VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

DEPARTMENT

OF

COMPUTER ENGINEERING

COURSE STRUCTURE AND SYLLABUS

for

B. Tech – Artificial Intelligence & Data Science

(Applicable for batches admitted from 2020-2021)

VVIT

VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

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 – 522 508

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, 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 MoUs with Industry and Training & Placement Companies like Infosys, Tech Mahindra, Social Agro, Efftronics, AMCAT and Cocubes. Centre of Excellence (CoE) by Siemens India was established in the year 2016 by APSSDCto 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

To achieve the yearnings of arising architects to accomplish worldwide knowledge by acquiring figuring and plan capacities through correspondence that raise them to address the issues of industry, economy, society, ecological and worldwide.

Department Mission

- *To give the satiate of-the craftsmanship offices to fashion the understudies in industry-prepared in Artificial Intelligence and Data Science*
- *To cultivate the intelligence of creativity and innovation for various socio-economic related applications useful for increasing the productivity.*
- *To encourage alliance with the apparent industries to have the best of all careers.*
- *To empower graduates as novel entrepreneurs.*

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.Techfrom 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	CSE (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

3. **Medium of Instruction:** The medium of instruction of the entire B. Tech undergraduate 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) oneSubject 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 90 minutes for descriptive paper) 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 25 marks. The internal 25 marks shall be awarded as follows: day to day work 5 marks, record 5 marks and the remaining 15 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 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 ith subject and G_i is the grade point scored by the student in the ith 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 ith 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 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th 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	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)

	of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any 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.	has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all 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.	

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

Course structure for eight semesters during four years of study is as follows

I Year I Semester (Semester-1)

S No.	Course 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 & Electronics Engineering Lab	0	0	3	1.5
8	ES1103L	Problem Solving using C Lab	0	0	3	1.5
					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 (Semester-2)

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	3	0	0	3
4	ES1201	Problem Solving using Python	3	0	0	3
5	ES1202	Digital Logic Design	2	1	0	3
6	BS1202L	Applied Physics Lab & 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
					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 (Semester-3)

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	3	0	0	3
4	PC2103	Java Programming	3	0	0	3
5	PC2104	Database Management Systems	3	0	0	3
6	PC2102L	Data Structures Lab	0	0	3	1.5
7	PC2103L	Java Programming Lab	0	0	3	1.5
8	PC2104L	Database Management Systems Lab	0	0	3	1.5
9	SOC2101	Advanced Python Programming	1	0	2	2
10	MC2101	Essence of Indian Traditional Knowledge	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 (Semester-4)

S No.	Course Code	Course Name	L	T	P	C
1	BS2201	Probability and Statistics	2	1	0	3
2	ES2201	Computer Organization	3	0	0	3
3	PC2201	Operating Systems	3	0	0	3
4	PC2202	Software Engineering	3	0	0	3
5	PC2203	Data Warehousing and Data Mining	3	0	0	3
6	PC2201L	Operating Systems Lab	0	0	3	1.5
7	PC2202L	Software Engineering Lab	0	0	3	1.5
8	PC2203L	Data Warehousing and Data Mining Lab	0	0	3	1.5
9	SOC2201	R Programming	1	0	2	2
					Total	**21.5**
		Internship/Community Service Project 2 Months (Mandatory) during summer vacation				
		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 (Semester-5)

S.No.	Course Code	Course Name	L	T	P	C
1	PC3101	Computer Networks	3	0	0	3
2	PC3102	Design and Analysis of Algorithms	3	0	0	3
3	PC3103	Automata Theory and Compiler Design	3	0	0	3
4	PE3101	Professional Elective I	3	0	0	3
5	OE3101	Open Elective I	3	0	0	3
6	PC3101L	Computer Networks Lab	0	0	3	1.5
7	PC3102L	Design and Analysis of Algorithms Lab	0	0	3	1.5
8	SOC3101	.Net	1	0	2	2
9	MC3101	Indian Constitution	2	0	0	0
10	INTERN3101	Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester)	0	0	3	1.5
					Total	**21.5**
		Honors/Minor courses	3	1	0	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
INTERN	Summer Internship	1.5
	Total Credits	**21.5**

III Year II Semester (Semester-6)

S No.	Course Code	Course Name	L	T	P	C
1	HS3201	Engineering Economics and Management	3	0	0	3
2	PC3201	Artificial Intelligence	3	0	0	3
3	PC3202	Data Science, Preparation and Analysis	3	0	0	3
4	PE3201	Professional Elective II	3	0	0	3
5	OE3201	Open Elective II	3	0	0	3
6	PC3201L	Artificial Intelligence Tools and Techniques Lab	0	0	3	1.5
7	PC3202L	Data Science, Preparation and Analysis Lab	0	0	3	1.5
8	PC3203L	Full Stack Lab	0	0	3	1.5
9	SOC3201	Soft Skills	1	0	2	2
10	MC3201	Public Administration	2	0	0	0
					Total	**21.5**
		Industrial/Research Internship 2 Months (Mandatory) during summer vacation				
		Honors/Minor courses	3	0	2	4

Category		Credits
HS	Humanities and Social Science Courses	3
PC	Professional Core Courses	3+3+1.5+1.5+1.5=10.5
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	HS4101	Universal Human Values-2: Understanding Harmony	3	0	0	3
2	PE4101	Professional Elective III	3	0	0	3
3	PE4102	Professional Elective IV	3	0	0	3
4	PE4103	Professional Elective V	3	0	0	3
5	OE4101	Open Elective III	3	0	0	3
6	OE4102	Open Elective IV	3	0	0	3
7	SOC4101	Mongo DB	1	0	2	2
8	INTERN4101	Summer Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester)	0	0	6	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/Soft Skills Course	2
INTERN	Summer Internship	3
	Total Credits	**23**

IV Year II Semester (Semester-8)

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

Open Elective Courses

OE3101	Optimization Techniques	Cryptography and Network Security	High Performance Computing	Environmental Pollution and Control
OE3201	Full Stack Development	Cloud Computing	Embedded Systems	Green Buildings
OE4101	Graph Theory	Computational Number Theory	Fundamentals & Principles of Internet of Things	E-Waste management
OE4102	Fuzzy Sets, Logic and Systems	Soft Computing	Robotics	Supply Chain Management

Professional Elective Courses

PE3101	Big Data Analytics	Business Intelligence	Predictive Analysis	Pattern Recognition	Software Architecture and Design Patterns
PE3201	(NPTEL/SWAYAM) Duration: 12 Weeks minimum *Course/subject title can't be repeated				
PE4101	Machine Learning	Sentiment Analysis	Natural Language Processing	Devops	Software Project Management
PE4102	NO – SQL Databases	Deep Learning	Geospatial and Time Oriented Analysis	Digital Image Processing	Software Testing Methodologies
PE4103	Dimensionality Reduction and Model Validation Techniques	Social Media Analytics	Video Analytics	Computer Vision	Cyber Security Essentials

VVIT Life skill courses

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

S. No	Year and 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.

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-1

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-2

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-3

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-4

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-5

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.

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.

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.

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.

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

Course Objectives

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

Unit-1

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-2

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-3

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-4

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-5

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.

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

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)

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.

REFERENCE BOOKS

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

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, users 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 Aeroplane.
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.

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.

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

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 learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
2. To gain knowledge of the operators, selection, control statements and repetition in C
3. To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
4. To assimilate about pointers, dynamic memory allocation and know the significance of Pre-processor.
5. To assimilate about File I/O and significance of functions

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.

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

- **CO1.** **Understand** 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.

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

REFERENCE BOOKS

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

I- Year I - Semester	Name of the Course	L	T	P	C
BS1101L	Applied Chemistry Lab	0	0	3	1.5

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations quantitative analysis .

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)

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)

REFERENCE BOOKS

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

I- Year I - Semester	Name of the Course	L	T	P	C
ES1102L	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5

Course Objectives

- To Verify Kirchhoff's laws, Voltage and Current division rules.
- To learn speed control and testing of DC Shunt Motor.
- To learn and understand the operation of induction motor.
- 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.

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.

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.

REFERENCE BOOKS

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

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.

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

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)

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.

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.

Course Outcomes: The students will be able to

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 behaviour of matter.
CO5. Identify the type of semiconductors using Hall Effect.

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).

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

"How to Become a Self-Motivator" by Charles T Jones

"How to Eliminate Your Bad Habits" by OgMandino

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)**

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

Grammar/Vocabulary

English Language Learning Online
http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/
http://www.nonstopenglish.com/
https://www.vocabulary.com/
BBC Vocabulary Games
Free Rice Vocabulary Game

Reading

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

Listening

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

Speaking

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

All Skills

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

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

Course Objectives

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- 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.

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

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.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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 MUXand 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 substractors, 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, Paritybit Generator, Synchronous Modulo N –Counters, Finite state machinecapabilities and limitations, Mealy and Moore models.

Note: Case Studies / Small Projects ofDigital Circuits and Logic Design

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)**

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 BOOKS

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

I- Year II - Semester	Name of the Course	L	T	P	C
BS1201L	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"by Og Mandino

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)

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/
7. http://www.nonstopenglish.com/
8. https://www.vocabulary.com/
9. BBC Vocabulary Games
10. Free Rice Vocabulary Game

Reading

11. https://www.usingenglish.com/comprehension/
12. https://www.englishclub.com/reading/short-stories.htm
13. https://www.english-online.at/

Listening

14. https://learningenglish.voanews.com/z/3613
15. http://www.englishmedialab.com/listening.html

Speaking

16. https://www.talkenglish.com/
17. BBC Learning English – Pronunciation tips
18. Merriam-Webster – Perfect pronunciation Exercises
19. **All Skills**
20. https://www.englishclub.com/
21. http://www.world-english.org/
22. http://learnenglish.britishcouncil.org/

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

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python
- To develop the skill of designing Graphical user Interfaces in Python
- 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, millimeters, centimeters, meters, or kilometers. 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: After completing this course, Students will be able to-

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

- To make the students to get awareness on environment,
- 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
- 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.

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

COURSE OUTCOMES

CO1 Able to U**nderstand** The concepts of the ecosystem
CO2 Able to U**nderstand** The natural resources and their importance
CO3 Able to learn The biodiversity of India and the threats to biodiversity, and **Apply** conservation practices
CO4 Able to learn Various attributes of the pollution and their impacts
CO5 Able to U**nderstand** Social issues both rural and urban environment
CO6 Able to U**nderstand** About environmental Impact assessment and **Evaluate** the stages involved in EIA

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

REFERENCE BOOKS

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.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

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

Pre-Requisites: Mathematics-I and Mathematics-II

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 1

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 3

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 3

Vector Differentiation:

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

Unit 4

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 5

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 $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

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)

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.

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

Course Objectives:

- To introduce concepts of mathematical logic.
- To introduce concepts and perform operations with sets, relations and functions.
- To solve counting problems by applying elementary counting techniques.
- To introduce algebraic structures, generating functions and recurrence relations.
- 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: 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).

Course Outcomes:

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

CO-1: Apply mathematical logic to solve problems(L3)
CO-2: Understand sets, relations and discrete structures
CO-3: Apply number theory to perform modulo arithmetic and computer arithmetic. (L3)
CO-4: Solve problems on recurrence relations and counting principles (L3)
CO-5: Analyze and solve real world problems using graphs and trees. (L5)

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, BernandKolman, Robert C. Busby, Sharon CutlerRoss, 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/

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

Course Outcomes:

CO1: **understand** 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: **understand** and implement algorithms for text processing.**(Understand)**

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

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

Inheritance, Interfaces, Packages

Inheritance: Need of inheritance, types, super keyword, abstract classes, interfaces, compile time and runtime polymorphism, Packages.

Unit – 3

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 – 4

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 – 5

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.

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

CO-1: Understand 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.

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.

II- Year I- Semester	Name of the Course	L	T	P	C
PC2104	Database Management Systems	3	0	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-1

Introduction

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-2

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-3

SQL & PL/SQL

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-4

Database Design

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

Why NoSQL? Importance of NoSQL

Unit-5

Transaction, Data Recovery & Storage Management

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

Course Outcomes:

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

CO1: To understand 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

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, ElmasriNavate Pearson Education

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

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 Objectives:

- **CO1:** Ability to apply computational thinking to a diverse set of problems.
- **CO2:** Ability to adapt to new challenges and computational environments.
- **CO3:** Proficiency in the design and implementation of algorithms.

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 asneeded.

