaries

**Design with Function:** Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function.

**Modules:** Modules, Standard Modules, Packages.

**Unit-4**

**File Operations:** Reading config files in python, writing log files in python, understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

**Object Oriented Programming:** Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support

**Design with Classes:** Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism

**Unit-5**

**Errors and Exceptions:** Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

**Graphical User Interfaces:** The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources.

**Programming:** Introduction to Programming Concepts with Scratch.

**TEXT BOOKS:**


1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Programming: A Modern Approach, VamsiKurama, Pearson.


**REFERENCES:**


1. Introduction to Python Programming, Gowrishankar. S, Veena A, CRC Press.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.


**Course Outcomes:**

**CO1:** Develop essential programming skills in computer programming concepts like data types, containers
**CO2:** Solve coding tasks related to conditions, loops and String processing
**CO3:** Experiment with various Data structures in interpreted Language and to build modules and packages for real software needs.
**CO4:** Implement Files and object-oriented principles in Python
**CO5:** Identify solutions using GUI in Python.

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1202 | Digital Logic Design | 2 | 1 | 0 | 3 |

**Course Objectives**

1. To understand common forms of number representation in digital circuits and Boolean algebra.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems and simplify logic expressions using basic theorems, K-map and Tabular methods.
3. To understand the concept of Combinational logic design and realize logic expressions using MUX and Decoder
4. Illustrate the concept of sequential logic design; analyze the operation of flip-flop and conversion from one flip-flop to another, and application of flip-flop.
5. To impart to student the concepts of sequential machines of digital system.

**Unit-1**

**Number Systems and Boolean Algebra**

**Number systems:** Introduction to different number system and their conversions, complement of number system and subtraction using complement method, Floating-Point Representation, Weighted and Non-weighted codes and its properties.

**Boolean Algebra:** Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Universal Gates.

**Unit-2**

**Minimization Methods of Boolean functions**

Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don't Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart, Simplification Rules.

**Unit-3**

**Combinational Circuits**

Design procedure, Half/full adders, Half / full subtractors, Carry look ahead adder, BCD adder, Multiplexer/De-Multiplexer, Encoder/Decoder, Priority encoders, Implementation of Higher-Order Device Using Lower Order devices, Implementation of combinational logic using MUX/Decoder, Magnitude Comparator, Error detection and correction codes.

**Unit-4**

**Sequential Circuits**

Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

**Unit-5**

**Sequential Machines**

Finite State Machines, Synthesis of Synchronous Sequential Circuits, Serial Binary Adder, Sequence Detector, Parity bit Generator, Synchronous Modulo N –Counters, Finite state machine capabilities and limitations, Mealy and Moore models.

*Note: Case Studies / Small Projects of Digital Circuits and Logic Design*

**TEXT BOOKS**

1. Digital Design by Mano, PHI
2. Modern Digital Electronics by RP Jain, TMH
3. Switching Theory and Logic Design by A. Anand Kumar, PHI.

**REFERENCE**

1. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition
2. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers

**Course Outcomes**

**CO1.** Distinguish the analog and digital systems, apply positional notations, number systems, computer codes in digital systems. **(Remember, Understand, and Apply)**

**CO2.** To understand the Boolean Algebra theorems, simplify and design logic circuits. **(Understand, Apply, Analyze and valuate)**

**CO3.** Implemented combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers. (**Apply, Analyze, valuate, and create)**

**CO4.** To understand the basic elements of sequential logic circuits. **(Understand, Apply, Analyze)**

**CO5.** Able to design and analyze sequential circuits. **(Apply, Analyze and create)**

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS1202L | Applied Physics and Virtual Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives:** The Applied Physics Lab is designed to

1. **Understand** the concepts of interference and diffraction and their applications.
2. **Apply** the concept of LASER in the determination of wavelength.
3. **Recognize** the importance of energy gap in the study of conductivity and Hall Effect.
4. **Illustrate** the magnetic and dielectric materials applications.
5. **Apply** the principles of semiconductors in various electronic devices.

**LIST OF EXPERIMENTS**

**(Any 10 of the following listed 15 experiments)**

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Variation of dielectric constant with temperature
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. LASER - Determination of wavelength by plane diffraction grating
11. Determination of resistivity of semiconductor by Four probe method.
12. Determine the radius of gyration using compound pendulum
13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
14. Dispersive power of diffraction grating.
15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

**Course Outcomes:** The students will be able to:

**CO1. Operate** optical instruments like microscope and spectrometer
**CO2. Determine** thickness of a paper with the concept of interference
**CO3. Estimate** the wavelength of different colours using diffraction grating and resolving power
**CO4. Plot** the intensity of the magnetic field of circular coil carrying current with distance
**CO5. Calculate** the band gap of a given semiconductor

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| HS1201L | Communicative English Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

**Introduction to Sound system of English**

**Articulation -** Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols.

**Accent -** Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.

**Intonation -** Stress and accent in connected speech. Types and functions of Intonation in English.

I. **A. Speaking**: Introducing Yourself and Others
**B. Listening:** Conversation between two and more people.

II. **A. Speaking:** Speak for a minute in response to a question about personal experience / wish.
**B. Listening:** Identifying the main idea of a talk or a conversation

III. **A. Speaking: Group discussion** – 5 minutes followed by a summary –1 or 2 minutes: Topics- 1. Features that make a place beautiful, 2. The most challenging job you can think of, 3. Some skills that everyone should learn, 4. The best criteria to measure success, 5. A recent news story that is interesting, 6. Impact of technology on the music industry, 7. An app that has helped society, 8. Pros and Cons of after school tutorials, 9. How to stay safe on Social Media, 10. The most common reasons why friendships fall apart, 11. Interactions with seniors on campus, 12. Coping with peer pressure, 13. Others' opinion vs your belief, 14. Feeling that plants would express if they could, 15. Growing up alone vs Growing up with siblings, 16. Uniforms stifle individuality, 17. In India summer is the best and worst of times, 18. A good sense of humour is a definite perk, 19. All fast food is not junk food and 20. Ideas to make your common room in college more inviting. Question Answer sessions – 1. Idea of a Tech Startup, 2. Training programme of T&P Cell, 3. Inter-college Cultural Fest, 4. 3-day Foreign University delegation visit to the campus, 5. Computer training programme by a reputed MNC, 6. Shifting your Dept or Classrooms to new location on campus, 7. How to manage attendance while attending additional courses (Minors/Honors), 8. How to choose placement offers? 9. Involvement in Student Affairs through SAC, 10. Planning an excursion.

**B. Listening:**1. Comprehension Exercise on Teamwork, 2. Predicting what the speaker would say from the title of the talk, 3. Comprehension based on a narrative or a short video, TED Talks

IV. **A. Speaking:** Preparing speech using picture clues, asking Q&A using pictures.
**B. Listening:** Listening Comprehension using short films, audio files, interviews of famous personalities

V. **A. Speaking:** Preparing 30-day planner, Using important phrasal expressions in speech, Oral Presentations on – 1. Setting goals is important2. Asking the right question is the skill you need to develop, 3. Do college students want their parents' attention4. Everyone needs to learn how to cook5. Doing household chores is everyone's responsibility 6. Study groups facilitate peer-monitoring7. Is it OK for students to do things just because they want to fit in? 8. Students should compulsorily make time for physical activity, 9. Taking breaks to pursue other interests improves academic performance, 10. Strategies to avoid stress, 11. How best to use the media for educational activities, 12. Why volunteer for service activities? 13. International student exchange programme, 15. Work-life balance 16. Strategies to build on your strength and overcome weaknesses, 17. Strategies to build confidence and self-esteem18. Procrastination kills opportunities, 19. Setting a budget and sticking to it, 20. Grooming and etiquette 21. Pros and Cons of being Competitive, 22. Virtual classroom vs real classroom, 23. Freedom brings more responsibility 24. To-do lists help you become more productive 25. Having a diverse group of friends is an asset 26. One thing you wish you had learnt in High school 27. Why is it important to be non-judgmental towards others? 28. Humans need empathy, 29. Public speaking is a necessary skill 30. How to build and maintain good professional relationships.
**B. Listening:** Listening Comprehension, Speeches by Famous personalities

Pair work, Role-play, conversational practice and Individual speaking activities based on following essays from University of Success.

1. "How to Fashion Your Own Brand of Success" by Howard Whitman
2. "How to Recognize Your Failure Symptoms" by Dorothea Brande
3. "How to Conquer the Ten Most Common Causes of Failure" by Louis Binstock
4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz
5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand
6. "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman
7. "How to Win Your War against Negative Feelings" by Dr Maxwell Maltz
8. "How to Find the Courage to Take Risks" by Drs. Tom Rust and Randy Reed
9. "How to Become a Self-Motivator" by Charles T Jones
10. "How to Eliminate Your Bad Habits"byOgMandino

**Text Books**

1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019
2. University of Success by OgMandino, Jaico, 2015.

**Reference Books**

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.

3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

**AICTE Recommended Books**

1. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press, 2018.
2. Pushplata and Sanjay Kumar. Communication Skills, Oxford University Press, 2018.
3. Kulbushan Kumar. Effective Communication Skills. Khanna Publishing House, Delhi

**Sample Web Resources**

**Grammar / Listening / Writing**

1. 1-language.com
2. http://www.5minuteenglish.com/
3. https://www.englishpractice.com/

**Grammar/Vocabulary**

4. English Language Learning Online
5. http://www.bbc.co.uk/learningenglish/
6. http://www.better-english.com/

**Reading**

7. https://www.usingenglish.com/comprehension/
8. https://www.englishclub.com/reading/short-stories.htm
9. https://www.english-online.at/

**Listening**

10. https://learningenglish.voanews.com/z/3613
11. http://www.englishmedialab.com/listening.html

**Speaking**

12. https://www.talkenglish.com/
13. BBC Learning English – Pronunciation tips
14. Merriam-Webster – Perfect pronunciation Exercises

**All Skills**

15. https://www.englishclub.com/
16. http://www.world-english.org/
17. http://learnenglish.britishcouncil.org/

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

**CO1.** identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

**CO2.** take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3)

**CO3.** write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3)

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES1201L | Problem Solving using Python Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

**List of Problems**

1. Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2. Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3. Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4. Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5. Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

   *

   **

   ***

   ****
6. Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7. Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.
8. Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9. Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*. Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be 1,000,000.
10. In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.
11. Write a program that generates a list of 20 random numbers between 1 and 100.
    a) Print the list.
    b) Print the average of the elements in the list.
    c) Print the largest and smallest values in the list.
    d) Print the second largest and second smallest entries in the list

e) Print how many even numbers are in the list.

12. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
13. Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.
14. Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
15. Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimetres, centimetres, meters, or kilometres. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements,it is much shorter with lists and it is also easier to add new conversions if you use lists.
16. Write a function called *sum digits* that is given an integer num and returns the sum of the digits of num.
17. Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
18. Write a function called *number_of_factors* that takes an integer and returns how many factors the number has.
19. Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise
20. Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.
21. Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
22. Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.

a) Do this using the sort method. b) Do this without using the sort method.

23. Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.
24. Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
25. Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.
26. Write a class called Product. The class should have fields called name, amount, and price, holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.
27. Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours* that returns a string of hours, minutes, and seconds formatted analogously to the previous method.

28. Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.
29. Write a Python class to implement pow(x, n).
30. Write a Python class to reverse a string word by word.
31. Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.
32. Write a program to demonstrate Try/except/else.
33. Write a program to demonstrate try/finally and with/as.

**Course Outcomes:**

**CO1:** Comprehend how software easily to build right out of the box.
**CO2:** Demonstrates the use of an interpreted language for problem solving through control statements including loops and conditionals.
**CO3:** Practice with data structures for quick programming solutions.
**CO4:** Demonstrates software building for real needs by breaking out code into reusable functions and modules.
**CO5:** Comprehend the software reliability through exception handling.

| I- Year II - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| MC1201 | Environmental Science | 2 | 0 | 0 | 0 |

**Course Objectives**

1. To make the students to get awareness on environment,
2. to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3. to save earth from the inventions by the engineers.

**Unit-1**

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**

Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**Unit-2**

**ECOSYSTEMS, BIODIVERSITY, AND ITS CONSERVATION**

**Ecosystems:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Biodiversity And Its Conservation :** Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**Unit-3**

**ENVIRONMENTAL POLLUTION AND SOLID WASTE MANAGEMENT**

**Environmental Pollution:** Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

**Solid Waste Management:** Causes,effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**Unit-4**

**SOCIAL ISSUES AND THE ENVIRONMENT**

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**Unit-5**

**HUMAN POPULATION AND THE ENVIRONMENT**

Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**FIELD WORK:** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

**TEXT BOOKS**

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr. S. Azeem Unnisa, Academic Publishing Company

**REFERENCES**

1. Textbook of Environmental Science by Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.
3. Comprehensive Environmental studies by J. P. Sharma, Laxmi publications.

**Course Outcomes:**

1. Able to U**nderstand** the concepts of the ecosystem
2. Able to U**nderstand** the natural resources and their importance
3. Able to learn the biodiversity of India and the threats to biodiversity and **Apply** conservation practices
4. Able to learn Various attributes of the pollution and their impacts
5. Able to U**nderstand** Social issues both rural and urban environment
6. Able to U**nderstand** About environmental Impact assessment and **evaluate** the stages involved in EIA

| II- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS2101 | Mathematics – III | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To instruct the concept of Matrices in solving linear algebraic equations
2. To familiarize the techniques in partial differential equations
3. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

**UNIT-I: Solving system of linear equations, Eigen values and Eigen Vectors**

Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations-Eigen values and Eigen vectors and their properties

**UNIT-II: Cayley-Hamilton theorem and quadratic forms:**

Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

**Application:** Free vibration of two mass systems.

**UNIT – III: Vector Differentiation:**

Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives– Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.

**UNIT– IV: Vector Integration:**

Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.

**UNIT– V: Solutions of Partial differential Equations**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Second order PDE: Solutions of linear partial differential equations with constant coefficients RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

**Text Books:**

1. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

**Reference Books:**

1. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

CO1: develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)

CO2: solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3)

CO3: to interpret the physical meaning of different operators such as gradient, curl and divergence (L5)

CO4: estimate the work done against a field, circulation and flux using vector calculus (L5)

CO5: identify the solution methods for partial differential equation that model physical processes (L3)

| II- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2101 | Mathematical Foundations of Computer Science | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To introduce concepts of mathematical logic.
2. To introduce concepts and perform operations with sets, relations and functions.
3. To solve counting problems by applying elementary counting techniques.
4. To introduce algebraic structures, generating functions and recurrence relations.
5. To use graph theory for solving problems.

**Unit-1: Mathematical Logic & Calculus**

**Mathematical Logic:** Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, and Indirect Method of Proof.

**Predicate Calculus:** Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

**Unit-2: Set theory & Relations**

***Set Theory*:** Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion.

***Relations:*** Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams, *Functions:* Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties.