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 SavingsAccount. 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 ondeposit. Provide method calculateMonthlyInterest to calculate the monthly interest by multiplying the savingsBalance by annualInterestRate divided by 12 this interest should be added to savingsBalance. 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 annualInterestRate to 4%, then calculate the monthly interest and print the new balances for both savers. Then set the annualInterest Rate 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% of BP 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 currencyconverter(DollartoINR,EURO toINR,YentoINR and vice versa), distance converter (meter to KM, miles to KM and vice versa), timeconverter (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 thenumber. [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 inbytes. [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: at the end of the lab, the student will be able to

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
PC2104L	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 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

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

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

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.

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/

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

Course 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-1

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

Learning Outcomes:

At the end of the unit the student will able to:

- Understand the traditional knowledge.
- Contrast and compare characteristics importance kinds of traditional knowledge.
- Analyse physical and social contexts of traditional knowledge.
- Evaluate social change on traditional knowledge.

Unit-2

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.

Learning Outcomes:

At the end of the unit the student will able to:

- Know the need of protecting traditional knowledge.
- Apply significance of TK protection.
- Analyse the value of TK in global economy.
- evaluate role of government

Unit-3

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.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand legal framework of TK.
- Contrast and compare the ST and other traditional forest dwellers
- Analyse plant variant protections
- Evaluate farmers right act

Unit-4

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.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand TK and IPR
- Apply systems of TK protection.
- Analyze legal concepts for the protection of TK.
- Evaluate strategies to increase the protection of TK.

Unit-5

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.

Learning Outcomes:

At the end of the unit the student will able to:

- know TK in different sectors.
- apply TK in engineering.
- analyze TK in various sectors.
- evaluate food security and protection of TK in the country.

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

TEXT 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. http://nptel.ac.in/courses/121106003/

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-1

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 -2

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 -3

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 -4

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 -5

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.

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

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.

e- Resources & other digital material

1. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE (For Probability and Statistics)
2. https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB (For Probability and Statistics)
3. https://www.mathsisfun.com/data/standard-normal-distribution-table.html (Information about Normal distribution)
4. https://www.statisticshowto.com/tables/t-distribution-table/(Information about T-distribution)

Statistical Tables to be allowed in examinations:

1. Normal distribution table
2. T- distribution table

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

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 – 2

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 – 3

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 – 4

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 – 5

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.

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

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

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

II- Year II- Semester	Name of the Course	L	T	P	C
PC2201	Operating Systems	3	0	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 1

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 2

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 3

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 4

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 5

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.

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

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/

II- Year II- Semester	Name of the Course	L	T	P	C
PC2202	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.

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

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

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

II- Year II- Semester	Name of the Course	L	T	P	C
PC2203	Data Warehousing and Data Mining	3	0	0	3

Prerequisites: Database management systems

Course Objectives:

1. Distinguishes the certainty of various classical approaches for mining data in warehouse.
2. Prepares students in identifying various problems and its corresponding approaches for mining data.
3. Outlines a student about merits and demerits of mining approaches contextually.

Unit 1

Introduction: Data Warehousing: Architecture, OLAP vs OLTP, Data Cube and their operations. **Data Mining**: Patterns of data mining, issues in data mining, Statistical descriptions, data visualizations, similarity and dissimilarity measures of data.

Unit 2

Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Unit 3

Classification: Basic concepts, General approach for solving a classification problem, Decision tree algorithm working and attribute selection measures, **Alternative techniques**: Bayes' Theorem, Naïve Bayesian classification Algorithm, Bayesian Belief networks.

Unit 4

Association Analysis: Basic Concepts, Frequent item set generation, compact representation of frequent item sets and FP-Growth Algorithm.

Unit 5

Cluster Analysis: Basic Concepts, Different types of Clustering and cluster, **Algorithms:** K-means algorithm and their additional issues, Bisecting K-means, Agglomerative Hierarchical Clustering Agorithm, DBSCAN Algorithm strengths and their weaknesses.

Course Outcomes:

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

CO1: Infers about Data Warehousing & Data Mining. (Understand)
CO2: Demonstrates Pre-processing Techniques before Data Mining. (Applying)
CO3: Infers Classification & recite different approaches. (Analyzing)
CO4: Infers Association Analysis & recite different approaches. (Analyzing)
CO5: Infers Cluster Analysis & recite different approaches. (Analyzing)

TEXT BOOKS:

1. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
2. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier.

REFERENCE BOOKS:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining : VikramPudi and P. Radha Krishna, Oxford.
3. Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford
4. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.

e-Reesources:

1. https://www.saedsayad.com/data_mining_map.htm
2. https://nptel.ac.in/courses/106/105/106105174/
3. (NPTEL course by Prof.Pabitra Mitra)
   http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4. (NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran)
   http://www.saedsayad.com/data_mining_map.htm

II- Year II - Semester	Name of the course	L	T	P	C
PC2201L	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 (Premptive, Non Premptive)
c) Priority (Premptive, Non Premptive)
d) Round Robin

2. Simulate the following Process Synchronization techniques [CO1]
a) Bounded-Buffer problem
b) Readers-Writers problem
c) Dining philosophers problem using semaphores
d) Dining-Philosophers 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:Analyse various storage management techniques like file allocation and disk scheduling. [K4, Analyze]

II-Year-II Semester	Name of the Course	L	T	P	C
PC2202L	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

Course Outcomes

CO1: To demonstrate requirement gathering techniques to create SRS for a defined problem.
CO2: To implement the cost, size, effort estimation techniques on a defined problem
CO3: To assess the risk for a defined problem by applying Risk Assessment strategies like RMMM.
CO4: To investigate a real-world problem using modern modelling tools.
CO5: To formulate test cases based on requirements and design
CO6: To conduct FTRs as a measure of communication between him and the other stakeholders of the project.

REFERENCE BOOKS:

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

II-Year-II Semester	Name of the Course	L	T	P	C
PC2203L	Data Warehousing & Data Mining Lab	0	0	3	1.5

Course Objectives:

- Demonstrates various Data Mining Tasks.
- Relates students in differentiating Data Sets for analysis.
- Illustrates students in evaluating the methods contextually.

List of experiments:

1. Demonstration of preprocessing on dataset student.arff [CO1]
2. Demonstration of preprocessing on dataset labor.arff [CO1]
3. Demonstration of Association rule process on dataset contactlenses.arff using apriori algorithm [CO3]
4. Demonstration of Association rule process on dataset test.arff using apriori algorithm [CO3]
5. Demonstration of classification rule process on dataset student.arff using j48 algorithm [CO2]
6. Demonstration of classification rule process on dataset employee.arff using j48 algorithm [CO2]
7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm [CO2]
8. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm [CO2]
9. Demonstration of clustering rule process on dataset iris.arff using simple k-means [CO4]
10. Demonstration of clustering rule process on dataset student.arff using simple k- means. [CO4]

Course Outcomes:

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

CO – 1 : Demonstrates Data Pre-processing Techniques.

CO – 2 : Demonstrates and Discovers Knowledge using Classification Methods

CO – 3 : Demonstrates and Discovers Knowledge using Association Methods

CO – 4 : Demonstrates and Discovers Knowledge using Clustering Methods

II- Year II- Semester	Name of the Course	L	T	P	C
SOC2201L	R Programming Lab	0	0	3	1.5

Prerequisites: Basic mathematical background, basic knowledge in programming, fundamental knowledge of mathematical and statistical computations, simulations and data analysis and data science and modelling.

Learning Outcomes: After successful completion of the course, students should be able to

- Understand the basics in R programming in terms of constructs, control statements, functions, vectors,lists, etc.
- import, review, manipulate and summarize data-sets in R.
- Learn how to apply R programming for Data processing.
- Able to appreciate and apply the R programming from a statistical perspective.

Week1:

1. Write an R-Program to print Hello World .
2. Write an R-Program to take input from user.
3. Write a program to illustrate Variable assignment in R.

Week2:

1. Write a program to illustrate basic Arithmetic in R.
2. Write a program to illustrate data types in R .

Week3:

1. Write a program to illustrate creating and naming a vector in R (create vector using : operator, create vector using seq() function).
2. Write a program to create two vectors and perform different operations(+,-,*.etc.) on them and print the result.
3. Write a program to create two vectors and use the functions i)dim() ii)length( ) iii)is.numeric() iv)is.character() v)rbind() vi) cbind()

Week4:

1. Write a program to illustrate create a matrix and naming matrix in R .
2. Write a program to illustrate Add column and Add a Row in Matrix in R.
3. Write a program to illustrate Selection of elements in Matrixes in R .
4. Write a program to illustrate Performing Arithmetic of Matrices .

Week5:

1. Write a program to illustrate if-else-else if in R .
2. Write a Program to illustrate While and For loops in R .
3. Write a program to illustrate Compare and Matrices and Compare vectors .
4. Write a program to illustrate Logical & and Logical | operators in R.

Week6:

1. Write an R Program to Find the Factorial of a Number
2. Write an R Program to Find the Factors of a Number .
3. Write an R Program to Find the Fibonacci sequence Using Recursive Function.

Week7:

1.Write a program to print 1 to N numbers in reverse order using rev function in R.

2. Write a program to find cumulative sum 1:10 using cumsum function in R.

3. Write a program to compute log to base 10 of the sqrt of 50.

Week8:

1. Write a program to illustrate Functions in Quick sort implementation in R.
2. Write a program to illustrate Function inside function in R
3. Write a program to count the odd numbers in a vector of integers by defining function named oddcount().

Week9:

1. Write a program to illustrate List ? Why would you need a List .

2. Write a program to illustrate Adding more elements into a List .

Week10:

1. Write a program to illustrate Factors in R .

2. Case study of why you need use a Factor in R .

3. Write a program to illustrate Ordered Factors in R .

Week11:

1. Write a program to illustrate Data Frame Selection of elements in a Data frame. Create a data frame with the following fields

Name	Age	Height	Weight	Gender
Ramu	21	171	71	M
Arun	20	168	69	M
Rani	22	160	64	F
John	19	173	70	M

i)Find the Mean height of students and weight of students.

ii)Find the standard deviation of heights and weights of students

iii)Find the number of male and female students.

2. Write a program to illustrate Sorting a Data frame .

Week12:

1. Write a program to illustrate to create graphs and usage of plot() function in R .

2. Write a program to illustrate Customising and Saving to Graphs in R.

3. Write a program to illustrate some built in Mathematical Functions.

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

CO1: **Comprehend** the various concepts of a R language
CO2: **Develop** R Programming for Data Processing
CO3: **Design** and development of R problem solving skills.
CO4: **Apply** the R programming from a statistical perspective.

III- Year I - Semester	Name of the Course	L	T	P	C
PC3101	Computer Networks	3	0	0	3

Prerequisites: MFCS, Data Structures

Course Objectives:

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

Unit-1

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-2

Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Control Protocols, Sliding Window Protocols, HDLC, PPP, Channel Allocation problem, Multiple Access Protocols, IEEE standards for Local Area Networks, WLAN, Bluetooth

Unit-3

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

Unit-4

Transport Layer: Transport Layer Design Issues, Connection Establishment, Connection Termination, Transport and User Datagram Protocols

Unit-5

Application Layer: Design Issues, DNS, WWW, HTTP/HTTPS, E-mail, FTP

Course Outcomes:

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

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

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 BOOKS:

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

Web Resources:

1.https://youtube.com/playlist?list=PLbRMhDVUMngfpeFloB7kyiA40EptH1up
2. https://www.geeksforgeeks.org/computer-network-tutorials/
3.https://www.cisco.com/c/en/us/support/docs/ip/routing-information-protocol-rip/13788-3.html

III- Year I - Semester	Name of the Course	L	T	P	C
PC3102	Design and Analysis of Algorithms	3	0	0	3

Prerequisites: Prior knowledge of programming language(s) and basic Data Structures and Algorithms

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 - 1

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 - 2

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing With Deadlines Problem, Single Source Shortest Path Problem, Optimal Merge Patterns Problem.

Unit - 3

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 - 4

Backtracking: The General Method, The N-Queens Problem, Sum of Subsets Problem, Graph Coloring Problem, Hamiltonian Cycles Problem.

Unit - 5

Branch and Bound: The General Method, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack Problem, Traveling Salesperson Problem.

NP-Hard and NP-Complete problems: Basic concepts, Cook's Theorem.

Course Outcomes:

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

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.

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, " Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.

REFERENCE BOOKSs:

1. Harsh Bhasin, " Algorithms Design & Analysis", Oxford University Press.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103	Automata Theory and Compiler Design	3	0	0	3

Prerequisites: MFCS

Course Objectives:

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

Unit - 1

Automata: Need for Automata Theory, Chomsky hierarchy, Acceptance of a string, Design of NFA with Є, NFA without Є, DFA, Equivalence of NFA, DFA

Finite Automata Conversions: Conversion from NFA Є to NFA, NFA to DFA, Minimization of DFA, Moore and Mealy Machines.

Unit - 2

Regular Expressions: Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets

Grammars: Grammars, Classification of Grammars, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars, Normal Forms- Chomsky Normal Form, Griebach Normal Form.

Unit - 3

Push Down Automata (PDA): Design of PDA, Deterministic PDA, Non-deterministic PDA, Equivalence of PDA and Context Free Grammars.

Turing Machine (TM): Design of Turing Machine, Deterministic TM, Non-deterministic TM.

Unit - 4

Machine Independent Phases

Lexical Analysis: Logical phases of compiler**,** Lexical Analysis, Lexemes Tokens and patterns, Lexical Errors, Regular Expressions, Regular definitions for the language constructs, Strings, Sequences, Comments, Transition diagram for recognition of tokens, Reserved words and identifiers.

Syntax Analysis: Parsing definition, types of parsing, left recursion, left factoring, Top-down parsing, First and Follow, LL(1) Grammars, Non- Recursive predictive parsing, Bottom-up Parsers, Shift Reduce Parsing, LR parsers.
Semantic Analysis: Syntax Directed Translation, L-attributed and S-attributed definitions
Symbol tables: use and need of symbol tables.

Unit - 5

Machine Dependent Phases
Intermediate Code Generation: Intermediate code, three address code, quadruples, 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, Register allocation and assignment.

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.

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 BOOKSs

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 You tube 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

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103 - A	Big Data Analytics	3	0	0	3

Prerequisites: Java Programming, DBMS, Data Mining

Course Objectives:

The student should be able to
1. Understand the Big Data Concepts and Big Data Technologies
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hadoop Eco System (HDFS, MapReduce, Pig & Hive)

Unit - 1

Introduction to Big Data: Big Data-definition, Characteristics of Big Data (Volume, Variety, Velocity), Data in the Warehouse and Data in Hadoop, Why is Big Data Important? Patterns for Big Data Development, Examples of Big Data Analytics.

Introduction to Hadoop: Working with Big Data: Google File System, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem, Hadoop Releases, Hadoop Installation Modes.

Hadoop Distributed File System: HDFS, Building Blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo distributed mode, Fully Distributed mode), Configuring XML files

Unit - 2

Map Reduce: A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic Concepts Hadoop MapReduce: Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

Unit - 3

Hadoop IO: The Writable Interface, WritableComparable and Comparators, Writable Classes: Writable wrappers for Java primitives, Text, BytesWritable, NullWritable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a RawComparator for speed, Custom Comparators.

Unit - 4

PIG: Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Installation and Running of Pig, Execution Types, Evaluating Local and Distributed Modes, Pig Latin Editors, Comparison with databases, Pig Latin, Functions, Data Processing Operators, Checking out the Pig Script Interfaces, Scripting with Pig Latin, Running Pig Programs.

Unit - 5

Installing Hive, Comparison with Traditional Databases, Running Hive, Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data.

Course Outcomes:

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

CO1 **Understand** the concepts of Big Data Analytics, **Master** the concepts of Hadoop Distributed File System and Hadoop Architecture {Understand level, KL2} {Apply level, KL3} {Analyze level, KL4}

CO2 **Acquire** knowledge on Map Reduce Framework. { Evaluate level, KL5}

CO3 **Understand** the concepts of Hadoop IO formats and methods. {Understand level, KL2}

CO4 **Apply** Pig concepts for Data Processing. {Evaluate level, KL5}

CO5 **Apply** Hive concepts for Data Processing. {Evaluate level, KL5}

TEXT BOOKS:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC.
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly.
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, Rafael Coss.

REFERENCE BOOKS:

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, Srinath Perera, Thilina Gunarathne

Software Links:

1. Hadoop: http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3. Pig Latin: http://pig.apache.org/docs/r0.7.0/tutorial.html

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103 - B	Business Intelligence	3	0	0	3

Course Objectives:

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for Analytics.
5. To apply analytics for different functions of a business

Unit – 1

Introduction to Business Analytics: Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

Unit – 2

Business Intelligence: Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

Unit – 3

Business Forecasting: Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

Unit – 4

HR & Supply Chain Analytics: Human Resources – Planning and Recruitment – Training and Development - Supply chainnetwork - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

Unit - 5

Marketing and Sales Anlatyics: Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

COURSE OUTCOMES:

CO1: Explain the real world business problems and model with analytical solutions.
CO2: Identify the business processes for extracting Business Intelligence
CO3: Apply predictive analytics for business fore-casting
CO4: Apply analytics for supply chain and logistics management

CO5: Use analytics for marketing and sales.

TEXT BOOKS:

1. R. Evans James, Business Analytics, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education, 2018.

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103 - C	Predictive Analysis	3	0	0	3

Course Objectives

1. To equip students with key concepts of statistical learning.
2. To provide the transition from mathematical statistics to predictive analytics and its applications.
3. Enable students to practice regression and Random forests topics.

Unit - 1

Linear Methods for Regression and Classification: Overview of supervised learning, Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection , Ridge regression, Lasso regression , Linear Discriminant Analysis , Logistic regression , Perceptron learning algorithm.

Unit - 2

Model Assesment and Selection : Bias, Variance,and model complexity, Bias-variance trade off, Optimisim of the training error rate, Esimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation ,Boot strap methods, conditional or expected test error

Unit - 3

Additive Models, Trees and Boosting: Generalized additive models, Regression and classification trees , Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting ,Examples (Spam data)

Unit - 4

Neural Networks(NN) , Support Vector Machines(SVM),and K-nearest Neighbor: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest –Neighbour classifiers(Image Scene Classification)

Unit - 5

Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

TEXT BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009.
2. Predictive Analytics for Business Strategy, 1st Edition, By Jeff Prince, McGraw-Hill Publishers, 2019

REFERENCE BOOKS:

1. Pattern Recognition and Machine Learning, C.M.Bishop , Springer,2006
2. All of Statistics - A Concise Course in Statistical Inference, L.Wasserman, Springer,2004

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103 - D	Pattern Recognition	3	0	0	3

Course Objectives:

- Introduce basic concepts and major techniques in pattern recognition such as Bayesian Decision Theory, linear discriminant analysis, Un-supervised learning and clustering.
- Introduce research development ability in pattern recognition through technical survey and presentation.

Unit - 1

Introduction: Machine perception, pattern recognition example, pattern recognition systems, the design cycle, learning and adaptation, Bayesian Decision Theory: Introduction, continuous features - two categories classifications, minimum error-rate classification- zero–one loss function, classifiers, discriminant functions, and decision surfaces.

Unit - 2

Normal density: Univariate and multivariate density, discriminant functions for the normal density different cases, Bayes decision theory – discrete features, compound Bayesiandecision theory and context.

Unit - 3

Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case

Unit - 4

Component analysis and Discriminants: Principal Component Analysis, Fisher Linear Discriminant, Multiple Discriminant Analysis

Unit - 5

Un-supervised learning and clustering: Introduction, mixture densities and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering.

Course Outcomes:

CO1 Demonstrate basic concepts in pattern recognition
CO2 Gain knowledge about state-of-the-art algorithms used in pattern recognition research
CO3 Apply pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
CO4 Analyze various pattern recognition techniques in practical problems.

CO5 Evaluate the performance of various classifiers and clustering techniques on real-world datasets.

TEXT BOOKS:

1. Richard O. Duda, Peter E. Hart and David G. Stroke,"Pattern Classifications", 2nd Edition, Wiley Student Edition, 2011.

REFERENCE BOOKS:

1. Earl Gose, Richard John Baugh and Steve Jost, "Pattern Recognition and Image Analysis", PHI, 2004.
2. Prof. P.K. Biswas. (June 2014). Pattern Recognition and Applications [NPTEL, Video lecture]. Available: http://www.nptel.ac.in/courses/117105101/

III- Year I - Semester	Name of the Course	L	T	P	C
PC3103 - E	Software Architecture & Design Patterns	3	0	0	3

Course Objectives

- To understand interrelationships, principles and guidelines governing architecture and evolution over time.
- To understand various architectural styles of software systems
- To understand design patterns and their underlying object oriented concepts
- To understand implementation of design patterns and providing solutions to real world software design problems
- To understand patterns with each other and understanding the consequences of combining patterns on the overall quality of a system
- To understand designing a document editor

Unit - 1

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

Creating and Architecture Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

Unit - 2

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM

Moving from One System to Many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

Unit - 3

Patterns: Pattern Description, organizing catalogs, role in solving design problems, Selection and usage.

Creational Patterns: Abstract factory, Builder, Factory method, Prototype, Singleton

Unit - 4

Structural Patterns: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, PROXY.

Unit - 5

Behavioral Patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

Course Outcomes

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

CO1 Understand the architecture, creating it and moving from one to any, different structural patterns.
CO2 Analyze the architecture and build the system from the components.
CO3 Design creational patterns
CO4 Design structural patterns
CO5 Learn about behavioral patterns.

TEXT BOOKS:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

REFERENCE BOOKSS:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.
8. Pattern Oriented Software Architecture, F.Buschmann & others, John Wiley & Sons.

III- Year I - Semester	Name of the Course	L	T	P	C
OE3101 - A	Cryptography and Network Security	3	0	0	3

Prerequisites: Computer Networks, MFCS

Course Objectives:

1 To understand and classify various security attacks, services mechanisms and classical cryptographic techniques
2 To analyse the design principles of block ciphers and their implementation.
3 To compute and analyse asymmetric key cryptographic algorithms
4 To evaluate Authentication, Hash Codes and verify the digital signatures
5 To impart the knowledge on Network security concepts.

Unit – 1

Introduction to Cryptography and Network Security: Introduction - Security attacks, services & mechanisms, Network Security Model, Symmetric Cipher Model, Mathematics of Cryptography, Substitution Ciphers, Transposition Ciphers Techniques, Steganography.

Unit – 2

Symmetric Key Cryptography: Mathematics of Symmetric Key Cryptography, Modern Block Ciphers, Modes of Block Ciphers, Design Principles of Block Ciphers, Feistel Cipher, Data Encryption Standard, Double DES, Triple DES, International Data Encryption Algorithm, CAST-128, Blowfish, Advanced Encryption Standard

Unit - 3

Asymmetric (Public) Key Cryptography: Mathematics of Asymmetric Key Cryptography: Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Primitive Roots, Discrete Logarithms, Principles of Public Key Cryptosystems, Applications, RSA, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, El-Gammal Key Exchange.

Unit - 4

Data Integrity, Digital Signatures, Authentication Protocols: Requirements of Hash Functions and Message Authentication Codes, Hash Algorithms: MD5, SHA-160,256,512, RIPEMD, Properties of Digital Signatures, DSS, Authentication Applications: Kerberos Version4 and Version 5.

Unit - 5

Network Security: IP Security - IP Security Overview, Architecture, Authentication Header, Encapsulating Security Payload, eb Security: Overview, Secure Socket Layer and Transport

Layer Security, Secure Electronic Transaction, Email Security: Pretty Good Privacy, S/MIME, System Security: Intruders, Password Management, Viruses and Worms.

Course Outcomes:

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

CO1: Classify various security attacks, services mechanisms and classical cryptographic techniques

CO2: Analyse the design principles of block ciphers and their implementation.

CO3: Computes and Analyse various Asymmetric Key Cryptographic techniques

CO4: Evaluates Authentication, Hash Codes and verify the digital signatures

CO5: Impart the knowledge on Network security concepts.

TEXT BOOKS:

1. Cryptography and Network Security Principles and Practices: William Stallings, Pearson Education, 5th Edition
2. Cryptography and Network Security, Behrouz A Forouzan, Tata McGraw Hill, 3rd Edition

REFERENCE BOOKS:

1. Practical Cryptography, Bruce Schneier, Wiley, Deamtech India Pvt Ltd.

Web Resources:

1. https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/
2. https://nptel.ac.in/courses/106105162

III- Year I - Semester	Name of the Course	L	T	P	C
OE3101 - B	Optimization Techniques	3	0	0	3

Course Objective:

1. To understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.
2. To formulate real-life problems with Linear Programming models using graphical and simplex methods.
3. To formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms and to find out probability of expected completion time using PERT-CPM networks.
4. To apply dynamic programming and integer programming to optimize multi stage decision problems.
5. To determine the level of game theory and simulation modelling that a business must maintain to ensure smooth operation.