**Unit-3: Algebraic Structures and Number Theory**

***Algebraic Structures:*** Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism.

***Number Theory:***Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, and Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)

**Unit-4: Combinatorics & Recurrence Relations**

Combinatorics: Binomial and Multinomial Coefficients, Binomial and Multinomial Theorems, Pigeonhole Principle and its Application.

Recurrence Relations: Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving non homogeneous Recurrence Relations.

**Unit-5: Graph Theory**

**Graph Theory:** Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multi graphs, Planar Graphs, Euler's Formula, Graph Colouring, Chromatic

Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).

**Text Books:**

1. Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.
2. Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P.Mohapatra, 3rdEdition, Tata McGraw Hill.
3. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H.Rosen, 7th Edition, Tata McGraw Hill.

**Reference Books:**

1. Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel, T.P. Baker, 2nd Edition, Prentice Hall of India.
2. Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby, Sharon Cutler Ross, PHI.
3. Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2020

**E-resources**

1. https://nptel.ac.in/courses/106/103/106103205/
2. https://nptel.ac.in/courses/106/106/106106183/

**Course Outcomes:**

By the end the of the course, the student will be able to

**CO-1: Use** mathematical logic to solve problems(L3)
**CO-2: Comprehend** sets, relations and discrete structures(L2)
**CO-3: Use** number theory to perform modulo arithmetic and computer arithmetic. (L3)
**CO-4: Solve** problems on recurrence relations and counting principles (L3)
**CO-5: Identify** and solve real world problems using graphs and trees. (L4)

| II- Year I - Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2102 | Data Structures | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To impart the usage of linear list to students.
2. To help students understand the difference between dynamic memory using linked list.
3. To demonstrate the students about the operations Trees.
4. To make the student to understand various algorithms in graphs.
5. To make the students to learn the importance of hashing and sorting algorithms.

**Unit-1:**

**Algorithms and Linear Lists :**Algorithmic complexity, performance and Analysis, Linear lists (Arrays) , Applications of Linear List : Searching and Sorting

**Unit-2:**

**Stacks and Queues, Linked Lists:** Single Linked List, Double Linked List, Circular Linked List, Stack and Queues using Linked list

**Unit-3:**

**Trees:** Binary Trees Operations, Tree traversal, Threaded Binary Trees, Binary Search Trees, Binary Heap

**Unit-4:**

**Graphs-** Elementary Graph Operations, Graph Traversals, Minimum cost spanning tree Algorithms , Shortest paths algorithms.

**Unit-5:**

**Hashing and Pattern Matching:** Concept Hashing, Hash Functions, Collision Resolution Techniques, Pattern Matching algorithms

**Text Books**

1. Data structures, Algorithms and Applications in Java, S. Sahni, University Press (India) Pvt. Ltd, 2nd edition, Universities Press, Pvt. Ltd.
2. Data structures and Algorithm Analysis in Java, Mark Allen Weiss, Pearson Education. Ltd, Second Edition

**Reference Books**

1. Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Pearson, 2002.
2. Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, MIT Press. 3rd Edition.
3. Classical Data Structures, 2nd Edition, DebasisSamanta, PHI

**e- resources**

1. Data Structures Visualizations : https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

2. Code Archery Youtube Channel:
   https://www.youtube.com/playlist?list=PLrKBFf87Cy9CNZpzi3poq8BFWc0h4f0vL

**Course Outcomes:**

CO1: **Comprehend** the implementation of linear lists**(Understand)**
CO2: **Examine** static and dynamic data structures with suitable applications. **(Apply)**
CO3: **Determine** trees applications. **(Apply)**
CO4: appreciate the importance and **significance** of graph algorithms in building and solving real world applications. **(Analyze)**
CO5: **Comprehend** and implement algorithms for text processing. **(Understand)**

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2103 | Java Programming | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To understand object-oriented programming concepts, and apply them in solving problems.
2. To make the students to learn the principles of inheritance and polymorphism; and to demonstrate how they relate to the design of abstract classes; to introduce the implementation of packages and interfaces.
3. To make the students to learn the concepts of exception handling.
4. To make the students to learn the concepts of multithreading.
5. To make the students to develop GUI applications.

**Unit-1: Introduction to OOPS Concepts, Classes and Strings**

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements.
**Classes:** Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, arrays-One Dimensional and multi-dimensional arrays, Searching, Sorting.

**Strings**-Exploring the String class, String buffer class, Command-line arguments.

**Unit – II: Inheritance, Interfaces, Packages**
**Inheritance**: Need of inheritance, types, super keyword, abstract classes, interfaces, compile time and runtime polymorphism, Packages.

**Unit – III: Exception Handling and I/O Streams**
**Exception Handling:** Concepts of Exception handling, Built-in exceptions, creating own exception sub classes, Assertions.
**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, Object Serialization, exploring java.nio

**Unit – IV: Multithreading**
**Multithreading:** Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, thread groups.

**Unit – V: GUI Programming**
**GUI Programming with Swing:** Introduction, limitations of AWT, Various swing components & hierarchy.
**Event Handling**- event delegation model, sources of event, Event Listeners, adapter classes, inner classes.

**Text Books**

1. Java - The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016

**Reference Books**

1. “Java – How to Program”, Paul Deitel, Harvey Deitel, PHI.
2. “Core Java”, Nageswar Rao, Wiley Publishers.
3. “Thinking in Java”, Bruce Eckel, Pearson Education
4. “A Programmers Guide to Java SCJP”, Third Edition, Mughal, Rasmussen, Pearson.

**Course Outcomes**

**CO-1: Comprehend** object-oriented programming concepts for problem solving.
**CO-2: Build** class hierarchy and packages for real world problems.
**CO-3: Develop** thread safe Java programs with appropriate Exception handling.
**CO-4: Demonstrate** multithreaded application programs through a language
**CO-5: Design** GUI applications using swings and multithreading.

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2104 | Software Engineering | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:** The student should be able to

1. To understand the software life cycle models.
2. To understand the software requirements and SRS document.
3. To understand the importance of modeling and modeling languages.
4. To design and develop correct and robust software products.
5. To understand the quality control and how to ensure good quality software.

**Unit-1: Introduction to Software Engineering:**

Software, Software Classifications and Characteristics, Emergency of Software Engineering, what is Software Engineering? Software Engineering Challenges **Software Processes** Process model, Elements and Characteristics of Process model, Process Classification, Phased Development Life Cycle, Software Development **Process Models**: Prescriptive Process Models, Agile process models, and RUP process model

**Unit-2: Project Management & Planning:**

Project management essentials, Project success and failures, Project Life Cycle, Project team structure and organization, Software Configuration Management. Project planning activities, Metrics and Measurements, Project Size Estimation, Effort Estimation Techniques, Staffing and Personnel Planning, Project Scheduling and Miscellaneous Plans.

**Unit-3: Requirement Engineering:**

Software Requirements, Requirement Engineering Process, Requirement Elicitation, Requirement Analysis (Structured Analysis, Object Oriented Analysis, Data Oriented Analysis and Prototyping Analysis), Requirements Specification, Requirement Validation, and Requirement Management.

**Unit-4: Software Design:**

Software Design Process, Characteristics of a Good Design**,** Design Principles, Modular Design (Coupling and Cohesion), Software Architecture, Design Methodologies (Function Oriented Design and Object-Oriented Design), Structured Design Methodology (SDM), Transaction Analysis and Logical Design; **Coding:** Coding principles, Coding process, Code verification and documentations.

**Unit-5: Software Testing:**

Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Debugging Approaches **Quality of Software:** Quality Concept, Quality Factors, Verification and Validation, Quality Assurance Activities, Quality Standards: Capability Maturity Model (CMM), ISO 9000, Six Sigma. **Maintenance:** Software Maintenance, Maintenance Process Models and Reengineering.

**Text Books**


1. Software Engineering: Concepts and Practices, Ugrasen Suman, Cengage Learning Publications.
2. Fundamentals of Software Engineering, Rajib Mall, PHI, New Delhi.

**Reference Books**


1. An Integrated Approach to S/w Engineering- Pankaj Jalote, Narosa Publishing House.
2. Software Engineering- Ian Sommerville, Pearson Education, New Delhi.
3. Software Engineering Concepts-Richard E. Fairly, Tata McGraw Hill Inc. New York.


**e- resources**

https://www.javatpoint.com/software-engineering-tutorial

**COURSE OUTCOMES:** Upon successful completion of the course, the student will be able to

**CO1:** Define and develop s/w projects from requirement gathering to implementation.
**CO2:** Obtain knowledge about principles and practices of software engineering.
**CO3:** Focus on the fundamentals of modeling a software project.
**CO4:** Obtain knowledge about estimation and maintenance of software systems
**CO5:** Design test cases, schedules and perform testing for SQA

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2101L | Data Structures Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. Ability to apply computational thinking to a diverse set of problems.
2. Ability to adapt to new challenges and computational environments.
3. Proficiency in the design and implementation of algorithms.

**List of experiments:**

**Prerequisites: Solve the following problems in Hackerrank**

1. Time Conversion
2. Diagonal Difference
3. Stair case
4. Birthday Cake candles

**UNIT I**

1. Implement Binary Search using arrays
2. Implement Insertion Sort.
3. Implement Quick Sort
4. Implement Merge Sort
5. Implement Radix Sort

**String Pairs**

**Anagram**

**UNIT II**

6. Implement stack using arrays
7. Implement conversion of infix to postfix expression.
8. Implement queue using arrays.
9. Implement circular queue
10. Implement Singly Linked List
11. Implement Doubly Linked List
12. Implement Binary Heap Operations.

**Minimize the Sum**

**Implement Expression Tree.**

**UNIT III**

13. Implement Complete Binary Tree
14. Implement Binary Trees Traversal techniques (recursive and non-recursive)
15. Implement Binary Search Tree
16. Implement Binary Heap Operations

**UNIT IV**

17. Implement Graph and its operations
18. Implement Breadth First Search
19. Implement Depth First Search

20. Implement Prims' Algorithm
21. Implement Kruskal's Algorithm
**Implement Island Strikes.**
**Implement Pawn Moves.**

**UNIT V**

22. Implement Linear Probing on a dictionary.
23. Implement Separate Chaining.
24. Implement Brute Force Pattern Matching.
25. Implement Boyer Moore Pattern Matching.

**Course Outcomes**: Upon successful completion of the course, the student will be able to

**CO1** Select the most appropriate data structure and defend the selection.
**CO2** Appropriately solve a variety of computational problems.
**CO3** Communicate their results and describe an algorithm.

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2102L | Java Programming Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. To write programs using abstract classes.
2. To write programs for solving real world problems using java collection frame work.
3. To write multithreaded programs.
4. To design GUI application using swing controls.
5. To introduce java compiler and eclipse platform
6. To impart hands on experience with java programming.

**Note:**

Mandatory to follow test driven development with Eclipse IDE empowered JUnit testing framework and code coverage plugin.

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. Create a class called Invoice that a hardware store might use to represent an invoice for an item sold at the store. An Invoice should include four pieces of information as instance variables-a part number (type String),a part description(type String),a quantity of the item being purchased (type int) and a price per item (double). Your class should have a constructor that initializes the four instance variables. Provide a set and a get method for each instance variable. In addition, provide a method named getInvoiceAmount() that calculates the invoice amount (i.e., multiplies the quantity by the price per item), then returns the amount as a double value. If the quantity is not positive, it should be set to 0. If the price per item is not positive, it should be set to 0.0. Write a test application named InvoiceTest that demonstrates class Invoice's capabilities. [CO1]
2. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e. domestic or commercial). Compute the bill amount using the following tariff. [CO1]

   If the type of the EB connection is domestic, calculate the amount to be paid as follows:

   1. First 100 units - Rs. 1 per unit
   2. 101-200units - Rs. 2.50 per unit
   3. 201 -500 units - Rs. 4 per unit
   4. >501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   5. First 100 units - Rs. 2 per unit
   6. 101-200units - Rs. 4.50 per unit
   7. 201 -500 units - Rs. 6 per unit
   8. >501 units - Rs. 7 per unit

3. Create class Savings Account. Use a static variable annualInterestRate to store the annual interest rate for all account holders. Each object of the class contains a private instance variable savingsBalance indicating the amount the saver currently has on deposit. Provide method calculateMonthlyInterest to calculate the monthly interest by multiplying the

savingsBalance by annualInterestRate divided by 12 this interest should be added to savings Balance. Provide a static method modifyInterestRate that sets the annualInterestRate to a new value.Write a program to test class SavingsAccount. Instantiate two savingsAccount objects, saver1 and saver2, with balances of $2000.00 and $3000.00, respectively. Set annualConcentration Rate to 4%, then calculate the monthly interest and print the new balances for both savers. Then set the annualInterestRate to 5%, calculate the next month's interest and print the new balances for both savers. [CO1]

4. Create a class called Book to represent a book. A Book should include four pieces of information as instance variables-a book name, an ISBN number, an author name and a publisher. Your class should have a constructor that initializes the four instance variables. Provide a mutator method and accessor method (query method) for each instance variable. In addition, provide a method named getBookInfo that returns the description of the book as a String (the description should include all the information about the book). You should use this keyword in member methods and constructor. Write a test application named BookTest to create an array of object for 30 elements for class Book to demonstrate the class Book's capabilities. [CO1].
5. Write a JAVA program to search for an element in a given list of elements using binary search mechanism. [CO1]
6. Write a Java program that implements Merge sort algorithm for sorting and also shows the number of interchanges occurred for the given set of integers. [CO1]
7. Write a java program to make rolling a pair of dice 10,000 times and counts the number of times doubles of are rolled for each different pair of doubles. Hint: Math.random() [CO1].
8. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% ofBP for staff club fund. Generate pay slips for the employees with their gross and net salary. [CO1]
9. 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.[CO2]
10. Develop a java application to implement currency converter (Dollar to INR,EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages. [CO1]
11. Write a Java Program to Handle Arithmetic Exceptions and InputMisMatchExceptions. [CO1]
12. Write a multi-threaded Java program to print all numbers below 100,000 that are both prime and Fibonacci number (some examples are 2, 3, 5, 13, etc.). Design a thread that generates prime numbers below 100,000 and writes them into a pipe. Design another thread that generates Fibonacci numbers and writes them to another pipe. The main thread should read both the pipes to identify numbers common to both. [CO3].
13. Write a java program that implements a multi-threaded application that has three threads. First thread generates a 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. [CO3].

14. Write a Java program that correctly implements the producer – consumer problem using the concept of inter-thread communication. [CO3].
15. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes. [CO1].
16. Write a Java program to build a Calculator in Swings/ [CO4]
17. Write a Java program to implement JMenu to draw all basic shapes using Graphics. [CO4]
18. Write a Java program to implement JTable and JTree. [CO4]
19. Write a Java program to implement JTabbedPane. [CO4]
20. Write a Java Program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle and the result produced by the server is the area of the circle. [CO3]

**Course Outcomes:**

**CO1 :** Develop programs for solving real world problems using java collection frame work.
**CO2 :** Develop and apply multithreaded programs in network applications.
**CO3 :** Develop GUI programs using swing controls in Java.