Unit - 1

Introduction to Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, Multi variable Optimization with and without constraints, Multivariable Optimization with equality constraints - solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints - Kuhn – Tucker conditions.

Unit - 2

Linear Programming: Various definitions, statements of basic theorems and properties, Advantages, Limitations and Application areas of Linear Programming, Graphical method of Linear Programming problem.

Simplex Method – Phase I of the Simplex Method, Primal and Dual Simplex Method, Big –M method.

Unit - 3

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

Network Analysis: Introduction, Project scheduling by CPM and PERT, Network diagram representations, Rules to construct Network diagrams, Time estimates in network analysis-EST, EFT, LST, LFT, float/slack and critical path, Time estimates and Probability considerations in PERT, Crashing in PERT

Unit - 3

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Integer Programming: Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

Unit - 5

Game theory: Theory Of Games: Introduction – Terminology, Solution of games with saddle points and without saddle points, 2×2 games, dominance principle, m X 2 & 2 X n games, Graphical method.

Simulation Modelling: Introduction, Definition and types, Limitations, Various phases of modelling, Monte Carlo method, Applications, advantages and limitations of simulation

Course Outcomes:

After completion of the course, students will be able to

CO 1. To understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.

CO 2. To formulate real-life problems with Linear Programming models using graphical and simplex methods.

CO 3. To formulate real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms and to find out probability of expected completion time using PERT-CPM networks.

CO 4. To apply dynamic programming and integer programming to optimize multi stage decision problems.

CO 5. To determine the level of game theory and simulation modelling that a business must maintain to ensure smooth operation.

TEXT BOOKS:

1. Engineering optimization: Theory and practice"-by S.S.Rao, New Age International (P) Limited.
2. Operations Research: An Introduction" by H A Taha, 5th Edition, Macmillan, New York.
3. Operations Research by P K GUPTA AND D S HIRA BY SCHAND PUBLICATIONS, 7E

REFERENCE BOOKSS:

1. Optimization Methods in Operations Research and systems Analysis" – by K.V. Mittal and C. Mohan, New Age, International (P) Limited, Publishers
2. Operations Research – by S.D.Sharma, Kedarnath Ramanath& Co
3. Linear programming, G. Hadley, Narosa Publishing House, New Delhi.
4. Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai& co

III- Year I - Semester	Name of the Course	L	T	P	C
OE3101 - C	High Performance Computing	3	0	0	3

Course Objectives

- To Study various computing technology architecture.
- To learn how to improve the quality of the programs that you write for execution on high performance computer systems.
- Learn various activities that happen during program execution, and how they are managed by the hardware (architectural features) and system software (operating systems, run-time systems).

Unit - 1

Parallel Programming Platforms: Implicit parallelism: Trends in Microprocessor Architectures, Limitations of memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, Routing mechanisms for interconnection networks.

Principles of Parallel Algorithm Design: Preliminaries, decomposition Techniques, Characteristics of tasks and interactions, mapping techniques for load balancing, parallel algorithm models.

Unit - 2

Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction,All-Reduce and Prefix-Sum Operations, Scatter and Gather.

Analytical modeling of parallel programs: sources of overhead in parallel programs, performance metrics forparallel systems, The Effect of granularity on performance, scalability of parallel systems.

Unit - 3

Programming using the message passing paradigm: Principles of Message passing programming, The building blocks: Send and Receive Operations, MPI: the message passing interface, collective communication and computation Operations.

Unit - 4

Programming shared address space platforms: Thread Basics, why Threads, Thread Basics: Creation and Termination, OpenMP: a standard for Directive based Parallel Programming.

Unit - 5

Dense Matrix Algorithms: Matrix-Vector Multiplication, Matrix – Matrix Multiplication.

Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble sort and its

variants.

Graph Algorithms: Minimum Spanning Tree: Prim's Algorithm, Single-Source shortest paths: Dijkstra's Algorithm.

Course Outcomes:

Upon successful completion of the course, the student will beable to:

CO1: Generalizes the parallel programming platforms for parallel computer systems.

CO2: Optimize the performance of parallel programs.

CO3: Interprets the working group communicationoperations of MPI.

CO4: Paraphrases algorithm for multicore processors systemsusing address space

CO5: Interprets algorithm for multicore processors systems using MPI and thread Techniques

TEXT BOOKS:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar: Introduction to Parallel Computing, Second Edition Pearson Education, 2007

REFERENCE BOOKS:

1. Michael J. Quinn, Parallel Programming in C with MPI and OpenMP McGraw-Hill International Editions, Computer Science Series, 2004.

III- Year I - Semester	Name of the Course	L	T	P	C
OE3101 - D	Environmental Pollution and Control	3	0	0	3

Course Objectives:

1. To introduce the concepts of Air Pollution and the control methods.
2. To impart the knowledge of the Solid Waste generation problem.
3. To familiarize the best practices for management of solid wastes adopted at the service provider level.
4. To elucidate noise pollution problems and emphasize the necessity to control them.

Unit -1

Air Pollution: Definitions, scope, significance and episodes – Types of pollutants, their sources and impacts (on plants, animals, materials) – Classifications, natural & artificial, primary & secondary, point &non point, linear & areal sources, stationary & mobile – Sampling and analysis of air pollutants – Ambient air quality standards by WHO (World Health Organization) & CPCB (Central Pollution Control Board).

Air Pollution Meteorology: Properties of atmosphere: heat, pressure, wind forces, moisture and relative humidity – Lapse rates – Influence of terrain and meteorological phenomena on plume behavior and air quality – Wind rose diagrams, plume rise models.

Unit - 2

Air Pollution Control and Monitoring: Control of particulates: control at sources, process changes, equipment modifications – Design and operation of control equipments, settling chambers, cyclone separators, fabric filters, scrubbers, electrostatic precipitators – Control of gases like SOx , NOx , CO and HC, Air-fuel ratio, computation and control of products of combustion – Monitoring of SPM, SO2 , NOx and CO, Stack Monitoring for flue gases.

Unit - 3

Solid Waste Generation and Collection: Characteristics – types, sources, and properties of solid waste – Generation, typical generation rates, estimation of solid waste quantities, factors that affect generation of wastes – Collection services, types of collection systems, determination of vehicle and labour requirement and transportation of solid waste – Transfer stations, transfer means and methods.

Unit - 4

Solid Waste Management and Disposal: Engineered systems for solid waste management (refuse, reduce, reuse, recover, recycle) – Reuse of solid waste materials, processing techniques, materials recovery system, recovery of biological, thermal conversion products and recovery of energy from conversion products – Recycling of segregated waste materials – Ultimate Disposal of solid waste (Land filling, incineration, composting).

Unit - 5

Noise Pollution and Control: Sources of noise pollution, impacts of noise, measurement of noise and permissible limits of noise, control methods of noise pollution, The Noise Pollution (Regulation and Control) Rules, 2000 as per CPCB.

Course Outcomes:

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

CO1 Evaluate the ambient air quality based on the analysis of air pollutants and relate the polluting plume behavior with weather data.

CO2 Identify suitable control methods depending on the severity and type of air pollution.

CO3 Classify solid wastes and identify suitable collection and transfer mechanisms.

CO4 Suggest suitable solid waste management methods based on the nature of solid waste and the quantities to be handled.

CO5 Identify the sources of noise pollution and suggest methods for mitigating the problem.

TEXT BOOKS:

1. Air Pollution, M.N.Rao, H.V.N.Rao, 1st Edition, McGraw Hill Education.
2. Solid and Hazardous Waste Management, M.N.Rao, Razia Sultana, 1st Edition, BS Publications.
3. Noise Pollution and Its Control,H.C.Bhatia, 1st Edition, Atlantic Publisher

REFERENCE BOOKS:

1. Advanced Air and Noise Pollution Control, Lawrence K.Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
2. Municipal Solid Waste Management, P.Jayarama Reddy, 1st Edition, B.S.Publications.

III- Year I - Semester	Name of the Course	L	T	P	C
PC3101L	Computer Networks Lab	0	0	3	1.5

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To understand the network simulator environment and visualize a network topology and observe its performance.
3. To analyze the traffic flow and the contents of protocol frames.

LIST OF EXPERIMENTS

1. Networking commands
2. To write a socket program for implementation of echo.
3. To write a client-server application for chat.
4. Write a program to compute CRC code for the polynomials.
5. To write a java program to perform sliding window protocol.
6. To write a java program to perform stop and wait protocol.
7. To write a java program to perform Go-Back-N mechanism.
8. To implement Address Resolution Protocol(ARP) and Reverse Address Resolution Protocol (RARP) .
9. To implement Remote Method Invocation(RMI).
10. To implement Distance vector routing algorithm.
11. To implement Subnetting.
12. To write a java program for congestion control using Leaky bucket algorithm.
13. To Perform File Transfer in Client & Server Using TCP/IP.
14. To write a java program for DNS application.
15. To write a socket program for implementation of client program in c language and server program in java language.
16. To Study of Network simulator (NS).and Simulation of Congestion Control Algorithms usingNS.

Course Outcomes:

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

CO1: Implement data link layer farming methods.

CO2: Analyze error detection and error correction codes.

CO3: Implement and analyze routing and congestion issues in network design.

III- Year I - Semester	Name of the Course	L	T	P	C
PC3102L	Design and Analysis of Algorithms Lab	0	0	3	1.5

Prerequisites: Prior knowledge of programming language(s) and basic Data Structures and Algorithms

Course Objectives:

1. To learn fundamental algorithmic problems.
2. To understand methods of designing and analysing algorithms.
3. To know various designing paradigms of algorithms for solving real world problems.

List of experiments:

1. Write a program to find the maximum and minimum element from the collection of elements using divide and conquer technique.
2. Write a program to find the optimal profit of a Knapsack using Greedy method.
3. Write a program for Optimal Merge Patterns problem using Greedy Method.
4. Write a program for Single Source Shortest Path for General Weights using Dynamic Programming.
5. Write a program to find all pair shortest path from any node to any other node within a graph.
6. Write a program to find the non-attacking positions of Queens in a given chess board using backtracking.
7. Find a subset of a given set S = $\{S_l, S_2, ..., S_n\}$ of n positive integers, whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1, 8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
8. Write a program to color the nodes in a given graph such that no two adjacent can have the same color using backtracking.
9. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using Backtracking principle.

Course Outcomes:

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

CO1: Identify and apply the suitable algorithm for the given problem.

CO2: Design and implement efficient algorithms for a specified application.

III- Year I - Semester	Name of the Course	L	T	P	C
SOC3101	.Net	1	0	2	2

Prerequisites: OOP's Concept and Programming Skills

Course Objectives: This Lab course will help students to achieve the following objectives:
1. Introduce to .Net IDE Component Framework.
2. Programming concepts in .Net Framework.
3. Creating website using ASP.Net Controls.

List of Experiments:

1.Program to display the addition, subtraction, multiplication and division of two number using console application.
2. Program to display the first 10 natural numbers and their sum using console application.
3. Program to display the addition using the windows application.
4. Write a program to convert input string from lower to upper and upper to lower case.
5. Write a program ta o simple calculator using a windows application.
6. Write a program working with Page using ASP.Net.
7. Write a program working with forms using ASP.NET.
8. Write a program to connect with the Oracle database.
9. Write a program to access data sources through ADO.NET.
10. Write a program to manage the session.

Course Outcomes: At the end of this Lab course students will be able to:
CO1. Create user interactive web pages using ASP.Net. (L3)
CO2. Create simple data binding applications using ADO.Net connectivity. (L3)
CO3. Performing Database operations for Windows Form and web applications. (L3)

e-resources:

https://dotnettutorials.net/course/csharp-dot-net-tutorials/

III- Year I - Semester	Name of the Course	L	T	P	C
MC3101	Indian Constitution	2	0	0	0

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

Unit - 1

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.

LEARNING OUTCOMES:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyse the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

Unit – 2

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.