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2103L | SOFTWARE ENGINEERING LAB | 0 | 0 | 3 | 1.5 |

The Software Engineering lab will facilitate the students to develop a preliminary yet practical understanding of software development process and tools

**Course Objectives**

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

**Experiments**

Take any real time problem and do the following experiments:

1. Do the Requirement Analysis and Prepare SRS
2. Using COCOMO model estimate effort.
3. Calculate effort using FP oriented estimation model.
4. Analyze the Risk related to the project and prepare RMMM plan.
5. Develop Time-line chart and project table using PERT or CPM project scheduling methods.
6. Draw E-R diagrams, DFD, CFD and structured charts for the project.
7. Design of Test cases based on requirements and design.
8. Prepare FTR
9. Prepare Version control and change control for software configuration items

**Reference Books:**

1. Roger S. Pressman, Software engineering-A practitioner's Approach, McGraw-Hill International Edition, 6th edition, 2001.
2. Ian Sommerville, Software engineering, Pearson education Asia, 6th edition, 2000.

## Course Outcomes

1. To demonstrate requirement gathering techniques to create SRS for a defined problem.
2. To implement the cost, size, effort estimation techniques on a defined problem
3. To assess the risk for a defined problem by applying Risk Assessment strategies like RMMM.
4. To investigate a real-world problem using modern modelling tools.
5. To formulate test cases based on requirements and design
6. To conduct FTRs as a measure of communication between him and the other stakeholders of the project

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| SOC2101 | Advanced Python Programming | 1 | 0 | 2 | 2 |

**PRE-REQUISITES:**

- Fundamentals of Python
- Problem solving skills

**Course objectives:** The student should be able to

1. Able to learn advanced concepts in Python
2. Able to use advanced packages like numpy, scipy, opencv in Python for building data processing & visualizing applications.
3. Able to process digital imaging applications

**Unit-1**

**Python Fundamentals**: Introduction to Python, Data Structures – List, Dictionaries, Sets and Tuples. **Modules, Python Packages, Libraries:** Modules - Creating modules, import statement, from Import statement, name spacing. Math Module: Constants, Power and logarithmic functions, Trigonometric functions. Numpy Library: Numpy import, Basic functions, Matrices Addition, Subtraction Multiplication, Transpose, Inverse, Eigen values and Eigenvectors using Numpy

**Unit-2**

**Python packages:** Introduction to PIP, Installing Packages via PIP, Using Python Packages**(4hrs)**

**Data Visualization** – Matplotlib - Loading the library and importing the data, How Mat plot lib works? modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, Scatter plots, Bar plots.

**Unit-3**

**File Handling –** Introduction to Files, File modes, Reading, writing data from files, Copy one file to another, deletion of files. Other file programs in Python. **Text Processing:** Word, character and line counting, Frequency count. Usage of with () and split (). Reading and writing into CSV formats**.**

**Unit-4**

**Image Processing** - Installing Jupiter notebook. Image & Its properties. Image processing applications. Image I/O and display with Python, Reading, saving and displaying an image using Open CV - PyPI, matplotlib, Sample programs – Image statistics Croping, converting images from RGB to Gray and resizing the image.

**Unit-5**

**Using Databases and SQL** – Introduction to Database Concepts, usage of SQLite, Create, Insert & Retrieve data, Spidering twitter using a database. Sample Python codes

**Text books**:

1. Python for Everybody: Exploring Data Using Python 3, Charles Severance
2. The Hitchiker's Guide to Python, O'Reilly publication

**Reference books:**

1. Hands-On Image Processing with Python, O'Reilly Publications
2. *Think Python*, Allen Downey, Green Tea Press

**e- Resources & other digital material**

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/106/106/106106145/#
3. https://realpython.com/python-mysql/

**Course Outcomes**

**CO1: Recall** the usage of Python Concepts.

**CO2: Use** different Python packages for Data Visualization

**CO3: Demonstrate** File handling & text processing

**CO4: Demonstrate** applications that performs Image processing

**CO5: Connect** database with Python.

| II- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| MC2101 | Essence of Indian Tradition and Knowledge | 2 | 0 | 0 | 0 |

**Objectives**:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
- To know the student traditional knowledge in different sector.

**Unit-I**

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

**Unit-II**

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

**Unit-III**

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

**Unit-IV**

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FOR A for increasing protection of Indian Traditional Knowledge.

**Unit-V**

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

**Reference Books**:


1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino


**E-Resources:**

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. 2.http://nptel.ac.in/courses/121106003/

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

1. understand the concept of Traditional knowledge and its importance
2. know the need and importance of protecting traditional knowledge
3. know the various enactments related to the protection of traditional knowledge.
4. understand the concepts of Intellectual property to protect the traditional knowledge

***

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| BS2201 | Probability and Statistics | 2 | 1 | 0 | 3 |

**Course objectives:**

1. To **Classify** the concepts of data science and its importance
2. To **Interpret** the association of characteristics and through correlation and regression tools
3. To **Understand** the concepts of probability and their applications, **apply** discrete and continuous probability distributions
4. To **Design** the components of a classical hypothesis test
5. To **Infer** the statistical inferential methods based on small and large sampling tests

**UNIT-I**

**Descriptive statistics and methods for data science:**

Data science-Statistics Introduction-Population vs Sample-Collection of data-primary and secondary data-Types of variable: dependent and independent Categorical and Continuous Variables-Data Visualization-Measures of Central Tendency-Measures of Variability (spread or variance)-Skewness Kurtosis.

**UNIT-II**

**Correlation and Curve fitting:**

Correlation- correlation coefficient-Rank Correlation-Regression coefficient and properties-regression lines-Multiple Regression-Method of least squares-Straight line-parabola-Exponential-Power curves.

**UNIT-III**

**Probability and Distributions:**

Probability-Conditional probability and Baye's Theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance-Binomial, Poisson, Uniform and Normal distributions.

**UNIT-IV**

**Sampling Theory:**

Introduction–Population and samples-Sampling distribution of Means and Variance (definition only)-Central limit theorem (without proof)-Point and Interval estimations, good estimator, Unbiased estimator, Efficiency estimator-Maximum error of estimate.

**UNIT-V**

**Test of Hypothesis:**

Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean, two means, and proportions using Z test, Tests concerning one mean, two means using t test, also chi-square and F tests use for small samples.

**Text books**:


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

**Reference books**


1. **Shron L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
2. **Jay I. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
3. **Sheldon M. Ross,** Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. **Johannes Ledolter and Robert V. Hogg,** Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.
5. **T. K. V. Iyenger**, Probability and Statistics, S. Chand & Company Ltd, 2015.


**Course Outcomes**

Upon successful completion of the course, the student will be able to

**CO1:** **Classify** the concepts of data science and its importance (L4) or (L2)(**Understand, Analyze)**

**CO2:** **Interpret** the association of characteristics and through correlation and regression tools (L4) **Analyze**

**CO3:** **Understand** the concepts of probability and their applications, **apply** discrete and continuous probability distributions (L3)**Understand, Apply**

**CO4:** **Design** the components of a classical hypothesis test (L6)**Understand, Design, create**

**CO5:** **Infer** the statistical inferential methods based on small and large sampling tests (L4) **Understand, Analyze**

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| ES2201 | Computer Organization | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To understand basic structures of computers and to understand various machine instructions.
2. To understand basic structures of computers and to understand various machine instructions.
3. To analyse ALU & I/O organization of a computer.
4. To understand various memory systems.
5. To analyse functionalities done by processing unit and also learn micro programmed control.

**Unit – I: Basic Structure of a Computer and Machine Instructions.**

Introduction, History of Computer Generations, Functional unit, Basic Operational concepts, Bus structures, System Software, Performance. Number representation: Fixed Point and Floating-Point representation. Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types

**Unit – II: Addressing modes and types of Instructions**

Addressing Modes, Basic Input/output Operations, and role of Stacks and Queues in computer programming equation.

**Component of Instructions:** Logical Instructions, shift and Rotate Instructions. Type of Instructions: Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations

**Unit – III**: **Basic building blocks for the ALU:**

Adder, Subtractor, Shifter, Multiplication and division circuits. Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB)

**Unit – IV: The Memory Systems**

Basic memory circuits, Memory System Consideration, Read- Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Associative Memory, Cache Memories: Mapping Functions, INTERLEAVING, Secondary Storage: Magnetic Hard Disks, Optical Disks.

**Unit – V: Processing unit**

Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control, MICRO PROGRAMMED CONTROL: Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field.

**Text Books:**

1. Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.
2. Computer Architecture and Organization by William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003

**Reference Books:**

1. Computer Architecture and Organization, John P. Hayes, 3rd Edition, McGraw Hill.
2. Computer System Architecture by M Morris Mano, Prentice Hall of India, 2001

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

**CO-1:** Comprehend basic structures of computers and various machine Instructions.
**CO-2:** Learn and use the addressing modes and types of instructions.
**CO-3:** Analyze I/O organization of a computer.
**CO-4:** Comprehend various memory systems.
**CO-5:** Analyze functionalities done by processing unit and also learn micro programmed control.

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2203 | Operating Systems | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. Study the basic concepts and functions of operating system
2. Learn about Processes, Threads and Scheduling algorithms
3. Understand the principles of concurrency and Deadlocks
4. Learn various memory management schemes
5. Study I/O management and File systems

**UNIT-I**

**Introduction to Operating System Concepts:** What Operating Systems do, Computer System Organization, Functions of Operating systems, Types of Operating Systems, Operating Systems Services, System calls, Types of System calls, Operating System Structures, Distributed Systems, Special purpose systems.

**UNIT-II**

**Process Management:** Process concept, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Scheduling Criteria, Scheduling algorithms and their evaluation, Operations on Processes, Inter-process Communication. **Threads:** Overview, User and Kernel threads, Multi-threading Models.

**UNIT-III**

**Concurrency:** Process Synchronization, The Critical- Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Monitors, and Classic Problems of Synchronization.

**Principles of deadlock:** System Model, Deadlock Characterization, Methods for Handling Deadlocks: Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

**UNIT- IV**

**Memory Management:** Logical vs physical address space, Swapping, Contiguous Memory Allocation, Paging, Structures of the Page Table, Segmentation. **Virtual Memory Management:** Virtual memory overview, Demand Paging, Page-Replacement & its algorithms, Allocation of Frames, Thrashing.

**UNIT-V**

**File system Interface:** The concept of a file, Access Methods, Directory structure, files sharing, protection. **File System implementation:** File system structure, Allocation methods, and Free-space management. **Mass-storage structure:** overview of Mass-storage structure, Disk scheduling, Swap space management.

**Text Books:**

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012

2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011

**Reference Books:**

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, Tata McGraw-Hill Education

**e-Resources**

1. https://en.wikipedia.org/wiki/Operating_system
2. https://www.tutorialspoint.com/operating_system/

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

**CO-1: Understand** the structure and functionalities of Operating System
**CO-2: Demonstrate** the concept of Process, Threads and CPU Scheduling Algorithms
**CO-3: Use** the principles of Concurrency to solve Synchronization problems
**CO-4: Demonstrate** various methods for handling Deadlocks
**CO-5: Infer** various Memory Management Techniques
**CO-6: Illustrate** File System Implementation

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2202 | Database Management System | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. Study the basic concepts and importance of Database Management Systems
2. Learn and understand the conceptual design of database and information retrieval
3. Learn various commands and writing of queries for information retrieval
4. Understand the concepts of Database design
5. Study of internal storage and its access

**Unit-I:**

**Introduction** to Database, Applications of Database, Purpose of Database, View of Data, Data Independence, Data Models, Users of Database, DBA, Query Processor, Storage Manager, Database Architecture

**Unit-II**

**Conceptual Design & Relational Query Languages** Conceptual Design of Database using ER Model, Notations, Types of attributes, Relation, Mapping Constraints, Features of ER Diagram, Weak Entity Set, Examples of Conceptual Design, Relational Algebra: Selection, Projection, Set Operations, Rename, Cartesian-Product, Join, Outer Join, Examples **Relational Calculus:** Tuple Relational Calculus and Domain Relational Calculus, Safety Expressions

**Unit-III**

SQL Commands: DDL, DML, TCL, DCL, Types of Constraints (Primary, Alternate, Not Null, Check, Foreign), Basic form of SQL query, joins, outer joins, set operations, group operations, various types of queries, PL/SQL (Cursor, Procedures, Functions, Packages, Triggers…)

**Unit-IV**

Database Design: Normalization, Purpose of Normalization, Functional Dependency, Closure, 1NF, 2NF, 3NF, BCNF, MVFD, 4NF, Join Dependency, 5NF, Why NoSQL? Importance of NoSQL

**Unit-V**

Transaction Management: ACID Properties of Transactions, Conflict & View serializability, Lock based protocols, Time Stamp based protocol, Thomas Write Rule, Validation Based Protocol, Deadlock detection, Deadlock avoidance, Deadlock prevention: wait-die and wound-wait **Recovery Management:** Types of failures, ideal storage, Log, Log records, log-based recovery techniques, Shadow Paging, ARIES, **File Organization & Indexing:** Types of File Organizations, Primary Indexing, Secondary Indexing, Multi-level Indexing, Hash Indexing, Tree Indexing

## Text Books:


1. Data base System Concepts,5/e, Silberschatz, Korth, TMH
2. Introduction to Database Systems, CJ Date, Pearson

## Reference Books:


1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, and TATA McGraw Hill 3rd Edition
2. Fundamentals of Database Systems, Elmasri Navate Pearson Education


**Course Outcomes:**

CO1: To **comprehend** the basics of database systems and applications

CO2: To **construct** logical design of database and information retrieval

CO3: To **demonstrate** relational model practically (Structured Query Language)

CO4: To **demonstrate** and relate normalization for database design

CO5: To **outline** the necessity of transaction management, recovery management, file organization & indexing

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2201 | Artificial Intelligence | 3 | 0 | 0 | 3 |

**Preamble:** Introduce the concepts of Artificial Intelligence; Learn the methods of solving problems using Artificial Intelligence in Graph Playing, Natural Language Processing, Expert Systems and Machine Learning.

**Course objectives**: The main objectives are

1. To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language.
2. To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs.
3. To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning

**UNIT-I**

**Introduction to artificial intelligence:** Introduction ,history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI.

**UNIT-II**

**Problem solving: state-space search and control strategies** :Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction Problem reduction and game playing: Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games.

**UNIT-III**

**Logic concepts**: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic. **Knowledge representation:** Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames

**UNIT- IV**

**Advanced knowledge representation techniques**: Introduction, conceptual dependency theory, script structure, cyclic theory, case grammars, semantic web. **Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.

**UNIT-V**

**Uncertainty measure:** probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory **Fuzzy sets and fuzzy logic:** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic,

fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

**Text Books:**

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA

## Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
3. Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

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

**CO1** Identify problems that are amenable to solution by AI methods.
**CO2** Identify appropriate AI methods to solve a given problem.
**CO3** Formalize a given problem in the language/framework of different AI methods
**CO4** Design and carry out an empirical evaluation of different algorithms on a problem formalization
**CO5** State the conclusions that the evaluation supports

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2203L | **OPERATING SYSTEMS LAB** | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. Ability to apply computational thinking to a diverse set of problems.
2. Ability to analyze the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS.
3. Proficiency in the design and implementation of algorithms.

## LIST OF EXPERIMENTS

1. Simulate the following CPU scheduling algorithms [CO1]
a) FCFS
b) SJF (Preemptive, Non-Preemptive)
c) Priority (Preemptive, Non-Preemptive)
d) Round Robin

2. Simulate the following Process Synchronization techniques [CO1]
a) Bounded-Buffer problem
b) Readers-Writers problem
c) Dining philosopher's problem using semaphores
d) Dining Philosopher's Solution using Monitors

4. Simulate Bankers Algorithm for [CO1]
a) Dead Lock Avoidance
b) Dead Lock Prevention

4. Simulate the following page replacement algorithms. [CO2]
a) FIFO
b) LRU
c) LFU
d) MFU

5. Simulate the following [CO2]
a) Multiprogramming with a fixed number of tasks (MFT)
b) Multiprogramming with a variable number of tasks (MVT)

6. Simulate the following File allocation strategies [CO3]
a) Contiguous
b) Linked
c) Indexed

7. Simulate the following disk-scheduling algorithms [CO3]
a) FCFS

b) SSTF
c) SCAN
d) C-SCAN
e) LOOK
f) C-LOOK

**Course Outcomes:**

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

**CO1:** Examine various process management techniques like CPU scheduling, process synchronization and deadlocks. [K4, Analyze]
**CO2:** Prioritize various memory management techniques like page replacement algorithms. [K4, Analyze]
**CO3:**Analyze various storage management techniques like file allocation and disk scheduling. [K4, Analyze]

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2201L | **DATABASE MANAGEMENT SYSTEMS LAB** | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. To familiarize the participant with the distinctions of database environments towards an information-oriented framework
2. To give a good formal foundation on the relational model of data
3. To present SQL and procedural interfaces to SQL comprehensively

**List of experiments:**

**SQL**

1. Queries for Creating, Dropping, and Altering Tables, Views, and Constraints **[CO1]**
2. Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions. **[CO1]**
3. Queries using operators in SQL **[CO2]**
4. Queries to Retrieve and Change Data: Select, Insert, Delete, and Update **[CO2]**
5. Queries using Group By, Order By, and Having Clauses **[CO2]**
6. Queries on Controlling Data: Commit, Rollback, and Save point **[CO2]**
7. Queries to Build Report in SQL *PLUS **[CO2]**
8. Queries on Joins and Correlated Sub-Queries **[CO2]**
9. Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features **[CO2]**

**PL/SQL**

1. Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation **[CO3]**
2. Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL **[CO3]**
3. Write a PL/SQL block using SQL and Control Structures in PL/SQL **[CO3]**
4. Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types **[CO3]**
5. Write a PL/SQL Code using Procedures, Functions, and Packages FORMS **[CO4]**
6. Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc. **[CO4]**
7. Demonstration of database connectivity **[CO4]**

**Course Outcomes:**

CO1: To create database for user (Creation of Database)
CO2: To solve various SQL queries for user defined schemas
CO3: To generalize PL/ SQL blocks
CO4: To illustrate the usage of user defined packages

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC2203L | Artificial Intelligence Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. Find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. Search Formalization

**Experiments:**

1. Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules.
2. Write simple facts for the statements and querying it.
3. Write Program for Tictactoe Problem.
4. Solve any problem using depth first search.
5. Solve any problem using best first search.
6. Write a program which behaves a small expert for medical Diagnosis.
7. Write programs for computation of recursive functions like factorial Fibonacci numbers, etc.
8. Write program to solve 8-queens problem.
9. Write a Program for water jug problem.
10. Write a program for travelling salesman program.
11. Case study of standard AI programs like Mycin and AI Shell

**Course Outcomes:** At the end of the course the students will be able to

**CO1** Design appropriate Bayes Nets corresponding to the causal relationships and conditional independence of a real-world situation

**CO2** To Implement different problems

| II- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| SOC2201 | R Programming Lab | 1 | 0 | 2 | 2 |

**Course Objectives:**

1. Use R for statistical programming, computation, graphics, and modeling,
2. Write functions and use R in an efficient way
3. Fit some basic types of statistical models
4. Use R in their own research,
5. Be able to expand their knowledge of R on their own.

**Unit-1:**
Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.
**Unit–2:**
R Programming Structures, Control Statements, Loops, - Looping Over Non-vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.
**Unit–3:**
Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices
**Unit–4:**
Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files
**Unit–5**
Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

**Course Outcomes**
**CO1** List motivation for learning a programming language
**CO2** Access online resources for R and import new function packages into the R workspace
**CO3** Explore data-sets to create testable hypotheses and identify appropriate statistical tests
**CO4** Perform appropriate statistical tests using R Create and edit visualizations with

**Text Books:**
1. The Art of R Programming, Norman Matloff, Cengage Learning
2. R for Everyone, Lander, Pearson.

**Reference Books**:

1. R Cookbook, Paul Teetor, Oreilly.
2. R in Action, Rob Kabacoff, Manning

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3103 | **Computer Networks** | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To understand OSI and TCP/IP reference models and Example networks, characteristics of transmission media and classify multiplexing techniques
2. To understand the Error Control, Flow Control and Medium Access Control Protocols
3. To Compute optimal path using Routing Algorithms.
4. To understand the concepts of reliable unreliable transmission
5. To acquire the knowledge on various application layer protocols

**UNIT-I**

**Introduction to Computer Networks and Physical Layer-**Introduction: Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, Example Networks, Physical Layer – Fourier Analysis – Bandwidth Limited Signals – The Maximum Data Rate of a Channel Guided Transmission Media, Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing

**UNIT-II**

**Data Link Layer** Design Issues, Error Detection and Correction, Elementary Data Link Control Protocols, Sliding Window Protocols, HDLC, PPP,

**UNIT-III**

**Medium Access Control Sub Layer -** Channel Allocation problem, Multiple Access Protocols, IEEE standards for Local Area Networks, WLAN, Bluetooth

**UNIT– IV**

**Network Layer -** Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Internet Protocol Header, IP Addresses, subnetting and super netting.

**UNIT-V**

**Transport & Application Layer -** Transport Layer Design Issues, Connection Establishment, Connection Termination, Transport and User Datagram Protocols, Design Issues, DNS, WWW, HTTP/HTTPS, E-mail

**Text Books:**

1. Computer Networks, Andrew S Tanenbaum, Pearson, 5th Edition
2. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw Hill, 4th Edition

**Reference Book:**

1. TCP/IP Protocol Suite, Behrouz A Forouzan**,** Tata McGraw Hill Edition, 3rd Edition

**Course Outcomes**

**CO1**: Explain OSI and TCP/IP reference models and Example networks, characteristics of transmission media and classify multiplexing techniques (L2)
**CO2**: Summarize various Error Control, Flow Control techniques and Medium Access Control Protocols (L2)
**CO3**: Compute optimal path using Routing Algorithms. (L3)
**CO4**: Explain the concepts of reliable unreliable transmission (L2)
**CO5**: Illustrate the working of various application layer protocols (L3)

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3101 | Automata and Compiler Design | 2 | 1 | 0 | 3 |

**Course Objectives**

1. To learn fundamentals of Regular and Context Free Grammars and Languages
2. To understand the relation between Regular Language and Finite Automata and machines
3. To understand the relation between Contexts free Languages, Push Down Automata and Turing Machine
4. To study various phases in the design of compiler and understanding the machine independent phases of compiler
5. To understand machine dependent phases of compiler

**UNIT-I**

Finite Automata

Need for Automata Theory, Alphabet, Strings, Language, Operations, Deterministic Finite Automata, Non-Deterministic Finite Automata, Design of DFA, Design of NFA, Equivalence of NFA, DFA, Finite Automata Conversions : Conversion from NFA to DFA, NFA ε to NFA, Minimization of DFA, Moore and Mealy Machines.

**UNIT-II**

Regular Expressions and Grammars - Regular Expressions: Regular Sets, Identity Rules, constructing finite Automata for a given regular expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets.

Grammars: Grammars, Classification of Grammars, Regular grammars- Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion, Context Free Grammar, Left most and Rightmost Derivations, derivation trees.

**UNIT-III**

Context Free Grammar, Pushdown Automata and Turing Machines - Context Free Grammar: Ambiguous Grammars, Simplification of Context Free Grammars, Normal Forms-Chomsky Normal Form, Griebach Normal Form. Pushdown Automata (PDA): Definition, Model, Design of PDA, Deterministic PDA, Non-deterministic PDA, Equivalence of PDA and Context Free Grammars. Turing Machine(TM): Definition, Model, Design of Turing Machine, Deterministic TM, Non-deterministic TM.

**UNIT-IV**

Machine Independent Phases

Lexical Analysis: Logical phases of compiler, Lexical Analysis, Lexemes Tokens and patterns, Lexical Errors.

Syntax Analysis: Parsing definition, types of parsers, left recursion, left factoring, Top-down parser, First() and Follow(), LL(1)Grammars, Non-Recursive predictive parsing, Bottom-up Parsers, Shift Reduce Parser, LR parsers.

Semantic Analysis: Syntax Directed Translation, L-attributed and S-attributed definitions.

**UNIT-V**

Machine Dependent Phases

Intermediate Code Generation: Intermediate code, three address code, quadruples, triples, indirect triples, directed acyclic graph.

Code Optimization: Common sub expression elimination, copy propagation, dead code elimination, constant folding, strength reduction, loop optimization. Code Generation: Basic blocks & flow graphs, Peephole optimization

**Text Books:**


1. Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008
2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007
3. Compilers, Principles Techniques and Tools- Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman,2nd ed, Pearson,2007.


**Reference Books**


1. Elements of Theory of Computation, Lewis H.P. &Papadimition C.H., Pearson /PHI
2. Theory of Computation, V. Kulkarni, Oxford University Press, 2013
3. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011.
4. Compiler construction, Principles and Practice, Kenneth C Louden, CENGAGE


**e- Resources & other digital material**

https://nptel.ac.in/courses/106/104/106104028/
https://nptel.ac.in/courses/106/105/106105190/

**University Academy Youtube Channel for Automata Theory and Compiler Design:**

https://www.youtube.com/playlist?list=PL-JvKqQx2AtdhlS7j6jFoEnxmUEEsH9KH
https://www.youtube.com/playlist?list=PL-JvKqQx2Ate5DWhppx-MUOtGNA4S3spT

**GATE Lectures:**

https://www.youtube.com/playlist?list=PLEbnTDJUr_IdM___FmDFBJBz0zCsOFxfK
https://www.youtube.com/playlist?list=PLMzYNEvC0P7FwwnrXwAjPq8zLTC4MDQKQ

**Course Outcomes:**

By the end the of the course, the student will be able to

**CO1**:Classify machines by their power to recognize languages.

**CO2**:Summarize language classes and grammars relationship among them with the help of Chomsky hierarchy.

**CO3**: employ finite state machines in problem solving and also illustrate deterministic and non-deterministic machines.

**CO4**: design and implement scanners and parsers.

**CO5**: perform code optimization to improve performance and apply algorithms to generate code.

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3102 | Machine Learning | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning algorithms.
2. Understanding the machine learning model prediction through classification, scoring and ranking using R.
3. Predict objects classification through decision tree building and rule building.
4. Know the importance of features and perform feature engineering
5. Summarizing the data from large tables into smaller set of summary indices through principal component analysis.

**Unit 1**

**Introduction to Statistical Learning**: What Is Statistical Learning, Assessing Model Accuracy.
**Linear Regression:** Simple Linear Regression, Estimating the Coefficients, Assessing the Accuracy of the Coefficient Estimates, Assessing the Accuracy of the Model.

**Unit 2**

**Multiple Linear Regression:** Estimating the Regression Coefficients, Other Considerations in the Regression Model, Comparison of Linear Regression with K-Nearest Neighbours.

**Classification:** An Overview of Classification, Why Not Linear Regression, Logistic Regression, Generative Models for Classification, A Comparison of Classification Methods.

**Unit 3**

**Resampling Methods:** Cross-Validation, the Bootstrap.
**Linear Model Selection and Regularization**, Subset Selection, Shrinkage Methods, Dimension Reduction Methods, Considerations in High Dimensions.

**Unit 4**

**Tree-Based Methods:** The Basics of Decision Trees, Regression Trees, Classification Trees, Trees Versus Linear Models, Advantages and Disadvantages of Trees, Bagging, Random Forests, Boosting and Bayesian Additive Regression Trees.

**Unit 5**

**Support Vector Machines,** Maximal Margin Classifier, Support Vector Classifiers, Support Vector Machines.
**Unsupervised Learning:** The Challenge of Unsupervised Learning, Principal Components Analysis, Missing Values and Matrix Completion, Clustering Methods.

**Text Books:**

1. Gareth James, et al. An Introduction to Statistical Learning: with Applications in R, Springer. 2nd edition (2021 edition).

**Reference Books:**


1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997
2. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.
3. Andrew Ng, Machine learning yearning, https://www.deeplearning.ai/machine-learning-yearning/
4. Hands-on machine learning with R" by Bradley Boehmke & Brandon Greenwell
5. "Machine learning with R, the tidyverse, and mlr" by Hefin I. Rhys


**Web Resources:**

1. R Programming Crash Course – https://www.youtube.com/watch?v=ZYdXI1GteDE&t=1849s
2. Machine Learning with R | Machine Learning Full Course | Machine Learning Tutorial | Simplilearn - https://www.youtube.com/watch?v=6dEUTmoXz0w
3. Statistics for Data Science | Probability and Statistics | Statistics Tutorial | Ph.D. (Stanford) - https://www.youtube.com/watch?v=Vfo5le26IhY&list=PLlgLmuG_KgbaXMKcISC-fdz7HUn1oKr9i
4. Linear Regression Algorithm | Linear Regression Machine Learning | Linear Regression Full Course - https://www.youtube.com/watch?v=tFi4Y_y-GNM
5. Learning: Support Vector Machines - https://www.youtube.com/watch?v=_PwhiWxHK8o

**Course Outcomes (CO):**

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

1. Explain the differences among the three main styles of learning: reinforcement learning, supervised, and unsupervised learning.
2. Implement the algorithms for supervised learning and unsupervised learning using R.
3. Determine which of the three learning styles is appropriate to a particular problem domain.
4. Be able to work with real-world data and perform machine learning through data analytics
5. Characterize the state of the art in learning theory, including its achievements and its challenges.

| III- Year I- Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PE3101 | **Artificial Neural Networks (Professional Elective - 1.1)** | 2 | 1 | 0 | 3 |

**Course Objectives:**

1. To learn data processing and cleaning
2. To understand mathematical model of artificial neuron
3. To learn various activation functions used in neural network
3. To understand training and learning process in neural networks
4. To implement neural network models using python

**Unit-1:** Linear Algebra- Creating matrices add vectors using numpy, implementation of operations on matrices-addition, subtraction, multiplication, transpose, inverse, determinant, Vectors- addition, subtraction, dot product, various norms. Linear transformations, pre-processing data using pandas. Scikit Learn-data processing, creating model using scikit-learn.