LEARNING OUTCOMES: -

- After completion of this unit student will
- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

Unit - 3

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

LEARNING OUTCOMES: -

- After completion of this unit student will
- Understand the structure of state government
- Analyse the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

Unit - 4

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

LEARNING OUTCOMES: -

- After completion of this unit student will
- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyse the role of Myer and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organisation

Unit - 5

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

LEARNING OUTCOMES: -

- After completion of this unit student will
- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissioner ate
- Analyse role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

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

REFERENCE BOOKS:

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
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

III- Year II - Semester	Name of the Course	L	T	P	C
HS3201	Engineering Economics and Management	2	1	0	3

Course objectives:

The student should be able to

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.
2. To understand the nature of markets and the concepts of Money and RBI functions.
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.
4. To learn different Accounting Systems, preparation of Financial Statement and to familiarize with the tools of project Management.
5. To understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit 1

Introduction to Economics and Theory of Production

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 2

Introduction to Markets and Money

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 3

Introduction to Management

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 4

Introduction to Accounting & Project Management

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 5

Capital and Capital Budgeting:

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).

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

CO 1. The Learner is equipped with the knowledge of estimating the Demand and demand elasticity's for a product and Input-Output-Cost relationships.

CO 2. The Learner is also ready to understand the nature of different markets and also to have the knowledge of Money & Banking.

CO 3. The Learner will acquire the knowledge on management, HRM and Marketing.
CO 4. The Learner will acquire the knowledge to prepare Financial Statements and the techniques of project management.
CO 5. The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

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.
4. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, 'Introduction to *Management Science'* Cengage, Delhi, 2012.
5. Engineering Economy and Management 1 Edition Pravin Kumar – Wiley Publication.
6. Engineering Economics & Management- Dr. Vilas Kulkarni & HardikBavishi - Vikas Publishing.

REFERENCE BOOKS:

1. R. L Varshney, K.L. Maheshwari : Managerial Economics, Sultan Chand&Sons 2014,22e.
2. Suma Damodaran : Managerial Economics, Oxford 2010,2e.
3. Ambrish Gupta: 'Financial Accounting for Management', Pearson 2015,5e.
4. Dr. S.N. Maheswari: Financial Accounting, Vikas Publications 2018.
5. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2017.
6. Principles of Marketing: A South Asian Perspective, Kotler Philip, Gary Armstrong, Prafulla Y. Agnihotri, and Eshan ul Haque , 17th Edition, Pearson Education/ Prentice Hall of India, 2018.
7. Human Resource Management: Gary Dessler, 14th Edition, pearson 2015.
8. Project Planning and Control with PERT and CPM: Dr. B. C. Punmia, K. K Khandelwal, Laxmi Publication, 2017, 4th Edition.

e-Resources:

1. www.managementstudyguide.com
2. www.tutorialspoint.com
3. www.lecturenotes.in

III- Year II - Semester	Name of the Course	L	T	P	C
PC3201	Artificial Intelligence	2	1	0	3

Course Objectives:

- 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.
- To improve analytical and problem solving skills based on the characteristics of the problem using various heuristic search techniques and to improve designing and playing a game
- To have knowledge on propositional calculus, proportional and predicate logic to understand few systems such as natural deduction, axiomatic system, etc.
- 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.
- 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
- To have basic knowledge on probabilistic analysis and networks as well as fuzzy systems and fuzzy logics.

Unit - 1

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

Unit - 2

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, alphabeta pruning, two-player perfect information game.

Unit - 3

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 – 4

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc 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 - 5

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.

Course Outcomes

At the end of the course the students will be able to

CO1: Understand the theory of Artificial intelligence

CO2: Exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, and planning and constraint management.

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 : Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

TEXT BOOKS:

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

REFERNCE 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,

III- Year II - Semester	Name of the Course	L	T	P	C
PC3202	Data Science, Preparation & Analysis	2	1	0	3

Course Objectives:

1. To gain knowledge in the basic concepts of Data Analysis
2. To acquire skills in data preparatory and preprocessing steps
3. To learn the tools and packages in Python for data science
4. To gain understanding in classification and Regression Model
5. To acquire knowledge in data interpretation and visualization techniques

Unit - 1

Introduction: Need for data science – benefits and uses – facets of data – data science process – setting their search goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

Unit - 2

Describing Data I: Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs –averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – inter quartile range –variability for qualitative and ranked data.

Unit - 3

Python for Data Handling: Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets –aggregation and grouping – pivot tables.

Unit - 4

Describing Data II: Normal distributions – z scores – normal curve problems– finding proportions – finding scores –more about z scores – correlation – scatter plots – correlation coefficient for quantitative data –computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r2– multiple regression equations –regression toward the mean.

Unit - 5

Python for Data Visualization: Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using state models and seaborn – graph

plotting using Plotly – interactive data visualization using Bokeh.

Course Outcomes:

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

CO1: Outlines (Gain) knowledge in the basic concepts of Data Analysis (L1)

CO2: Comprehends (Acquire) skills in data preparatory and preprocessing steps (L2)

CO3: Demonstrates (Learn) the tools and packages in Python for data science (L3)

CO4: Comprehends (Gain) understanding in classification and Regression Model (L2)

CO5: Demonstrates (Acquire) knowledge in data interpretation and visualization techniques (L3)

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Chapters 1–7 for Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Chapters 2– 4 for Units IV and V)

REFERENCE BOOKS:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

III- Year II - Semester	Name of the Course	L	T	P	C
OE3201 - A	Full Stack Development	3	0	0	3

Prerequisites: Java

Course Objectives:

1 To learn Client-side application development using HTML and CSS
2 To understand Java script ES6 features
3 To focus on contemporary front-end technologies like React
4 To understand data access through NodeJS

Unit-1

Introduction to HTML 5, syntax, attributes, events, SVG, Web storage, Introduction to Canvas, Audio & Video, Geolocations, Drag & Drop, Web workers, working with Fonts, working with other graphics.

Style sheets: Introduction CSS, Applying CSS to HTML, Selectors, Properties and Values, CSS Colors and Backgrounds, CSS Box Model, CSS Margins, Padding, and Borders, CSS Text and Font Properties

Unit-2

Introduction to ES6 features, Arrow functions, default parameters, destructuring elements, Higher order functions, defining classes, accessing data members, constructors, inheritance, super.

Unit-3

ReactJS: Introduction, creating a simple react project, Templating using JSX, Components, Rendering, State and Props, Types of Components – Component Lifecycle, Forms and User Input, Event Handling, Communicate Between Components.

Unit-4

React **JS:** React Routing, Introduction to Hooks, State management, Types of Hooks -useState, useEffect, useContext. CORS policies, Usage of Web API calls- fetch and axios, Error Handling.

Unit-5

Node JS: Overview, Node js - Basics and Setup, Node js Console, Node js Command Utilties, Node js Modules, Node js Concepts, Node js Events, Node js with xpress js. Introduction to MongoDB, creating databases, Operations – insert, update, delete and Querying.

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

CO1 Summarize Client-side design of the web.
CO2 Explore different ES6 features in Java script.
CO3 Implement components and props through React.
CO4 Comprehend React Hooks
CO5 Use NodeJs for data availability

TEXT BOOKS:

1 HTML5, Black book, Dreamtech Publications
2 Beginning React, Greg Lim
3 Learning AngularJS: A Guide to AngularJS Development, O' Reilly Publication

REFERENCE BOOKS:

1 React Cook Book, Carlos Santana Roldan
2 Learning React, 2nd Edition, O' Reilly publications.
3 React in Action by Mark Tielens Thomas

Web Resources:

1 https://developer.mozilla.org/en-US/docs/Web/JavaScript
2 https://reactjs.org/docs/getting-started.html
3 https://nodejs.org/en/docs/

III- Year II - Semester	Name of the Course	L	T	P	C
OE3201 - B	Cloud Computing	3	0	0	3

Course Objectives:

1. Students will be able to learn about cloud environment.
2. Students will be able to learn about the key dimensions of the challenges of cloud computing.
3. Student encounters with building software systems and components which scale millions of users in modern internet.
4. students will be able to deal with various cloud service models such as Iaas, Paas, Saas
5. Students will be able to learn about the storage and management of resources concepts in the cloud.

Unit - 1

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.
Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

Unit - 2

Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

Unit - 3

Cloud Platform Architecture Cloud Computing and service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

Unit - 4

Cloud Resource Management and Scheduling Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds.

Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling MapReduce Applications Subject to Deadlines.

Unit -5

Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Storage Systems Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore, Amazon Simple Storage Service (S3)

Course Outcomes:

1. Understanding the key dimensions of the challenge of Cloud Computing (**Understanding**)
2. Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization (**Evaluating**)
3. Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications. (**Evaluating**)
4. Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas. (**Evaluating**)

TEXT BOOKS:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
3. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
4. Cloud Computing, A Hands on approach, Arshadeep Bahga, Vijay Madisetti, University Press

REFERNCE BOOKS:

1. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH
2. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH

ONLINE RESOURCE:

1. **https://nptel.ac.in/courses/106/105/106105167/**
2. **https://cloudacademy.com/courses/**
3. **www.slideshare.net**

III- Year II - Semester	Name of the Course	L	T	P	C
OE3201 - C	Embedded Systems	3	0	0	3

Course Objectives:

- The objective of this course is to equip the students with the basic concepts of embedded system, applications in which they are used, 8051 microcontroller programming concepts and various aspects of embedded system design from Hardware and Software points of view and it describes tools and methodologies needed for embedded system design.
- It provides RTOS concepts for coding the embedded system software routines. It tells what makes a system a real-time system and describes the characteristics of latency in real-time systems.

Unit - 1

Embedded Systems Basics: Introduction to Embedded systems, Examples of embedded systems, TypicalHardware,Gates,TimingDiagrams,Memory, Microprocessors, Buses, DirectMemoryAccess, Interrupts, Microprocessor Architecture, and Interrupt Basics.

Unit - 2

The 8051 Architecture : Introduction, 8051 Micro controller Hardware, Input/output Pin Ports and Circuits, External Memory, Serial data Input/output, Interrupts.

Unit - 3

Basic Assembly Language Programming Concepts: The Assembly Language ProgrammingProcess, Programming Tools and Techniques, Programming the 8051.

Unit - 4

Moving Data: Introduction, Addressing Modes, External Data Moves, Code Memory Read-Only Data Moves, Push and Pop Opcodes, Data Exchanges.

Basic Design Using a Real-Time Operating System: Message Queues, Mailboxes andPipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

Unit - 5

Applications: Introduction, keyboards, Human Factor, Key Switch Factors, Keyboard Configurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

Course Outcomes:

At the end of this course student will:

CO1:Understand the microprocessor architecture and its components used in embedded systems

CO2: Write the 8051 assembly language code for specific purposes

CO3: Implement code for interfacing various devices.
CO4: Develop simple embedded systems for real time operations
CO5: Compose simple embedded system with error free software to obtain target system

TEXT BOOKS:

1. An Embedded Software Primer, David E. Simon, Pearson Education
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson

REFERENCE BOOKS:

1. 8051 Microcontrollers, Satish Shah, Oxford Higher Education
2. Embedded Microcomputer Systems Real Time Interfacing, Jonathan W.Valvano, Cengage Learning.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education.

Online:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/

III- Year II - Semester	Name of the Course	L	T	P	C
OE3201 - D	Green Buildings	3	0	0	3

Course Objectives:

- Learn the principles of planning and orientation of buildings.
- Acquire knowledge on various aspects of green buildings

Unit - 1

Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Pollution, Better Buildings, Reducing energy consumption, Low energy design.

Unit - 2

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 - 3

Building Form – Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, rouping of buildings. Building Fabrics- Windows and doors, Floors, Walls, Masonry, Ecological walling systems, Thermal Properties of construction material.