**Unit-2:** Introduction to Artificial Neural Network, Biological Model of Neuron, ANN model, McCulloch and Pitts model, Adaline, Perceptron, Activation functions, realizing logic gates using perceptron, implementing perceptron using Python, implementing functionality of logic gates using perceptron in python.

**Unit-3:** Architectural Models for ANN, Single Layer Perceptron, Perceptron as a classifier, implementing classification using perceptron, Learning and training ANN, optimization- Gradient descent algorithm, stochastic gradient descent algorithm, implementation of gradient descent using python.

**Unit-4:** Multilayer Perceptron - architecture, functionality of neurons in different layers, implementing multilayer perceptron using scikit-learn, Back propagation algorithm-training and convergence, design issues, example, implementation using python.

**Unit-5:** Linear and logistic regression using MLP, multivariate regression, implementation of linear and logistic regression using scikit-learn, Function Approximation using MLP, RBF networks, RBF Training. Implementation of classification using ANN with scikit-learn on IRIS dataset.

**Text Books:**


1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.
3. Pradhan Manaranjan , U Dinesh Kumar,”Machine Learning Using Python” , wiley.


**References:**


1. Yegna narayana B,”Artificial Neural Networks”, PHI Learning Pvt. Ltd, 2009.
2. Martin T. Hagan, Howard B. Demuth, Mark Hudson Beale, Orlando De Jesús, Neural Network Design, 2nd Edtion (Free Online version available at url 4)
3. Aurélien Géron, Neural networks and deep learning, O'Reilly Media, 2018.

**Web Resources:**
https://numpy.org/doc/stable/user/quickstart.html
https://pandas.pydata.org/docs/user_guide/index.html
https://scikit-learn.org/stable/modules/neural_networks_supervised.html
https://towardsdatascience.com/data-preprocessing-with-python-pandas-part-1-missing-data-45e76b781993
https://hagan.okstate.edu/NNDesign.pdf
https://nptel.ac.in/courses/117105084
https://nptel.ac.in/courses/108108148
https://nptel.ac.in/courses/106105152

**Course Outcomes**

- Perform data pre-processing.
- Able to implement mathematical model of neural network using python.
- Implement training process using training data.
- Improve accuracy and performance by tuning parameters.
- Classify data using neural network models.

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| OE3101 | **Digital Image Processing (Professional Elective - 1.4)** | 2 | 0 | 2 | 3 |

**Course Objectives:**

1. Familiarize with basic concepts of digital image processing and different image transforms
2. Learn various image processing techniques like image enhancement both in spatial and frequency domain
3. Familiarize with basic restoration techniques
4. Understand segmentation and morphological techniques applicable to various tasks
5. Understand the need for compression and familiarize few compression methods

| Syllabus | | |
|---|---|---|
| **Unit No** | **Contents** | **Mapped CO** |
| **I** | **FUNDAMENTALS OF IMAGE PROCESSING**<br>Introduction, Fundamental steps in image processing,Image sampling, Quantization, Resolution, Elements of image processing system, Applications of Digital image processing. Color fundamentals, Color image formats and conversion. | **CO1** |
| **II** | **IMAGE ENHANCEMENT**<br>**Spatial domain methods**: Point & Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.<br>**Frequency domain methods**: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. | **CO2** |
| **III** | **IMAGE RESTORATION AND RECONSTRUCTION**<br>A model of the image degradation and Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering. | **CO3** |
| **IV** | **IMAGE SEGMENTATION**<br>Fundamentals, point, line, edge detection, thresholding, and region –based segmentation.<br>**MORPHOLOGICAL IMAGE PROCESSING**<br>Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning. | **CO4** |
| **V** | **IMAGE COMPRESSION**<br>Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding. | **CO5** |

## Learning Resources

**Text books:**


1. Digital Image Processing – Gonzalez and Woods, 2nd Ed., Pearson.
2. S. Jayaraman, S. Esakkirajan and T. VeeraKumar, "Digital Image processing, Tata McGraw Hill publishers, 2009


**Reference books:**


1. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. J. T. Tou, R. C. Gonzalez, "Pattern Recognition Principles", Addison-Wesley, 1974.
3. B. Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.


**E-Resources & other digital material:**

NPTEL Lecture material

1. Lecture Series on Digital Image Processing by Prof.P. K. Biswas, Department of Electrical& Electronic Communication Engineering,IIT Kharagpur.
   https://www.youtube.com/playlist?list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3101L | Unix & Shell Programming Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. Learn UNIX Filters related to text processing, communication and search utilities
2. Learn programming filters and interactive shell scripting
3. Learn shell programming constructs writing advanced scripts
4. Learn kernel programming on file operations and managing processes

**Course Outcomes:**

CO1: **Develop** chained commands to extract the required information from the system (apply)

CO2: **Navigate** in any Unix-flavoured operating system ( Apply)

CO3:**Develop** scripts compatible with different shells available under UNIX environment **( Create)**

CO4: **Develop** scripts for automating the tasks of programmer during deployment and maintenance **(Create )**

CO5: **Develop** scripts to automate task using programmable filters **(Create)**

**List of Shell Scripts:**

1. Create a script that, given a user name, finds the home directory of the user using the /etc/passwd file.

**Preparation:**

- None

**Script:**

- **Script Name: findHomeDirectory.scr**
- **Arguments:** One, The user name.
- **Validation:** The minimum validation requirements are :
  i.Ensure that there is only one argument.
- **Body Section:** Create a script that, given the name of a user (as the only argument), prints the absolute pathname of the user's home directory

**Testing the Script:**

- Test the script with two or more arguments.
- Test the script with no arguments.
- Test the script with one argument.

**Testing the Effect of the Script:**

- Verify the script by using your user name.

2. Write a script that creates a file out of the /etc/passwd file.

**Preparation:**

- None

**Script:**

- **Script Name: newEtcPasswd.scr**
- **Arguments:** One, The name of the file.
- **Validation:** The minimum validation requirements are:
  i.Ensure that there is only one argument.

- **Body Section:** Create a script that makes a file out of the information in the /etc/passwd file using the following format.

  User NameUser IdGroup IDHome Directory
  - - - - - - - -  - - - - - - - - - - - - - - - - - - - -
  ram23423/etc/usr/student/ram
  ----

**Testing the Script:**

- Test the script with two or more arguments.
- Test the script with no arguments.
- Test the script with one argument that is not the name of a file.
- Test the script with one argument that is the name of a file.

**Testing the Effect of the Script:**

- Verify the file was created and contains the correct information and format.

3. In a C Program, there is only one comment format. All comments must start with an open comment token, /*, and end with a close comment token, */. C++ programs use the C tokens for comments that span several lines. Single-line comments start with two slashes (//). In either case, the start token can be anywhere on the line.

   Write a script to change every single-line comment in a C++ source file that uses C program start and end comment tokens to a single-line comment starting with a C++ single-line token. The comment itself is to be unchanged.

   **Preparation:**

   - Create at least five C++ source files in your home directory. The files do not have to be real C++ source files; they can contain only a few lines of comments, some with C program tokens and some with C++ single-line tokens. Each program should have at least one multiple comment and at least one single-line comment that uses the C program tokens. Use one or more blank lines between comments. The name of the files should have C++ extension (.c++), such as file1.c++.

   **Script:**

   - **Script Name: commentType.scr**
   - **Arguments:** None
   - **Validation:** The minimum validation requirements are:
     i. Ensure that there is no argument.
   - **Body Section:** Create a script that finds all files with extension (.c++) under your directory and change only the lines with comments. The name of the files should be preserved. If a file has the name file1.c++, the name still should be file1.c++ after the change.

   **Testing the Script:**

   - Test the script with one or two arguments.
   - Test the script with no arguments.

   **Testing the Effect of the Script:**

   - Check to see if the comments are changed in the files.

4. Write a script to backup and archive a list of files.

   **Preparation:**

   - Create a file and type in it the list of files (in your home directory) that you want to back and archive
   - Create a directory in which you will store the backed-up files and archive file.

**Script**

- **Script Name:** backup.scr
- **Arguments:** A filename and a directory. The filename holds the list of the files that should be backed-up. The directory is where the backed-up files should be stored.
- **Validation:** The minimum validation requirements are:
    i. Ensure that exactly two arguments are entered.
    ii. Check that the first argument is the name of a file exists
    iii. Check that the second argument is the name of the directory that exists
- **Body Section:** Create backup files for files listed in the first argument. The backup files should have the same name as the original file with the extension bak. They should be copied to the directory given as the second argument.

**Testing the Script:**

- Test the script with no arguments
- Test the script with one argument
- Test the script with three arguments
- Test the script with two arguments in which the first one is not the name of the file
- Test the script with two arguments in which the second one is the name of a file rather than a directory.
- Test the script with name of the file and the name of the directory you created in the preparation section.

**Testing the Effect of the Script:**

- Check the contents of the directory to be sure that the files are copied

5. Write a script that finds all soft links to a specific file.

**Preparation:**

- Create a file and type some junk in it.
- Make at least five soft links to this file using completely arbitrary names.

**Script:**

- **Script Name: softLinkFinder.scr**
- **Arguments:** A filename. The file for which we want to find the soft links.
- **Validation:** The minimum validation requirements are:
    i. Ensure that exactly one argument is entered.
    ii. Check that only argument is the name of a file and that the specified file exists.
- **Body Section:** Use ls -l and grep command to find all the soft links attached to $1 positional parameter. Note that a file of type soft link is distinguished by lower case l. Be sure to find the soft links to the file defined in $1 and not other files.

**Testing the Script:**

- Test the script with no arguments
- Test the script with one argument
- Test the script with one argument that is not a file
- Test the script with one valid argument.

**Testing the Effect of the Script:**

- Check to make sure all the soft links you created are included in the list of soft links.

6. Create a script that simulates the ls -l command but prints only three columns of our choice.

**Preparation:**

- None

**Script:**

- **Script Name: ls.scr**
- **Arguments:** Three numeric arguments defining the column number of the ls -l output to be printed in the order we specify.
- **Validation:** The minimum validation requirements are :
  i. Ensure that exactly three arguments are entered.
  ii. Ensure that all three arguments are numeric
  iii. Ensure that each argument is less than or equal to the actual number of columns in the ls -l command output.
- **Body Section:** Creates a new command that shows the output of the ls -l command to be printed in three columns in the order we like.

**Testing the Script:**

- Test the script with no arguments.
- Test the script with one argument.
- Test the script with two arguments.
- Test the script with three arguments, one of them nonnumeric.
- Test the script with three arguments, two of them nonnumeric.
- Test the script with three arguments, one of them too large.
- Test the script with three arguments,1 4 5
- Test the script with three arguments,3 7 1

**Testing the Effect of the Script:**

- None

7. Create a script that sends contents of a message file to everybody who logged in.

**Preparation:**

- Create a file of a short friendly message and mention that this is a test message that should be discarded by the receiver

**Script:**

- **Script Name: message.scr**
- **Arguments:** One argument, a message file.
- **Validation:** The minimum validation requirements are:
  i. Ensure that exactly one argument is entered.
  ii. Ensure that the argument is a readable filename.
- **Body Section:** Create a script that uses awk to create a temporary file containing the usernames of those users who are logged into the system at this moment. Then send the message contained in the first argument to every logged-in user. Note that a user who has logged in more than once should receive only one message.

**Testing the Script:**

- Test the script with no arguments.
- Test the script with two arguments.
- Test the script with one argument that is not a readable file.
- Test the script with one valid argument.

**Testing the Effect of the Script:**

- You should include yourself in the recipient list. Check to see if you have received the message.

8. Create a script that can be executed only from a specific terminal. This is done for security purposes. For example, a superuser may write scripts that can only be executed from his or her office and nowhere else.

**Preparation:**

- None

**Script:**

- **Script Name: security.scr**
- **Arguments:** None.
- **Validation:** The minimum validation requirements are:
  i. Ensure that no argument is entered.
- **Body Section:** Create a script that prints a friendly message. However, the script can be executed only for one terminal. You can use the name of the terminal you are using when you write the script. If somebody uses the script from a terminal that is not authorized, the script is to exit immediately. Hint: Use the tty command to show your current terminal.

**Testing the Script:**

- Test the script with one argument.
- Test the script from right terminal.
- Log into the system using another terminal and test the script.

**Testing the Effect of the Script:**

- None

9. Create a script that finds each line in a file that contains a specified string.

**Preparation:**

- Create a file of at least 20 lines and insert a double quoted string, such as "hello," in several lines.

**Script:**

- **Script Name: search.scr**
- **Arguments:** Two arguments, the first is the string to be found; the second is the name of the file.
- **Validation:** The minimum validation requirements are:
  i. Ensure that exactly two arguments are entered.
  ii. Ensure that the second argument is the name of the file that exists and is not empty.
- **Body Section:** Create a script that uses grep and loops to find the line numbers in which the string is found. Note that grep should be applied to each line, not the whole file. The script should print the result in the following format:

**Line Number: [Line contents]**

**Testing the Script:**

- Test the script with no arguments.
- Test the script with one argument.
- Test the script with two argument but the second one is not a file.
- Test the script with two correct arguments.

**Testing the Effect of the Script:**

- Compare the results of your script with a printout of the file.

10. Create a script that compiles all C source files in your home directory and create executable files.

**Preparation:**

- Create at least five C source files in your home directory. The files do not have to be real C source files; at a minimum they should contain a comment line that contain a unique program name such as the following example:

  /* .....file1.c .....*/

  The name of the files should have a C source file extension (.c), such as file1.c.

**Script:**

- **Script Name: compile.scr**
- **Arguments:** Two arguments, the first is the string to be found; the second is the name of the file.
- **Validation:** The minimum validation requirements are :
  i.Ensure that there is no argument
- **Body Section:** Create a script that finds all files with extension (**.**c) under your home directory and compiles them one by one. Each executable file should have the same name as the source file except that the extension should be (**.**exe). For example, if the source filename is file1.c, the executable filename should be file1.exe. Use the following command to compile:

  cc -o executable_filename source_filename

**Testing the Script:**

- Test the script with one or two arguments.
- Test the script with no arguments.

**Testing the Effect of the Script:**

- Verify that executable files were created under your home directory.

11. Create a script that finds all files in subdirectories that have the same filename.

**Preparation:**

- Make several directories, at different levels, under your home directory. For example, make ~/A, ~/B, ~/C, ~/A/AA, ~/A/BB, ~/A/AA/AAA, and so on until you have at least 15 directories. Copy a small junk file named file1 under some of these directories; do not change its name. Copy another small junk file named file2 under some other directories. Copy a third junk file under several directories. Be sure that some directories get a combination of file1 and file2 or file1 and file3. In at least three of the directories, create a junk file with a unique name.

**Script:**

- **Script Name: duplicateName.scr**
- **Arguments:** None
- **Validation:** The minimum validation requirements are :
  i.Ensure that there is no argument.
- **Body Section:** Create a script that uses find and awk commands to create a list of files that are duplicated; use the full pathname for the duplicated filenames. Hint: Use a basename command and an array in awk. The output should look like the following example:

  file1: ~/A/file1~/A/AA/file1~/A/B/BB/BBB/file1
  file2: ~/B/file2~/C/file2
  . . .

**Testing the Script:**

- Test the script with one argument.
- Test the script with no arguments.

**Testing the Effect of the Script:**

- Use a recursive long list command to list the complete contents of your home directory. Verify the output of your script against the list command output.

12. Create a script that search for multiple occurrences of the specified string in each line.

**Preparation:**

- Create a file of at least 20 lines and insert a double quoted string, such as "hello," in several lines.
- Include two or three occurrences of the string in some lines.

**Script:**

- **Script Name: search.scr**
- **Arguments:** Two arguments, the first is the string to be found; the second is the name of the file.
- **Validation:** The minimum validation requirements are :
  i. Ensure that exactly two arguments are entered.
  ii. Ensure that the second argument is the name of the file that exists and is not empty.
- **Body Section:** Create a script that uses grep and loops to find the line numbers in which the string is found. Note that grep should be applied to each line, not the whole file. The script should print the result in the following format:

**Line Number: [Line contents]**

**Testing the Script:**

- Test the script with no arguments.
- Test the script with one argument.
- Test the script with two argument but the second one is not a file.
- Test the script with two correct arguments.

**Testing the Effect of the Script:**

- Compare the results of your script with a printout of the file.

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3102L | Machine Learning Lab | 0 | 0 | 3 | 1.5 |

**Course Objectives:**

1. To introduce students with statistical learning with R.
2. To familiarize students with data pre-processing using R.
3. To analyze performance of machine learning models
4. To learn implementation of super wised and un super wised algorithms using R

**Exercise 1**: Introduction to R, Basic Commands, Graphics, Indexing Data, Loading Data, Additional Graphical and Numerical Summaries.

**Exercise 2:**

Using simple linear regression perform the following tasks on the Autodata set.

(a) Use the lm() function to perform a simple linear regression with mpg as the response and horsepower as the predictor.

(b) Use the summary() function to print the results. Comment on the output.

That is

i. Is there a relationship between the predictor and the response?

ii. How strong is the relationship between the predictor and the response?

iii. Is the relationship between the predictor and the response positive or negative?

iv. What is the predicted mpg associated with a horsepower of98? What are the associated 95% confidence and prediction intervals?

(c) Plot the response and the predictor. Use the abline() function to display the least squares regression line.

(d) Use the plot() function to produce diagnostic plots of the least squares regression fit. Comment on any problems you see with the fit.

**Exercise 3:**

Using multiple linear regression perform the following tasks on the Autodata set.

(a) Produce a scatter plot matrix which includes all of the variable sin the data set.

(b) Compute the matrix of correlations between the variables using the function cor() . You will need to exclude the name variable, cor() which is qualitative.

(c) Use the lm() function to perform a multiple linear regression with mpg as the response and all other variables except name as the predictors. Use the summary() function to print the results.

Comment on the output, That is

i. Is there a relationship between the predictors and the response?

ii. Which predictors appear to have a statistically significant relationship to the response?

iii. What does the coefficient for the year variable suggest?

(d) Use the plot() function to produce diagnostic plots of the linear regression fit. Comment on any problems you see with the fit.

Do the residual plots suggest any unusually large outliers?

Does the leverage plot identify any observations with unusually high leverage?

(e) Use the * and : symbols to fit linear regression models with interaction effects. Do any interactions appear to be statistically significant?
(f) Try a few different transformations of the variables, such aslog(X),√ X, X 2 . Comment on your findings.

**Exercise 4:**
Implementation of KNN on the Breast Cancer Data set.

**Exercise 5:**
Implement LDA, QDA, and NAÏVE BAYES on the Stock market data and produce the empirical comparison.

**Exercise 6:**
Analyse the CAR SEATS dataset using Decision Trees.

**Exercise 7:**
Application of SVM for Gene Expression Data.

**Exercise 8:**
Perform PCA on the USArrests data set.

**Exercise 9:**
Perform K-Means Clustering on NC160 Dataset.

**Exercise 10:**
Perform Hierarchical clustering on NC160 Dataset.

**Course Outcomes:**
After successful completion of the course student able to

1. Perform data pre-processing operation to prepare data for training the model.
2. Implement various super wised and un super wised algorithms in machine learning.
3. Perform analytical tasks to assess the performance of machine learning model.
4. Understand hyper parameter tuning and optimization concepts.
5. Write R script to solve various real-world problems using machine learning algorithms.

| III- Year I-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| MC3101 | **Indian Constitution** | 2 | 0 | 0 | 0 |

**UNIT-I**

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**UNIT-II**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

**UNIT-III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

**UNIT-IV**

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayats: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

**UNIT-V**

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissioner ate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

**REFERENCES:**


1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics


**E-RESOURCES**:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/

**Course Outcomes**:

| | |
|---|---|
| **CO-1** | Know the sources, features and principles of Indian Constitution. |
| **CO-2** | Learn about Union Government, State government and its administration. |

| | |
|---|---|
| **CO-3** | Get acquainted with Local administration and Pachayati Raj. |
| **CO-4** | Be aware of basic concepts and developments of Human Rights. |
| **CO-5** | Gain knowledge on roles and functioning of Election Commission |

| III- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3201 | Deep Learning | 3 | 0 | 0 | 3 |

UNIT – I: Deep learning basics

Introduction, the perceptron, Over-fitting and generalization, linear perceptron, learning XOR function with non-linear functions, feed forward neural networks, types of activation functions, types of loss functions, Back-Propagation.

UNIT – II: Optimization

Challenges in neural network optimization, Regularization, Gradient Descent, Stochastic Gradient Descent, Momentum Optimizer, AdaGrad, RMSProp, Adam, Batch normalization.

UNIT – III: Deep Learning for Computer Vision

Building blocks of CNN, Local receptive fields, Shared weights and bias, stride, Pooling layers, Max-pooling, Average pooling, CNN for image classification - Alex Net, VGG, GoogleNet, ResNet architectures. CNN for segmentation – Unet.

UNIT –IV: Effective training of Deep Neural Networks

Early stopping, Dropout, Instance Normalization, Group Normalization, Transfer Learning, Data Augmentation.

UNIT – V: Deep Learning for Natural Language Processing

Computational representation of language, one-hot representation of words, word vectors – the skip-gram word2vec model, The CBOW word2vec model, word vector arithmetic, RNN, LSTM.

**Text Books**


1. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition - Aurélien Géron, O'Reilly Media, Inc. ISBN: 9781492032649
3. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.


**Reference Books**


1. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
2. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.
3. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.
4. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.
5. Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3202 | Natural Language Processing | 3 | 0 | 0 | 3 |

**Course Objectives:**

Upon completion of this course, students will be able to explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP). In particular, students will:

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm.

**Unit – I**

Introduction and Overview: Welcome, motivations, what is Natural Language Processing; The problem of ambiguity and uncertainty in language; The Turing test; NLP Representations in syntax, semantics, and pragmatics; The applications of NLP; The role of Deep Learning in Natural Language Processing; Deep Learning for Natural Language Computing: Backpropagation, Recurrent neural networks, Transformers;

**Unit – II**

Syntactic parsing: Grammar formalisms and tree banks; Efficient parsing for context-free grammars (CFGs); Statistical parsing and probabilistic CFGs (PCFGs); Lexicalized PCFGs;

Semantic Analysis: Lexical semantics and word-sense disambiguation. Compositional semantics; Semantic Role Labeling and Semantic Parsing

**Unit – III**

N-gram Language Models: The role of language models; Simple N-gram models. Estimating parameters and smoothing; evaluating language models.

Part of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training)

**Unit – IV**

Deep Learning for Named entity recognition, Dependency Parsing, Gradient checks, Overfitting, Regularization, Activation functions, Multi-task and Semi-supervised Learning; Text Embedding: Word Vector representations: word2vec, GloVe; Advanced word vector representations; Sequence-to-sequence model

## Unit – V

Information Extraction: Named entity recognition and relation extraction. IE using sequence labeling

Machine Translation: Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

**Text Books**


1. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.


**Reference books**


1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Speech and Language Processing (3rd ed. draft), Draft chapters in progress, October 16, 2019.
4. Jacob Eisenstein, Introduction to Natural Language Processing, MIT Press, 2019.
5. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016.
6. Radford, Andrew et. al., Linguistics, an Introduction, Cambridge University Press, 1999.
7. Pushpak Bhattacharyya, Machine Translation, CRC Press, 2017.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| HS3201 | Engineering Economics & Management | 3 | 0 | 0 | 3 |

**Course objectives**

**CO 1:** To understand the concept and nature of Economics and Demand and to familiarize about the Production function, Input Output relationship, Cost-Output relationship and Break Even Analysis.

**CO 2:** To understand the nature of markets and the concepts of Money and RBI functions.

**CO 3:** To familiarize with the process of management, principles, and to provide conceptual knowledge on functional management that is on Human resource management and Marketing management.

**CO 4:** To learn different Accounting Systems, preparation of Financial Statement and to familiarize with the tools of project Management.

**CO 5:** To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

**UNIT-I**

Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics –Concept of Demand, Types of Demand, Determinants of Demand-Law of Demand -Elasticity of Demand, Types of Elasticity of Demand.

Theory of production; production function, Law of variable proportions & law of returns to scale, Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, simple problems.

**UNIT-II**

Markets: meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly).National Income, GNP, GDP, NNP, NDP, Personal income and GST (Goods & Service Tax).

Money: meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools, Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.

**UNIT-III**

Concept –nature and importance of Management Functions of Management, Principles of Management. Human Resource Management: Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management.

Marketing Management: Functions of Marketing - Marketing strategies based on product Life Cycle, Channels of distributions.

**UNIT-IV**

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements.

Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path (Simple Problems).

**UNIT-V**

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (payback period,

accounting rate of return) and modern methods (Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

**Text books**

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2018, 2e.
2. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2012.
3. Management Science, Aryasri, Tata McGraw Hill, 2014.

**Reference books**

1. R. L Varshney, K.L. Maheshwari: Managerial Economics, Sultan Chand & Sons 2014, 2e.
2. Suma Damodaran: Managerial Economics, Oxford 2010, 2e.
3. Ambrish Gupta: 'Financial Accounting for Management', Pearson 2015, 5e.

**Course Outcomes**

Upon successful completion of the course, the student will be able to

**CO1** The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for a product and Input-Output-Cost relationships.

**CO2** The Learner is also ready to understand the nature of different markets and also to have the knowledge of Money & Banking.

**CO3** The Learner will acquire the knowledge on management, HRM and Marketing.

**CO4** The Learner will acquire the knowledge to prepare Financial Statements and the techniques of project management.

**CO5** The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

| III- Year II-Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PE3201 | **Design and Analysis of Algorithms** | 3 | 0 | 0 | 3 |

**Course Objectives:**

1. To provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms
2. To introduce the different algorithmic approaches for problem solving through numerous example problems
3. To provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness

**UNIT - I**

**Introduction:** Algorithm Definition, Algorithm Specification, Performance Analysis, Performance Measurement, Asymptotic notations.

**Divide and Conquer:** General Method, Binary Search, Finding the Maximum and Minimum, Quick Sort.

**UNIT - II**

**The Greedy Method:** The General Method, Knapsack Problem, Single Source Shortest Path Problem, Optimal Storage on Tapes Problem, Optimal Merge Patterns Problem.

**UNIT - III**

**Dynamic Programming:** The General Method, 0/1 Knapsack Problem, Single Source Shortest Path – General Weights, All Pairs-Shortest Paths Problem, Traveling Salesperson Problem, String Editing Problem.

**UNIT - IV**

**Backtracking:** The General Method, The N-Queens Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycles Problem.

**UNIT - V**

**Branch and Bound:** The General Method, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack Problem, Travelling Salesperson Problem.

**NP-Hard and NP-Complete problems:** Basic concepts, Cook's Theorem.

**Text Books**

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.

**Reference Books**

1. Harsh Bhasin, "Algorithms Design & Analysis", Oxford University Press.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press.

**Course Outcomes**

**CO1:** Infer the divide-and-conquer paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
**CO2:** Infer the greedy paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems.

**CO3:** Infer the dynamic-programming paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems.

**CO4:** Infer the backtracking paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems.

**CO5:** Infer the branch and bound paradigm and its context. Recite algorithms that employ this paradigm. Apply this paradigm to design algorithms for apt problems.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| OE3201 | Testing & Automation | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

1. Verifying the functionality of the software
2. Identifying and reporting defects,
3. Measuring the quality and coverage of testing, and providing feedback and recommendations
4. Improve and automate test practices.

**UNIT – I**

Software Development Methodologies: High-level overview, Waterfall, Agile, Scrum, Kanban, Extreme Programming. Version Control with GIT: Version Control concept, centralized vs. distributed version control systems, Download, install and configure GIT, GitHub, SSK-KEY, GIT internals, undoing changes (Git Revert & Git Reset), Branching and merge, Tags, Stash, Remotes, Branching strategies, Practical tasks.

**UNIT – II**

Introduction to Software Functional Test: Software testing and Software development processes, checklist, Test cases, Test Suites, Defect Reports, Test plan and Test Result Report

**UNIT – III**

Introduction to SQL: Introduction to Database Testing, DML statements - Select, insert, update, delete, truncate, DDL Statements - Create, Alter, Drop, DCL & TCL statements-Grant, Revoke & commit, Rollback, Save point.

**UNIT – IV**

Unit Testing Framework & Selenium API: Introduction to Selenium, Selenium Locators, Finding Elements, working with elements, Synchronizing Tests, Testng and list of annotations used in Testng.

**UNIT – V**

API Functional Testing & Automation: REST Architecture-Understanding of REST Architecture and Richardson Maturity Model, API Testing, Usage of Postman, Automated testing Web Services (Amazon, Flip kart, GitHub etc.).

**COURSE OUTCOMES**

1. Familiarize with real time concepts of Software Development Methodologies and GIT.
2. Learn various software functional test cases and Defects Reporting.
3. Familiarize with basic SQL statements.
4. Understand selenium IDE applicable to various tasks.
5. Understand about various tools and implement it on various Real Time Applications.