Unit - 4

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 - 5

Energy awareness, monitoring energy consumption, Building Environmental Assessment - environmental criteria - assessment methods - assessment tools (e.g. LEED, GRIHA & IGBC Certification for buildings. Ecohomes, 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

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

CO1 CO1 Explain the principles of building planning, its bylaws and provide facilities for rainwater harvesting

CO2 Understand the concepts of green buildings

TEXT BOOKS:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

REFERENCE BOOKS:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

E-Resources:

1. https://nptel.ac.in/courses/105102195

III- Year II - Semester	Name of the Course	L	T	P	C
MOOCS/ SWAYAM	Unified Modelling Language	3	0	0	3

Course Objectives:

- To understand how to solve complex problems
- Analyze and design solutions to problems using object-oriented approach
- Study the notations of Unified Modeling Language

Unit - 1

Introduction to OOAD, The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Introduction- Why we model, Conceptual model of UML Architecture

Unit - 2

Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams

Unit - 3

Introduction- Interactions, Interaction diagrams, use cases, Use case Diagrams, Activity Diagrams

Unit - 4

Events and signals, State machines, Processes and Threads, Time and space, State chart diagrams

Unit - 5

Introduction- Component, Deployment, Component diagrams, Deployment diagrams Case Study: The Unified Library application

Course Outcomes:

CO-1: Ability to find solutions to the complex problems using object-oriented approach
CO-2: Build classes, responsibilities and states using UML notation
CO-3: Identify basic Interactions, Use cases of the problem domain
CO-4: Understand advanced behavioral modeling using UML notation
CO-5: Understand components of the problem domain

TEXT BOOKS:

1. "Object- Oriented Analysis and Design with Applications", Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia, Houston, 3rd edition, 2013, PEARSON.
2. "The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.

REFERENCE BOOKS:

1. “Object-oriented analysis and design using UML”, Mahesh P. Matha, PHI
2. “Head first object-oriented analysis and design”, Brett D. McLaughlin, Gary Pollice, Dave West, O‟Reilly
3. “Object-oriented analysis and design with the Unified process”, John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning

Online References

1 http://nptel.ac.in/courses/

III- Year II - Semester	Name of the Course	L	T	P	C
PC3201L	Artificial Intelligence Lab	0	0	3	1.5

Course Objectives:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Introduce the concepts of machine learning.

Experiments

1. Write a Program to Implement Tic-Tac-Toe game using Python.
2. Write a program to solve water jug problem
3. Write a Program to Implement Breadth First Search using Python.
4. Write a Program to Implement Depth First Search using Python.
5. Write a Program to Implement 8-Puzzle problem using Python
6. Implementation of Towers of Hanoi Problem
7. Write a Program to Implement Missionaries-Cannibals Problems using Python
8. Write a Program to Implement Travelling Salesman Problem using Python
9. Write a Program to Implement Monkey Banana Problem using Python
10. Write a Program to Implement N-Queens Problem using Python

Course Outcomes:

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

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Recognize appropriate AI methods to solve a given problem.

CO3: Discuss a given problem in the language /framework of different AI methods.

CO4: Develop basic AI algorithms

III- Year II - Semester	Name of the Course	L	T	P	C
PC3202L	Data Science, Preparation and Analysis Lab	0	0	3	1.5

Course Objectives:

1. To develop knowledge of data preparation and preprocessing techniques
2. To become knowledgeable about methods for data interpretation and visualization

Experiments

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode
2. Write a python program to compute Measure of Dispersion: Variance, Standard Deviation
3. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
4. Study of Python Libraries for data manipulation with Pandas
5. Write a Python program for data handling using numpy arrays.
6. Implementation of probability distributions – normal, binomial,chi-square, poisson, f-dist
7. Implementation of python program to handle missing values, data indexing, selection.
8. Implementation of python program for correlation coeff,covariance, anova
9. Implementation of Logistic Regression, linear regression using sklearn
10. Implementation of data visualization for line plots, scatter plots, density plot
11. Implementation of data visualization for 3D plotting, seaborn, state models.
12. Implementation of data visualization using bokeh, plotly

Course Outcomes:

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

CO1: Demonstrates the packages in Python for data science
CO2: Demonstrates familiarity in data interpretation and visualization techniques

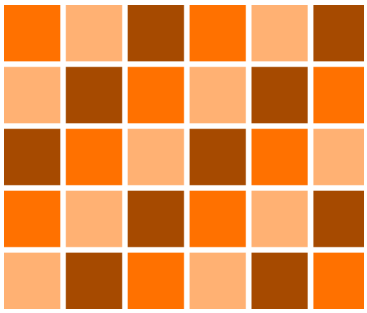
III- Year II - Semester	Name of the Course	L	T	P	C
PC3203L	Full Stack Development Lab	0	0	3	1.5

Course Objectives

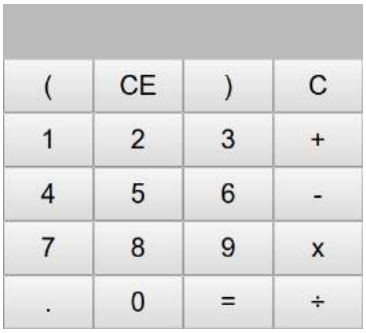
- At the end of the course the students will understand
- Higher order functions
- Class Components.
- Functional Components.
- Different types of Hooks.
- React application with data base connectivity.

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 useState Hook with the help sample text.
11. Demonstrate useContext Hook with necessary example.
12. Demonstrate useEffect 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.

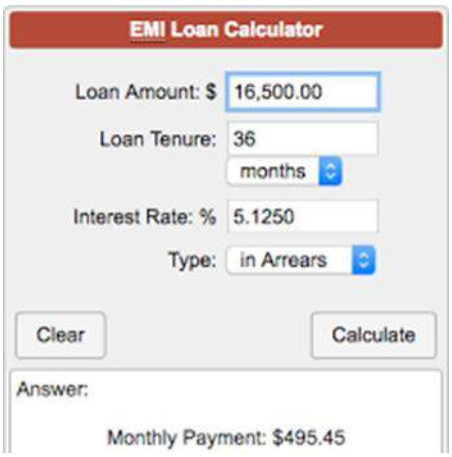
Formula:

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/m^2
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.

Course Outcomes:

CO1	At the end of the course the students will be able to
CO2	Use Higher Order functions like filter(), reduce(), map() .
CO3	Develop a react application using class components.
CO4	Develop a react application using functional components.
CO5	Develop a complete react application with data base connectivity

III- Year II - Semester	Name of the Course	L	T	P	C
SOC3201	Soft Skills	1	0	2	2

Soft Skills amount to talents for adaptive and optimistic behavior that alter humans to deal effectively with the stress and challenges of life. This notion is additionally termed as psychosocial proficiency. The subject varies greatly reckoning on social norms and community expectations however skills that operate for well-being and aid people to change into active and productive members of their communities' square measure thought-about as Soft Skills.

They exemplify innovativeness, significant thinking, problem-solving, decision-making, the supremacy to speak-up and team-up, in aggregation with personal and social responsibility that contribute to sensible citizenship – all essential skills for achievement within the twenty first century, each for healthy societies and for employable people.

The course of soft skills is introduced to boost the standard of learning and living by complementing scholastic records with skill-based coaching. Realizing that the dual purpose of education i.e., is to foster educational excellence among students and additionally guide them to transform themselves into responsible people and professionals.

Soft Skills are a unit, a crucial facet of having the ability to fulfil the strain of daily & professional lives in a very unendingly dynamical world. The big changes in international economies over the last 5 years have coincided with technological transformations, all of that area unit leaving an impression on education, the geographic point, and our personal lives. Students need dynamically guided soft skills and hands on exposure, like the power to face / tackle stress and frustration, to address the growing pace and alter recent life. Over the course of their careers, today's engineering aspirants can have various new professions, each one with its own set of constraints and necessities, with flexibility & adaptability in demand of learn ability.

Course Objectives:

By the end of the program students will be able to:

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 of their 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, and creating choices.
6. Manage self-competence and self-confidence.

Preamble: Soft skills are character traits and interpersonal skills that portray a person's relationships with other people. In the workplace, soft skills are considered to be a balance to hard skills, which refers to a person's knowledge and professional skills.

Syllabus

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 at the 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 an
- effective presentation
- Importance of non-verbal communication (signposting)
- Inciting the interview process by practicing a gamut of behavioral mock interviews.

Module 1 –Tasks

- Listening & comprehension skills – lessons from the corporate training videos / scenes in films.
- Role play – story telling & anchoring
- Extempore – students' experience with college/program.
- Listening & comprehension skills – lessons from the corporate training videos / scenes in films

Module 2 -Tasks

- Story paraphrasing, peer introduction and monologue.

- Assignment on short essay and blog building/digital profile creation.

Module 3 -Tasks

- Overview & analysis of a Job Description (JD) and its reflection in resume / self-introduction
- Crafting of resumes by mapping skills & competences to different profiles offered for engineering graduates.
- An act on – one day in the life of an HR manager/ Project leader etc.

Module 4 -Tasks

- Case scenarios – to identify behavioral competencies and personality traits
- increase self-awareness and improve interactions with others

Module 5 -Tasks

- Pair & Group work – debating / demonstration of product promotion, etc.
- Peer mock interview practice on selected profiles.

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

CO1: master advanced nuances of both written and oral communication skills that are imperative for any professional to succeed coupled with being emphatic.

CO2: confidently ace different competitive exams and develop writing skills.

CO3: gain awareness of the industry expectations and craft CV / Résumé in lieu with desired job profiles.

CO4: crack behavioral (HR) interview confidently and exhibit professional persona.

CO5: 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; 1edition, 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.

4. Caruso, D. R. and Salovey P, “The Emotionally Intelligent Manager: How to Develop and Use the FourKey Emotional Skills of Leadership”, John Wiley & Sons, 2004.

5. Kalyana, “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd, 2015.

6. Larry James, “The First Book of Life Skills”; First Edition, Embassy Books, 2016.

7. ShaliniVerma, “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand(G/L) & Company, 2014.

8. Daniel Goleman, "Emotional Intelligence"; Bantam, 2006.

9. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016.

10. Butterfield Jeff, "Soft Skills for Everyone", Cengage Learning India Pvt. Ltd; 1 edition, 2011.
11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6th Edition, 2015.

DIGITAL REFERENCES

1.InfosysSpringboard(https://infyspringboard.uk.onwingspan.com/web/en/login)
2. AICTE Digital Learning Portal (https://free.aicte-india.org/)
3. APSCHE LMS – Bringing Learning to People (https://apschelms.e-pragati.in/#/)
4. Dale Carnegie Academy (https://www.dalecarnegie.com/en)
5.TedX Program (https://www.ted.com/about/programs-initiatives/tedx-program)
6. Toast Masters International (https://www.toastmasters.org/)
7. NPTEL (https://nptel.ac.in/)
8.Coursera / Udemy / Unacademy / Wikipedia (https://en.wikipedia.org/wiki/Main_Page)

III- Year II - Semester	Name of the Course	L	T	P	C
MC3201	Public Administration	2	0	0	0

Course Objectives:

- Understanding Administrative Concepts and Theories
- Analyzing Public Policy Processes
- Exploring Ethics and Accountability in Public Administration
- Studying Organizational Management and Human Resources
- Adapting to Technological Advances and E-Governance

Unit - 1

Evolution of Indian Administration : Kautilya Arthashastra; Mughal administration; Legacy of British rule in politics and administration Indianization of Public services, revenue administration, district Administration, local self Government. .

Philosophical and Constitutional framework of Government : Salient features and value premises; Constitutionalism; Political culture; Bureaucracy and democracy; Bureaucracy and development.

Public Sector Undertakings: Public sector in modern India; Forms of Public Sector Undertakings; Problems of autonomy, accountability and control; Impact of liberalization and privatization.

Unit - 2

Union Government and Administration : Executive, Parliament, Judiciary-structure, functions, work processes; Recent trends; Intra-governmental relations; Cabinet Secretariat; Prime Minister's Office; Central Secretariat; Ministries and Departments; Boards; Commissions; Attached offices; Field organizations.

Plans and Priorities : Machinery of planning; Role, composition and functions of the Planning Commission and the National Development Council; 'Indicative' planning; Process of plan formulation at Union and State levels; Constitutional Amendments (1992) and decentralized planning for economic development and social justice.

State Government and Administration : Union-State administrative, legislative and financial relations; Role of the Finance Commission; Governor; Chief Minister; Council of Ministers; Chief Secretary; State Secretariat; Directorates.

Unit - 3

District Administration since Independence : Changing role of the Collector; Union-State-local relations; Imperatives of development management and law and order administration; District administration and democratic decentralization.

Civil Services : Constitutional position; Structure, recruitment, training and capacity building; Good governance initiatives; Code of conduct and discipline; Staff associations; Political rights; Grievance redressal mechanism; Civil service neutrality; Civil service activism.

Financial Management : Budget as a political instrument; Parliamentary control of public expenditure; Role of finance ministry in monetary and fiscal area; Accounting techniques; Audit; Role of Controller General of Accounts and Comptroller and Auditor General of India.

Unit - 4

Administrative Reforms since Independence : Major concerns; Important Committees and Commissions; Reforms in financial management and human resource development; Problems of implementation.