TEXT BOOKS:


1. Software Testing - Base Course (Svyatoslav Kulikov) - 3rd edition – EN
2. Software Development a Practical Approach! Hans-Petter Halvorsen
3. Pro Git by Scott Chacon &Ben Straub – 2nd edition.
4. Database Concepts, 8th edition. David M. Kroenke, David J. Auer, Scott L. Vandenberg, Robert C. Yoder.
5. Selenium Testing Tools Cookbook (Second Edition)
6. Rest API Automation Testing from Scratch – REST Assured Java

7. Automating and Testing a REST API: A Case Study in API testing using: Java, REST Assured, Postman, Tracks, curl and HTTP Proxies

REFERENCE BOOKS:

1. Mastering Selenium Web Driver

ONLINE REFERENCES:

1. https://www.selenium.dev/documentation/
2. https://dev.mysql.com/doc/
3. https://www.postgresql.org/docs/
4. https://git-scm.com/docs
5. https://learngitbranching.js.org/

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| SAC3201 | Skill Advanced Course – 2 Soft Skills | 1 | 0 | 2 | 2 |

**COURSE OBJECTIVES**

1. communicate clearly, confidently, concisely, and persuasively both written as well as orally.
2. rediscover and boost self-confidence, to the zenith, and solve issues with ease.
3. recognize the results (change) of their behavior / conduct and teach them to take ownership oftheir acts rather than blaming others.
4. build confidence in their speaking / presentation skills and become industry-ready.
5. develop a stronger sense of consciousness and appreciation for others by analyzing prospects, andcreating choices.
6. manage self-competence and self-confidence.

**Module 1 Effective communication skills**

- ✓ Start with self and connect with others.
- ✓ The art of narrating and storytelling.
- ✓ Enhance teamwork and influence change.

**Module 2 Advanced verbal ability concepts – practice and Professional writing skills**

- ✓ Nurture and enhance the verbal ability strength through practice.
- ✓ Conducting mock verbal (ability) tests and their timely review.
- ✓ List the steps of writing an email effectively & comprehend the importance of structuring an email.
- ✓ Overview of various elements related to accuracy, brevity and correctness in our everyday writing atthe workplace (Project proposals / covering letters / blogs / short essays).

**Module 3 Industry sneak and résumé / CV building strategies**

- ✓ Industry & aspirant career expectations and tailoring action learning plan aptly.
- ✓ Crafting winning résumé(s) suiting to different profiles.
- ✓ Framing responses to résumé based interview questions.

**Module 4 Behavioral competency building – Part II and psychometric test (HR Round Preparation)**

- ✓ Listing personal characteristics and preparing blueprint to inculcate them.
- ✓ Assess the students' ability to fit into a specific work environment or with specific personality types.
- ✓ Determine basic characteristics of an individual.

**Module 5 Presentation skills & Mock interviews**

- ✓ Illustration of presentation structure via impromptu / free speech – and essential criteria for aneffective presentation
- ✓ Importance of non-verbal communication (signposting)
- ✓ Inciting the interview process by practicing a gamut of behavioral mock interviews.

| | |
|---|---|
| **CO 1** | master advanced nuances of both written and oral communication skills that are imperative for any professional to succeed coupled with being emphatic. |
| **CO 2** | confidently ace different competitive exams and develop writing skills. |
| **CO 3** | gain awareness of the industry expectations and craft CV / Résumé in lieu with desired job profiles. |
| **CO 4** | crack behavioral (HR) interview confidently and exhibit professional persona. |
| **CO 5** | make presentations effective and develop interview strategies while get rid of interview phobia. |

**Reference Books**


1. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013.
2. Barun K. Mitra, “Personality Development & Soft Skills”, Oxford Publishers, Third impression,2017.
3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd.,2016.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| MC3201 | Entrepreneurial Skill Development | 2 | 0 | 0 | 0 |

**Course Objective:**

1. To impart the basics of entrepreneurship skills for better understanding of entrepreneurial scenario.
2. To familiarize the various components from I to E and promoting adaptability nature.
3. To be aware of small-scale ventures and registrations and patents related for entrepreneurship and startups management.
4. To familiarize with significance of institutional support at various levels for determining the marketing strategies.
5. To familiarize the strategic perspectives in entrepreneurship.

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

**CO1:** The basics of entrepreneurship skills for better understanding of entrepreneurial scenario are understood.

**CO2:** The various components from I to E and promoting adaptability nature were made familiar.

**CO3:** Awareness on small scale ventures and registrations and patents related for entrepreneurship and startups was explained.

**CO4:** significance of institutional support at various levels for determining the marketing strategies was explained.

**CO5:** Strategic perspectives in entrepreneurship are made familiar.

**SYLLABUS**

**UNIT I**

**Entrepreneurial Perspectives**

Introduction to Entrepreneurship – Evolution - Concept of Entrepreneurship - Types of Entrepreneurs - Entrepreneurial Competencies, Capacity Building for Entrepreneurs. Entrepreneurial Training Methods - Entrepreneurial Motivations - Models for Entrepreneurial Development - The process of Entrepreneurial Development.

**UNIT - II**

**New Venture Creation**

Introduction, Mobility of Entrepreneurs, Models for Opportunity Evaluation; Types of loans for entrepreneurship and startups. Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

**UNIT – III**

**Small Scale Ventures, MSME in India and their challenges**

Concept of micro, small and medium enterprises and startups. Scope and trends of small entrepreneurship and startup in India. Role of government in promoting small scale industries. Management of MSMEs and Sick Enterprises Challenges of MSMEs, Preventing Sickness in Enterprises – Specific Management Problems; Industrial Sickness; Industrial Sickness in India – Symptoms, process and Rehabilitation of Sick Units.

**UNIT – IV**

**Market growth for generating entrepreneurship opportunities**

Entrepreneur's legal and regulatory systems, Intellectual property rights, patents, Copy rights and trademark and their protection. Managing Marketing and Growth of Enterprises Essential

Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

**UNIT – V**

**Institutional Support to Entrepreneurship and Woman Entrepreneurship**

Strategic perspectives in Entrepreneurship, Technology and Entrepreneurship, Training institutions "District Industry Centre (DIC), Entrepreneurship Development Institute of India (EDII)" Innovation council – Ministry of Human Resource Development (MHRD), Small Industries Development Bank of India (SIDBI), Industrial Development Bank of India (IDBI).

Women Entrepreneurs – Strategies to develop Women Entrepreneurs, Institutions supporting Women Entrepreneurship in India, Association of Lady Entrepreneurs of India (ALEAP)

**TEXT BOOKS**


1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath, 2e, Pearson, 2014.
2. P. Narayana Reddy, Entrepreneurship, Cengage Learning, New Delhi,2010.
3. Steven Fisher, Ja-nae Duane, the startup equation – A visual guide book for building your startup, Indian edition, Mc Graw Hill Education India Pvt. Ltd. 2016


**REFERENCE BOOKS**


1. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
2. Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage, 2012.
3. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2015.
4. Anajan Rai Chaudhuri, Managing new ventures, concepts and cases, Prentice Hall International, 2010
5. Rajeev Roy: Entrepreneurship, Oxford university press, New Delhi, 2010.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3201L | Deep Learning Lab | 0 | 0 | 3 | 1.5 |

List of Experiments

1. Installation and working on python, Jupyter, and its different libraries for deep learning (Tensor Flow, NumPy, Kera, Pandas, Matplotlib, etc.)
2. To implement a Multilayer Perceptron (MLP) using Keras with TensorFlow, and fine-tune neural network hyper parameters for regression problem (house price prediction).
3. To implement a MLP using keras with TensorFlow for classification problem (heart disease predication).
4. To implement a Convolution Neural Network (CNN) for dog/cat classification problem using keras.
5. To Implement a CNN for object detection in the given image.
6. To implement a Recurrent Neural Network (RNN) for predicating time series data.
7. To implement a Long Short-Term Memory (LSTM) for predicating time series data.
8. To implement a Seq2Seq Model for Neural Machine Translation in Keras.
9. To implement an Encoder-Decoder Recurrent neural network model for Neural Machine Translation.
10. To implement a Gated Recurrent Unit (GRU) for time series data predication.

| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3202L | Cloud Computing Lab | 0 | 0 | 3 | 1.5 |

1. Basics of Virtualization: VMM, Example of VMM (virtual box), Creation of a VM, Networking and communication between VMs.

2. Introduction to Cloud Sim: Installation and Execution, Cloud Data centre, Network Topology.

3. Simulation of a Cloud Framework: Creating a DC, Creation of Tasks, Creation of VMs, Defining task and VM characteristics, execution of tasks on VMs.

4. Scalable and dynamic Cloud systems: Creation of scalable cloud entities, creation of dynamic entities.

5. Resource Allocation in Cloud Data centre: Experimenting and understanding various resource allocation policies, changing the resource allocation policy, effects of resource allocation policies.

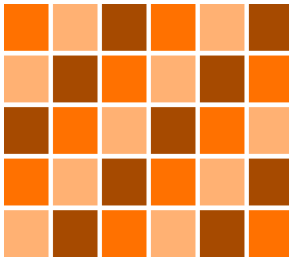
6. Power Management in Cloud Data centres: Creation of a power data centre, understanding various power saving techniques.

7. Understanding Commercial Cloud Frameworks: Amazon AWS, Elastic Cloud, Amazon Load Balancer, creating VMs, Allocation of Resources.

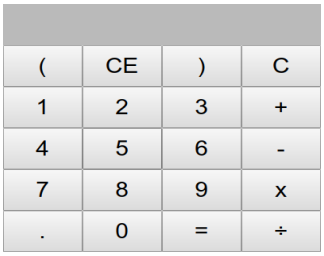
| III Year - II Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PC3203L | Full Stack Development Lab | 0 | 0 | 3 | 1.5 |

List of experiments:

1. Try to recreate the following patterns using HTML and CSS only



2. Implement Drag n Drop feature in HTML 5




3. Demonstrate Event bubbling with necessary examples.
4. Design a Calculator using Java script and relevant CSS.
5. Demonstrate Higher order functions with necessary examples – filter(), reduce() and map()
6. Create a Class Component for Counter in React JS
7. Create a Class component for Changing the color of the text given in React JS
8. Class a Class Component for viewing an array of objects in a tabular form.
9. Display a digital clock in React JS.
10. Demonstrate use State Hook with the help sample text.
11. Demonstrate use Context Hook with necessary example.
12. Demonstrate use Effect Hook with necessary example.
13. Demonstrate consuming web API using fetch & axios (AXIOS API). Demonstrate with the help of fake URL.
14. Design a BMI calculator using React JS based on the description given below:

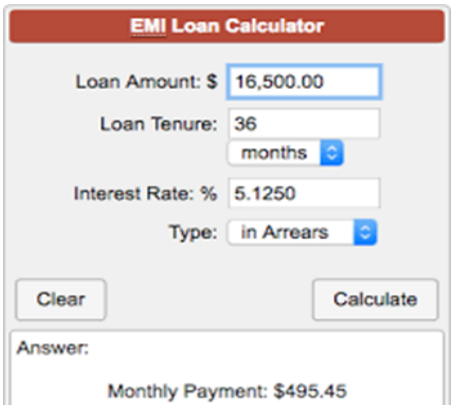
BMI is a measurement of a person's leanness or corpulence based on their height and weight, and is intended to quantify tissue mass. It is widely used as a general indicator of whether a person has a healthy body weight for their height.

Formula: weight (kg) / [height (m)]2 (or) [weight (kg) / height (cm) / height (cm)] x 10,000

BMI table for adults: This is the World Health Organization's (WHO) recommended body weight based on BMI values for adults. It is used for both men and women, age 18 or older.

| Category | BMI range - kg/m2 |
|---|---|
| Severe Thinness | < 16 |
| Moderate Thinness | 16 - 17 |
| Mild Thinness | 17 - 18.5 |
| Normal | 18.5 - 25 |
| Overweight | 25 - 30 |
| Obese Class I | 30 - 35 |
| Obese Class II | 35 - 40 |
| Obese Class III | > 40 |

15. Display a selected set of images in tabular format using React JS.
16. Implement Upload & down load options on a given file.
17. Create a React application to view EMI calculator. A specific view is given below:




$$E = P \times r \times \frac{(1+r)^n}{(1+r)^n - 1}$$

Where,

$E$ is the EMI
$P$ is the principal amount
$r$ is the monthly rate of interest
$n$ is the number of months

18. Design the following Hotel bill screen. User can select as many items as possible from the dropdown box and is allowed to enter in the text field provided. Each transaction must be added in the table given below along with the bill amount.

# GREEN STAR HOTEL

## Customer Bill

**Date:**

Items: Biryani No of Items:

| | | | | |
|---|---|---|---|---|
| 1. | Biryani | 2 | Rs. 140 Each | Rs.280 |
| 2. | Fried Rice | 1 | Rs. 110 Each | Rs.110 |
| 3. | Chicken Curry | 2 | Rs. 230 Each | Rs.460 |

| | |
|---|---|
| Total | Rs. 850 |
| GST @5% | Rs. 42.50 |
| Bill to be paid | Rs. 892.50 |

19. Demonstrate the procedure to create a schema in MongoDB.
20. Demonstrate CRUD operations using MongoDB.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| HSE4101 | Universal Human Values-2: Understanding Harmony | 3 | 0 | 0 | 3 |

COURSE OBJECTIVE:

The students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

UNIT-I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.

UNIT-III

Understanding Harmony in the Family and Society- Harmony in Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goal. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

UNIT-IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-

existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.

UNIT-V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

TEXTBOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCEBOOKS

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews

COURSE OUTCOMES:

1. Understanding the content and process for Value education.
2. Understanding the harmony in the human being, family, society and nature/existence
3. Apply the Strengthening of self-reflection.
4. Apply to All levels become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
5. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PE4101 | Insights of Big Data | 3 | 0 | 0 | 3 |

Course Objectives:

1. To understand the complexity and volume of Big Data and their challenges.
2. To analyze the various methods of data collection.
3. To comprehend the necessity for pre-processing Big Data and their issues.
4. To understand predictive analytics and descriptive analytics.
5. To understand and implement Big Data Analytics with data convergence and Business Maturity Model.

**UNIT– I**

INTRODUCTION TO BIG DATA: Data, Characteristics of data and types of digital data, Sources of data, working with unstructured data, Evolution and definition of big data, Characteristics and need of big data, Challenges of big data.

OVERVIEW OF BIG DATA ANALYTICS: Overview of business intelligence, Data science and analytics, Meaning and characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.

**UNIT – II**

INTRODUCTION TO HADOOP : Introducing hadoop, Need of hadoop, Limitations of RDBMS, RDBMS versus hadoop, Distributed computing challenges, History of hadoop , Hadoop overview, Use case of hadoop, Hadoop distributors, HDFS (Hadoop distributed file system), Processing data with hadoop, Managing resources and applications with hadoop YARN (yet another resource negotiator), Interacting with hadoop ecosystem.