Rural Development : Institutions and agencies since Independence; Rural development programmes: foci and strategies; Decentralization and Panchayati Raj; 73rd Constitutional amendment.

Urban Local Government : Municipal governance: main features, structures, finance and problem areas; 74^{th} Constitutional Amendment; Global-local debate; New localism; Development dynamics, politics and administration with special reference to city management.

Unit - 5

Law and Order Administration: British legacy; National Police Commission; Investigative agencies; Role of Central and State Agencies including para military forces in maintenance of law and order and countering insurgency and terrorism; Criminalisation of politics and administration; Police-public relations; Reforms in Police.

Significant issues in Indian Administration: Values in public service; Regulatory Commissions; National Human Rights Commission; Problems of administration in coalition regimes; Citizen administration interface; Corruption and administration; Disaster management.

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

CO1 To infer the nature and scope of Public Administration

CO2 To appreciate the methodological pluralism and synthesizing nature of knowledge in Public Administration

CO3 To comprehend the changing paradigms of Public Administration

CO4 To acquaint with the theories, approaches, concepts and principles of Public Administration

CO5 To infer the administrative theories and concepts to make sense of administrative practices.

CO6 To comprehend public administration theory and concepts from multiple perspectives

TEXT BOOKS:

1. Public Administration: Concepts and Cases" by Richard Stillman II
2. Public Administration: Understanding Management, Politics, and Law in the Public Sector by David H. Rosenbloom, Robert S. Kravchuk, and Richard M. Clerkin
3. Classics of Public Administration by Jay M. Shafritz and Albert C. Hyde
4. Introducing Public Administration by Jay M. Shafritz, E.W. Russell, and Christopher P. Borick

IV - Year I - Semester	Name of the Course	L	T	P	C
HS4101	Universal Human Values – 2: Understanding Harmony	3	0	0	3

Prerequisites: Basic knowledge of Professional ethics

Course Objective:

The objective of the course is

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Unit 1

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
4. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
5. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Unit - 2

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Unit - 3

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. 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 14. Understanding the meaning of Trust; Difference between intention and competence
2. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
3. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
4. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Unit - 4

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Unit - 5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. 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.
5. Case studies of typical holistic technologies, management models and production systems
6. 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

7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, 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
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4101 - A	Machine Learning	3	0	0	3

Prerequisites: Statistics and Data Mining

Course Objectives: The student should be able to:

- Recognize the importance and characteristics of machine learning.
- Apply supervised machine learning techniques for data handling and to gain knowledge from it.
- Apply advanced supervised machine learning and probabilistic models for classification problems.
- Apply unsupervised machine learning models to real world problems.
- Evaluate the performance of algorithms and to provide solution for various real-world applications using ensemble models.

Unit - 1

Introduction to Machine Learning: Introduction, Components of Learning, Learning Models, Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension.

Unit - 2

Supervised Learning: Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression.

Unit - 3

Advanced Supervised Learning: Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors.

Probabilistic Models: Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks.

Unit - 4

Unsupervised Learning: Introduction to clustering, K-means clustering, K-Mode Clustering, Distance based clustering, Clustering around mediods, Silhouettes, Hierarchical Clustering.

Unit - 5

Ensemble Learning: Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: RandomForest Trees, Boosting: Adaboost, Stacking.

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

CO1: Recognize the characteristics of machine learning.

CO2: Apply various supervised learning methods to appropriate problems.

CO3: Identify and integrate more than one technique to enhance the performance of learning and create probabilistic models for handling unknown pattern.
CO4: Apply unsupervised learning models e.g. clustering algorithms to handle the unknown data.
CO5: Apply Ensemble models to any real-world problem to Analyze its performance effectively.

TEXT BOOKS:

1. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar "Foundations of Machine Learning", MIT Press, 2012
3. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012

REFERENCE BOOKS:

1. Chris Albon: Machine Learning with Python Cookbook, O'Reilly Media, Inc.2018.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
4. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012 Jiawei Han and Micheline Kambers and Jian Pei, "Data Mining –Concepts and Techniques", 3rd Edition, Morgan Kaufman Publications, 2012.
5. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.

E- Resources & Other Digital Material:

1. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, https://www.cs.ubc.ca/~murphyk/MLbook/pml-intro-5nov11.pdf.
2. Professor S. Sarkar, IIT Kharagpur "Introduction to machine learning", https://www.youtube.com/playlist?list=PLYihddLFCgYuWNL55Wg8ALkm6u8U7gps.
3. Professor Carl Gustaf Jansson, KTH, Video Course on Machine Learning https://nptel.ac.in/noc/individual_course.php?id=noc19-cs35.
4. Tom Mitchell, "Machine Learning", http://www.cs.cmu.edu/~tom/10701_sp11/lectures.shtml

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4101 - B	Sentiment Analysis	3	0	0	3

Course Objectives:

- To give an overview on the need for sentiment analysis
- To explore the various methodologies necessary to perform sentiment classification
- To learn about opinion summarization
- To learn the various tools used for sentiment analysis
- To gain knowledge in aspect based sentiment analysis

Unit – 1

Introduction: Need for Sentiment Analysis, Problem of Sentiment Analysis, Subjectivity, Stance, Words to Discourse, Pragmatics, Natural Language Processing issues, Opinion Definition, Sentiment analysis Tasks, Opinion Summarization, Types of opinion, Subjectivity and emotion , Author and Reader Standpoint.

Unit - 2

Document Sentiment Classification: Sentiment Classification Using Supervised Learning, Unsupervised Learning , Rating Prediction, Cross-Domain Sentiment Classification, Cross Language Sentiment Classification, Sentence Subjectivity and Classification, Subjectivity Classification, Sentence Sentiment Classification, Conditional Sentences Sarcastic Sentences, Cross-Language Subjectivity and Sentiment Classification.

Unit – 3

Aspect Based Sentiment Analysis: Aspect sentiment classification, rules of opinions and compositional semantics, aspect extraction, identifying resource usage aspect, simultaneous opinion lexicon expansion and aspect extraction, Grouping aspects into categories, entity, opinion hold and timing extraction, coreference resolution and word sense disambiguation, aspect and entity extraction, sentiment lexicon generation, corpus based approach, dictionary based approach, desirable and undesirable facts.

Unit – 4

Opinion Summarization: Aspect based opinion summarization, improvements to aspect- based opinion summarization, contrastive view summarization, traditional summarization, Analysis of comparative opinions, identifying comparative sentences, identifying preferred entities, opinion search and retrieval, opinion spam detection, types of spam detection, supervised and un-supervised approach, group spam detection.

Unit – 5

Tools For Sentiment Analysis: Detecting fake or deceptive opinions, Quality of Review, Quality as regression model, other methods, Case study, sentiment analysis applications, tools

for sentiment analysis, Semantria, Meltwater, Google Analytics, Face book Insights, Tweetstats.

Course Outcomes:

CO1: Apply the various algorithms to perform opinion mining and classification
CO2: Identify the sentiment of any document, web-page or social networking site
CO3: Compare and contrast the various tools necessary for performing sentiment analysis
CO4: Use the apt tools to perform sentiment analysis for any given application
CO5: Understand knowledge about sentiment analysis aspects

TEXTBOOKS

1. Sentiment Analysis: Mining Opinions, Sentiments, and Emotions, by Bing Liu

REFERENCE BOOKS:

1. Sentiment Analysis in Social Networks By Federico Pozzi, Elisabetta Fersini, Enza Messina, Bing Liu · 2016
2. Sentiment Analysis for Social Media, Antonio Moreno, Carlos A. Iglesias, MDPI 2020
3. New Opportunities for Sentiment Analysis and Information Processing, Aakansha Sharaff, G. R. Sinha, Surbhi Bhatia, IGI Global, 2021
4. Sentiment Analysis and Knowledge Discovery in Contemporary Business, Dharmendra Singh Rajput, Ramjeevan Singh Thakur, S. Muzamil Basha, IGI Global, 2018

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4101 - C	Natural Language Processing	3	0	0	3

Course Objectives:

- To tag a given text with basic Language processing features, design an innovative application using NLP components
- Implement a rule based system to tackle morphology/syntax of a Language
- Design a tag set to be used for statistical processing keeping an application in mind
- Design a Statistical technique for a new application
- Compare and contrast use of different statistical approaches for different types of applications

Unit – 1

Introduction: Regular Expressions, Finite State Automata, Morphology , Finite state transducers, Probabilistic models, N-grams models.

Unit – 2

Syntax Analysis: Word classes and Part-of-Speech, Context Free Grammars for English, parsing with context free grammar, Syntax-Features and Unification, Lexicalized and Probabilistic Parsing, Language and Complexity.

Unit – 3

Semantic Analysis: Representing Meaning, Meaning Structure of Language, First Order Predicate Calculus, Representing Linguistically Relevant Concepts, Syntax-Driven Semantic Analysis, Semantic Attachments ,Syntax-Driven Analyzer ,Robust Analysis - Lexemes and Their Senses, Internal Structure, Word Sense Disambiguation, Information Retrieval.

Unit – 4

Pragmatics: Discourse- Reference Resolution, Text Coherence, Discourse Structure, Dialog and Conversational Agents, Natural Language Generation, Machine Translation , Transfer Metaphor, Interlingua, Statistical Approaches.

Unit – 5

Information Extraction: Entity recognition, relation detection, temporal expression analysis and template, filling. Question Answering and Summarization: Information retrieval-factoid question answering, single document summarization, generic multiple document summarization, query-focused summarization.

Course Outcomes:

CO1 Acquainted with natural language processing and learn how to apply basic algorithms in this field

CO2 Understand the algorithmic description of the main language levels: morphology, syntax

CO3 Understand semantics, and pragmatics of natural language data - corpora

CO4 Understand basics of knowledge representation

CO5 Inference relations to the artificial intelligence

TEXT BOOKS:

1. Daniel Jurafsky and James, H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics, and Speech Recognition”, 2nd Edition Prentice-Hall, 2009.
2. Tanveer Siddiqui and U.S.Tiwary, “Natural Languge Processing and Information Retrieval”, Oxford University Press, 2008.
3. James Allen “Natural Language Understanding”, Benjamin / Cummings Publishing Co., 1995

REFERENCE BOOKS

1. Gros, Jones and Webber, “Readings in Natural Language Processing”, MorganKonfmann publishers, 1986.

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4101 - D	Devops	3	0	0	3

Course Objectives:

- DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

Unit - 1

Phases of Software Development life cycle, Values and principles of agile software development

Unit - 2

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

Unit - 3

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Unit - 4

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment , Benefits of CI/CD, Metrics to track CI/CD practices

Unit - 5

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Course Outcomes:

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

CO1 Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility

CO2 Describe DevOps & DevSecOps methodologies and their key concepts

CO3 Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools and cloud models

CO4 Set up complete private infrastructure using version control systems and CI/CD tools

CO5 Illustrates maturity models

TEXT BOOKS:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.

2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides ,O'Reilly publications, 2012.

REFERENCE BOOKS:

1. Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications, 2013.
2. The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Microservices, 1st Edition, Viktor Farcic, CreateSpace Independent Publishing Platform publications, 2016
3. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, 1st Edition, Jez Humble and David Farley, 2010.
4. Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and microservices, 1st Edition, Dave Harrison, Knox Lively, Apress publications, 2019

e-Resources:

1. https://www.javatpoint.com/devops
2. https://github.com/nkatre/Free-DevOps-Books-1/blob

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4101 - E	Software Project Management	3	0	0	3

Prerequisites: Software Engineering

Course Objectives:

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

- To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project
- To compare and differentiate organization structures and project structures
- To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools

Unit - 1

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

Unit - 2

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

Unit - 3

Model Based Software Architectures: A Management perspective and technical perspective.

Work Flows of the Process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

Unit - 4

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Unit - 5

Process Automation: Automation Building blocks, The Project Environment.
Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.
Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

Course Outcomes:

Upon the completion of the course students will be able to:
CO-1: Summarize the process to be followed in the software development life-cycle models.
CO-2: Summarize the concepts of project management & planning
CO-3: Implement the project plans through managing people, communications and change
CO-4: Conduct activities necessary to successfully complete and close the Software projects
CO-5: Implement communication, modeling, and construction & deployment practices in software development.