**UNIT – III**

MAPREDUCE PROGRAMMING: Introduction-mapper, reducer, combiner, partitioner, searching, sorting, compression, real time applications using mapreduce, combiner, partitioner, matrix multiplication using mapreduce and page rank algorithm using mapreduce.

**UNIT – IV**

PIG BASICS: The anatomy of pig, Pig on hadoop, Pig philosophy, Usecase for pig, ETL processing, Pig Latin overview, Data types in pig, Running pig, Execution modes of pig, HDFS commands, Relational operators, Piggy bank, Word count example using pig, Pig at Yahoo.

**UNIT - V**

BASICS OF HIVE: Introduction to hive, Hive architecture, Hive data types, Hive file format, Hive query language (HQL), HIVE: Partitions and bucketing, RC File Implementation, working with XML files, User-defined Function (UDF) in Hive, Pig versus Hive.

TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, 1st edition, Wiley Publishers, 2015.

**REFERENCE BOOKS**


1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1st edition, Wiley, 2015.
2. Chris Eaton, Dirkderoosetal, "Understanding Big data ", 1st edition, McGraw Hill, 2012.
3. Tom White, "HADOOP: The definitive Guide", 1st edition, O Reilly 2012.
4. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st edition, Packet Publishing, 2013.


**Course Outcomes**

1. Identify the various sources of Big Data.
2. List the components of Hadoop and Hadoop Eco-System and Analyze file systems such as GFS and HDFS.
3. Apply map reduce concepts for desired applications.
4. Demonstrate the Pig architecture and evaluation of pig scripts.
5. Implement Big Data Activities using Hive

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PE4102 | Cyber Security | 3 | 0 | 0 | 3 |

**Course Objectives**

1. To understand various types of cyber-attacks and cyber-crimes
2. To learn threats and risks within context of the cyber security
3. To have an overview of the cyber laws & concepts of cyber forensics
4. To study the defensive techniques against these attacks.
5. To Analyze the Cyber Security needs of the Organizations.

**UNIT-I**

Introduction of Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes: Email Spoofing, Spamming, Internet Time Theft, Salami Attack/Salami Technique, Data Diddling, Forgery, Web Jacking, Newgroup Spam, Industrial Espionage, Hacking, Online Frauds, Pornographic offenses, Software Piracy, Computer Sabotage, E-Mail bombing, computer network intrusions, password sniffing, credit card frauds, identity theft, Cybercrime Era: Survival mantra for the Netizens.

**UNIT-II**

Cyber offenses: Criminals Plan: Categories of Cybercrime, Cyber Attacks: Reconnaissance, Passive Attack, Active Attacks, Scanning/Scrutinizing gathered Information, Attack, Social Engineering: Classification of Social Engineering, Cyberstalking: Types of Stalkers, Working of Stalking, Real-Life Incident of Cyber stalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Botnet, Attack Vector: Theft, viruses, mishing, vishing, smishing, hacking Bluetooth, Cybercrime and cloud computing.

**UNIT-III**

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT-IV**

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.

**UNIT-V**

Cybercrimes and Cyber security: Organizational Implications–Introduction–Insider threats, Privacy, Key challenges to organizations, Cost of Cybercrimes and IPR issues, Incident Handling: Definitions, Why Organizations need Incident Response systems, Examples of incidents, what organizations can do to protect, best practices for organizations.

**TEXT BOOKS**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Wiley India Publications

**REFERENCES**

[1] James Graham, R Howard, R Olson, "Cyber Security Essentials" CRC Press, 2018

[2] Michael E Whitman, Herbert J Mattord, "Principles of Information Security", 4th Edition,

Cengage Learning, 2012

[3] William Stallings, “Cryptography and Network Security- Principles and Practice”, 7th Edition, Pearson Education, 2017

**Course Outcomes**

CO 1. Analyze and evaluate the cyber security needs of an organization.

CO 2. Understand Cyber Security Regulations and Roles of International Law.

CO 3. Design and develop a security architecture for an organization.

CO 4. Understand fundamental concepts of data privacy attacks

CO 5. Analyze the cyber security needs of an organization.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| PE4103 | Digital Interaction Design | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

1. Demonstrate an understanding of guidelines, principles, and theories influencing human computer interaction.
2. Recognize how a computer system may be modified to include human diversity.
3. Select an effective style for a specific application.
4. Design mock ups and carry out user and expert evaluation of interfaces.
5. Carry out the steps of experimental design, usability and experimental testing, and evaluation of human computer interaction systems.
6. Use the information sources available, and be aware of the methodologies and technologies supporting advances in HCI

**UNIT-I**

Introduction to Usability of Interactive Systems: Introduction, usability goals and measures, usability motivations, universal usability, goals for our profession Managing.
Guidelines, Principles, and Theories: Introduction to Guidelines, Principles and Theories.

**UNIT-II**

Design Processes: Introduction, Organizational Support for design, The Design Process, Design Framework, Design Methods, Design Tools, Practices and patterns, Social Impact Analysis, Legal Issues.
Direct Manipulation and Immersive Environments: Introduction ,Direct Manipulation, Examples of Direct Manipulation, 2-D and 3-D Interfaces, Teleportation and Presence, Augmented and Virtual Reality.

**UNIT-III**

Fluid Navigation: Introduction, Navigation by Selection, Small Displays, Content Organization, Audio Menus, Form Fill-in and Dialog Boxes.
Expressive Human and Command Languages: Introduction, Speech Recognition, Speech Production, Human Language Technology, Traditional Command Languages.

**UNIT-IV**

Devices: Introduction to Keyboards and Keypads, Pointing Devices, Displays.
Advancing the User Experience: Introduction , Display Design , View (Window) ,Management , Animation , Webpage Design , Color , Non-anthropomorphic Design , Error Messages.

**UNIT-V**

User Documentation and Online Help: Introduction, Online Vs Paper Documentation, reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.

**Text Books**

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist Designing the User Interface: Strategies for Effective Human,Computer Interaction, Sixth Edition, Pearson Education, 2017.

**Reference Books**

1. Preece, Rogers and Sharps, “Interaction Design”, 3rd edition, Wiley Dreamtech, 2011.
2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.
3. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
4. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human Computer Interaction, Wiley, 5th Edition, 2019. ( Experiments)

**COURSE OUTCOMES**

1. List various classic Universal user, centric models
2. Outline complex interaction styles and techniques for contextual design.
3. Classify various applications to simulate natural language interaction.
4. Choose suitable designs for web and mobile applications.
5. Build the challenges for visualization researchers and practitioners alike.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| OE4101 | Operations Research | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

1. To understand the basics of linear programming, transportation, queueing, sequencing of jobs, replacement, inventory and simulation problems.
2. To apply linear programming, transportation and assignment models to solve real life problems.
3. To apply Sequencing, queueing, Game and Replacement theories to solve problems.
4. Apply knowledge of inventory control and simulation to solve practical industrial problems.

**UNIT-1**

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, INTRODUCTION TO OPERATIONS RESEARCH: History, definition, operations research models, phases of implementing operations research in practice, applications., LINEAR PROGRAMMING: Introduction, formulation, graphical solution, simplex method, Big M and two-phase methods, duality principle.

**UNIT-II**

Understanding Harmony in the Human Being - Harmony in Myself!
TRANSPORTATION: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method.
ASSIGNMENT: One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling salesman problem, maximization in A.P.

**UNIT-III**

Understanding Harmony in the Family and Society- Harmony in Human Relationship
QUEUING THEORY: Introduction, Kendall’s notation, classification of queuing models, single server and multi-server models, Poisson arrival, exponential service, infinite population.
SEQUENCING: Introduction, assumptions, processing n-jobs through two machines, n-jobs through three machines, and graphic solution for processing 2 jobs through n machines with different order of sequence.

**UNIT-IV**

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
GAME THEORY: Introduction, game with pure strategies, game with mixed strategies, dominance principle, graphical method for 2xn and mx2 games. REPLACEMENT THEORY: Introduction, replacement of items that deteriorate with time - value of money unchanging and changing, simple probabilistic model for replacement of items that fail completely.

**UNIT-V**

Implications of the above Holistic Understanding of Harmony on Professional Ethics
NETWORK ANALYSIS: Project planning, scheduling, and controlling – tools for project management – critical path method – Programme evaluation and review technique (PERT) – cost analysis and crashing – resource levelling – updating.

**TEXTBOOKS**

1. Operations Research, by S.D. Sharma, Kedarnath & Ramnath publications (15th edition),2013.
2. Introduction to Operations Research, by Taha, Pearson Education, New Delhi, (8th edition), 2008.

**REFERENCEBOOKS**

1. Operations Research, (4th edition) by A.M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education, New Delhi, 2009.
2. Operations Research, (2nd edition) by R. Panner Selvam, 2009, PHI Publications, Noida.
3. Operations Research, (2nd edition) by Wagner, 2007, PHI Publications, Noida
4. Operation Research, (4th edition) by J.K. Sharma, 2009, Macmillan publishers, India Ltd. New Delhi.

**COURSE OUTCOMES**:

1. The understand the basics of linear programming, transportation, queueing, sequencing of jobs, replacement, inventory, and simulation problems {Understand level, KL2}
2. To apply linear programming, transportation, and assignment models to solve real life problems.
3. To apply queuing and sequencing theories to solve real life problems.
4. To Recognize and solve queuing and game theory problems.
5. The Model the project management problems through CPM and PERT.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| OE4102 | Green Buildings | 0 | 0 | 3 | 1.5 |

**Course Objectives**

1. This course aims to highlight importance of Energy- Efficient Buildings within the context of Energy issues in the 21st century.
2. To familiarize students with the concept of Energy efficiency, Renewable sources of energy and their effective adaptation in green buildings
3. To give a fuller understanding of Building Form and Fabric, Infiltration, ventilation, Lighting, cooling and water conservation.
4. To highlight the importance of Environmental Management as well as Environmental Impact Assessment methods in Energy efficient buildings.
5. To make students aware regarding various Green Building Certifications and Energy Conservation Building code

**UNIT-I**

Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.

**UNIT II**

Renewable Energy sources that can be used in Green Buildings – Conventional and Non-Conventional Energy, Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy, Photovoltaics, Rainwater Harvesting Climate and Energy, Macro and Microclimate. Indian Examples.

**UNIT III**

Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, Grouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.

**UNIT IV**

Infiltration and ventilation, Natural ventilation in commercial buildings, passive cooling, modelling air flow and ventilation, Concepts of daylight factors and day lighting, daylight assessment, artificial lighting, New light sources. Cooling buildings, passive cooling, mechanical cooling. Water conservation- taps, toilets and urinals, novel systems, collection and utilization of rain water.

**UNIT V**

Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED, GRIHA & IGBC Certification for buildings. Eco-homes, Sustainable architecture and urban design – principles of environmental architecture, Benefits of green buildings – Energy Conservation Building code - NBC -Case Studies – Green Buildings in Auroville and Dakshina Chitra, Tamil Nadu, India

**TEXT BOOKS**

1. William T. Meyer., Energy Economics and Building Design., New York: McGraw- Hill, Inc Indian Green Building Council

**REFERENCE BOOKS**

1. Public Technology, Inc. (1996). Sustainable Building Technical Manual: Green Building Design, Construction, and Operations. Public Technology, Inc., Washington, DC.
2. Sim Van Der Ryn, Stuart Cowan, "Ecological Design", Island Press (1996).

**Course Outcomes**

1. Understand why buildings should be made energy efficient.
2. Have a fuller grasp on Renewable Energy mechanisms such as Passive Solar heating and collection, Photovoltaics, and Ground source heat pumps, and their adaption to green building concepts.
3. Understand the concepts of Site and Climate, Building Form, Building Fabric
4. Understand the concepts of Infiltration and ventilation, Lighting, Heating, Cooling, Energy Management and water conservation.
5. Have the necessary skills to undertake an Environmental Impact Assessment study for Energy Efficient Buildings. They shall be equipped with the associated cutting-edge management strategies too.

| IV Year - I Semester | Name of the Course | L | T | P | C |
|---|---|---|---|---|---|
| SAC4101 | System Design Using UML | 0 | 0 | 3 | 1.5 |

Course Objectives

1. To know the practical issues of the different object-oriented analysis and design concepts
2. Inculcate the art of object-oriented software analysis and design
3. Apply forward and reverse engineering of a software system
4. Carry out the analysis and design of a system in an object-oriented way

Week 1

Familiarization with Rational Rose/ Star UML/ Umbrella/ Visual Paradigm/ Microsoft Visio environment

Week 2:

Understanding different views that the UML aims to visualize through different modelling diagrams.

User's View: Use case Diagram, Structural View: Class Diagram, Object Diagram, Behavioral View: Sequence Diagram, Collaboration Diagram, State chart Diagram, Activity Diagram, Environmental View: Deployment diagram Implementation View: Component Diagram

Week 3:

Create a complete UML model for E-Mail Client system.

Week 4:

Create a complete UML model for Stock maintenance system.

Week 5:

Consider the User’s view of your respective system: Identify the use cases, actors involved in the system and develop the Use case and sub-use case diagrams.

Week 6:

Consider the Structural view of your respective system:

• Identify the classes, their attributes, methods, relationships and develop the Class diagram.

• Identify the objects and their links between and develop the Object diagram.

Week 7:

Consider the Behavioral view of your respective system: Visualize and ratify runtime framework of the system and develop the Sequence diagram by using life-lines, messages, execution occurrence, interaction fragments. Develop the Communication diagram/ Collaboration diagram to portray the object's architecture in the system.

Week 8:

Consider the Behavioral view of your respective system:

Develop the dynamic view of the system that portrays the behavior of the system using State-chart/ State-Machine diagram.

Develop the Activity diagram to demonstrate the flow of control within the system by considering concurrent and sequential activities.

Week 9:

Consider the Implementation view of your respective system:

Develop the Component diagram that visualizes the relationships as well as the organization between the components present in the system

Week 10:

Consider the Environmental view of your respective system:

Develop the Deployment diagram to depict how the software interacts with hardware to perform its execution by identifying nodes and their relationships in the system.

Week 11:

Create a system to design Student Mark Analysis System and generate code by using MS- Access as back end and VB as front end.

Week 12:

Consider your respective System UML model and generate code by using MS-Access as back end and VB as front end.

Course Outcomes:

1. Know the syntax of different UML diagrams
2. Create use case documents that capture requirements for a software system
3. Create class diagrams that model both the domain model and design model of a software system
4. Create interaction diagrams that model the dynamic aspects of a software system.
5. Write code that builds a software system.
6. Develop design for simple applications

| S. No | Subject code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | PROJ4201 | Major Project - Viva Voce | 0 | 0 | 0 | 8 |
| 2 | CSP01 | Community Service Project | 0 | 0 | 0 | 4 |
| Internship (6 months) | | | | | | |