TEXT BOOKS:

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

REFERENCE BOOKS:

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

e-resources:

1. https://archive.nptel.ac.in/courses/110/104/110104073/

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4102 - A	Software Testing Methodologies	3	0	0	3

Course Objectives:

1. To study fundamental concepts in software testing and discuss Various Software testing issues and solutions
2. To learn how to plan a test project, design test cases and data, Conduct, Testing, manage Software problems and defects, and generate a test report
3. To expose the advanced software testing concepts such as object-oriented Software testing methods, web-based and component-based software testing
4. To understand software test automation problems and solutions
5. To learn how to write software test documents and communicate with Engineers in various forms

Unit -1

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology.

Verification and Validation: Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

Unit – 2

Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.

White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

Unit - 3

Static Testing: Inspections, Structured Walkthroughs, Technical Reviews. Validation activities: Unit testing, Integration Testing, Function testing, system testing, acceptance testing. Regression testing: Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

Unit – 4

Efficient Test Suite Management: Growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring the effectiveness of a prioritized test suite Software Quality Management: Software Quality metrics, SQA models. Debugging: process, techniques, correcting bugs.

Unit - 5

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and Junit.

Test Automation using Selenium tool. Testing Object Oriented Software: basics, Object oriented testing Testing Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems, Testing mobile systems

Course Outcomes:

After completing this course, Students will be able to-

CO1: Identify and understand various software testing problems, apply software testing knowledge and engineering methods and solve these problems by designing and selecting software test models, criteria, strategies, and methods

CO2: Design and conduct a software test process for a software project

CO3: Analyze the needs of software test automation

CO4: Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects

CO5: Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web based application

TEXT BOOKS

1. Software Testing, Principles and Practices, Naresh Chauhan, Oxford
2. Software Testing, Yogesh Singh, CAMBRIDGE

REFERENCE BOOKS:

1. Foundations of Software testing, Aditya P Mathur, 2ed, Pearson
2. Software testing techniques – Baris Beizer, Dreamtech, second edition.
3. Software Testing, Principles, techniques and Tools, M G Limaye, TMH
4. Effective Methods for Software testing, Willian E Perry, 3ed, Wiley

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4102 - B	No SQL Databases	3	0	0	3

Course Objectives:

- To make student understand about NoSQL, its characteristics and history, and the primary benefits for using NoSQL data
- To explore students about various types of NO-SQL databases (wide-column, document, key-value, graph and object-oriented) in adding content and running queries
- To make students in understanding the NoSQL data architecture patterns

Unit – 1

Introduction to No-SQL

What is No-SQL? NoSQL Overview, NoSQL Database Environment, NoSQL Options, When to use No-SQL?, Introduction to No-SQL development

Unit – 2

Column-Oriented Databases

Column family, key and key space, Apache HBASE

Unit – 3

Key Value Databases

What is key value store? Key value databases, DynamoDB

Unit - 4

Document based Databases

What is document? Document Databases, MangoDB

Unit – 5

Graph Databases

What is Graph Database? Graph Databases, Neo4J

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

CO1: Outlines the importance of NoSQL and types of NoSQL Databases.
CO2: Demonstrates the working environment of Column-oriented databases.
CO3: Demonstrates the working environment of Key Value Databases.
CO4: Demonstrates the working environment of Document based Databases.
CO5: Demonstrates the working environment of Graph Databases.

TEXT BOOKS

1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Author: Sadalage, P. & Fowler, Publication: Pearson Education
2. NoSQL Databases A Complete Guide - 2020 Edition, Author: Gerardus Blo dyk, Publisher: 5starcooks

REFERENCE BOOKS

1. Name: Redmond, E. &Wilson, Author: Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement Edition: 1st Edition.
2. NoSQL For Dummies, Author: Adam Fowler, Publisher: A wiley Brand

e- Resources & other digital material:

1. https://www.guru99.com/hbase-tutorials.html
2. https://docs.mongodb.com/manual/tutorial/
3. https://dynobase.dev/dynamodb/
4.https://neo4j.com/developer/graph-db-vs-nosql/

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4102 - C	Deep Learning	3	0	0	3

Course Objectives:

- To understand basic concepts of neural networks.
- To emphasize on learning, optimization techniques.
- To learn CNN, RNN, Auto encoder models.
- To learn deep learning algorithms to solve real world problems.

Unit - 1

Deep learning basics Introduction, the perceptron, Practical network Overfitting training, Back-Propagation, why does it work? and generalization, Shallow Neural Network, Dep Neural Networks.

Unit - 2

Optimization Challenges in neural network Checking, RMSProp, Gradient Adam, Batch Descent, Stochastic Gradient Descent, Momentum Optimizer, AdaGrad, normalization. optimization, Initialization, - Regularization, Gradient

Unit - 3

Deep Learning for Computer Vision Building blocks of CNN, Local receptive fields, Shared weights and bias, Pooling layers, Max- pooling, Average pooling, CNN for image classification, CNN for segmentation, an example of DCNN- LeNet, LeNet code in Keras, Understanding the power of deep learning, Recognizing CIFAR-10 images with deep learning, recognizing cats with a VGG-16 net.

Unit - 4

Effective training of Deep Neural Networks and Recent trends in Deep Learning Architecture Early stopping, Dropout, Instance Normalization, Group Normalization, Transfer Learning, Improving the CIFAR-10 performance with deeper a network, Improving the CIFAR-10 performance with data augmentation, Predicting with ClFAR-10, Very deep convolutional networks for large-scale image recognition.

Unit - 5

Deep Learning for Natural Language Processing Computational representation of language, one-hot representation of words, word vectors, The skip-gram word2vec model, The CBOW word2vee model, word vector arithmetic, RNN, LSTM.

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

CO1 Summarize basic neural network models
CO2 Perform optimization and evaluate performance of the neural network Model.
CO3 Implement mathematical model of neural network.

CO4 Design convolutional neural network for solving problems.
CO5 Design RNN's, Auto encoders.

TEXT BOOKS:

1. Deep Learning- lan Goodfellow, YoshuaBenjio, Aaron Courville, The MIT Press
2. 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. Russell1, 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. Hastie. T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer.2001
4. Kolle, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009.

Web Resources & other digital material:

1. NPTEL Lecture material 1. Lecture Series on Deep Learning by Prof. P. K. Biswas, Department of Electrical & Electronic Communication Engineering, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc22_cs22/preview#:~text=Week%201%3A%20Introdhio ion%20to%20Deep, Multilayer%20Perceptron%2C%20Back%20Propagation%20Learning Course

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4102 - D	Digital Image Processing	3	0	0	3

Course Objectives: Students undergoing this course are expected to:

- Familiarize with basic concepts of digital image processing
- Learn various image processing techniques like image enhancement
- Understand Color fundamentals and different Color models
- Understand Image Compression & Morphological Image Processing

Unit – 1

Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

Unit – 2

Image Enhancement in The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods

Unit – 3

Color Image Processing: Color Fundamentals, Color Models, Pseudo color image processing, Color transformation, Smoothing and sharpening, Image segmentation based on Color, Noise in Color images

Unit – 4

Image Compression & Morphological Image Processing: Image Compression - Fundamentals, some basic compression methods, Digital Image water marking.
Morphological Image Processing - Erosion and Dilation, Opening and Closing, Hit-or-Miss Transformation, Some basic morphological algorithms, Gray-scale morphology.

Unit – 5

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

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

CO1: Summarize Digital Image Fundamentals

CO2: Perform various Image enhancement techniques

CO3: Analyze pseudo and full color image processing methods
CO4: Use various compression techniques and morphological operations.
CO5: Use various Image segmentation methods

TEXT BOOKS

1. Digital Image Processing, Third Edition, Rafael C Gonzalez, Richard E Wood

REFERENCE BOOKS

1. Milan Sonka "Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
3. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

Online Resources

1. https://web.stanford.edu/class/ee368/
2. https://inst.eecs.berkeley.edu/~ee225b/sp20/

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4102 - E	Geospatial & Time Oriented Analysis	3	0	0	3

Course Objectives:

- Know the concepts of Remote Sensing, its interpreting Techniques and concepts of Digital images
- Know the concept of Geographical Information System (GIS), coordinate system GIS Data and its types.
- Understand the students managing the spatial Data Using GIS.
- Understand Implementation of GIS interface for practical usage.

Unit – 1

Concepts of Remote Sensing Basics of remote sensing: elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology & Units, energy resources, energy interactions with earth surface features & atmosphere, atmospheric effects, satellite orbits, Sensor Resolution, types of sensors. Remote Sensing Platforms and Sensors, IRS satellites.

Remote Sensing Data Interpretation and Visual interpretation techniques: basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of soil, water and vegetation. Concepts of Digital image processing, image enhancements, qualitative & quantitative analysis and pattern recognition, classification techniques and accuracy estimation.

Unit – 2

Introduction to GIS: Introduction, History of GIS, GIS Components, GIS Applications in Real life, The Nature of geographic data, Maps, Types of maps, Map scale, Types of scale, Map and Globe, Coordinate systems, Map projections, Map transformation, Geo-referencing

Unit – 3

Spatial Database Management System: Introduction: Spatial DBMS, Data storage, Database structure models, database management system, entity-relationship model, normalization

Data models and data structures: Introduction, GIS Data model, vector data structure, raster data structure, attribute data, geo-database and metadata.

Unit – 4

Spatial Data input and editing: Data input methods – keyboard entry, digitization, scanning, conversion of existing data, remotely sensed data, errors in data input, Data accuracy, Micro and Macro components of accuracy, sources of error in GIS.

Spatial Analysis: Introduction, topology, spatial analysis, vector data analysis, Network analysis, raster data analysis, Spatial data interpolation techniques

Unit – 5

Implementing a GIS and Applications Implementing a GIS: Awareness, developing system requirements, evaluation of alternative systems, decision making using GIS.

Applications of GIS: GIS based road network planning, Mineral mapping using GIS, Shortest path detection using GIS, Hazard Zonation using remote sensing and GIS, GIS for solving multi criteria problems, GIS for business applications.

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

CO1 Describe different concepts and terms used in Remote Sensing and its data
CO2 Infer the Data conversion and Process in different coordinate systems of GIS interface
CO3 Evaluate the accuracy of Data and implementing a GIS
CO4 Comprehend the applicability of RS for various applications.
CO5 Comprehend the applicability of GIS for various applications.

TEXT BOOKS:

1. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Press, 2nd Edition, 2011.
2. Introduction to Geographic Information systems by Kang-tsung Chang, McGraw Hill Education (Indian Edition), 7th Edition, 2015.
3. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

REFERENCE BOOKS:

1. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, Wiley Publishers, 7th Edition, 2015.
2. Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3rd Edition, 2010.
3. Advanced Surveying: Total Station, GIS and Remote Sensing by Satheesh Gopi, R. SathiKumar, N. Madhu, Pearson Education, 1st Edition, 2007.
4. Textbook of Remote Sensing and Geographical Information systems by M. Anji Reddy

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4103 - A	Cyber Security Essentials	3	0	0	3

Course Objectives:

- Learn the foundations of Cyber security and threat landscape.
- Develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets

Unit – 1

Introduction to Cyber security

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security

Unit – 2

Cyber crime and Cyber law: Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.

Unit – 3

Data Privacy and Data Security and Security Introduction to Social networks: Data Privacy and Data Security, Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues

Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

Unit – 4

E - Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets,

Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act, 2007

Unit – 5

Digital Devices Security , Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

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

CO1: Understand the fundamental concepts of cyberspace, including its architecture, communication technologies, and the evolution of the internet

CO2: Comprehend various types of cybercrimes, analyse cybercriminals modus operandi, and discuss common cybercrimes targeting computers, mobiles, and vulnerable populations

CO3: Analyse the principles of data privacy and protection, evaluate data protection regulations such as GDPR and PIPEDA, and discuss compliance measures

CO4: Assess security issues, challenges the impact of social media on privacy and recommend security best practices. Students will also be equipped to advocate for responsible and secure social media usage

CO5: Articulate the e-commerce, evaluate its components, and analyze e-commerce security threats. Comprehend various digital payment modes, understand the risks associated with them, and propose preventive measures.

TEXT BOOKS

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4103 - B	Dimensionality Reduction and Model Validation Techniques	3	0	0	3

Course Objectives:

- Understanding High-Dimensional Data
- Mastering Dimensionality Reduction Methods
- Evaluating Model Performance and Hands-On over various Validation Methods

Unit - 1

Introduction to Dimensionality Reduction: Motivation and challenges of high-dimensional data, Curse of dimensionality and its implications, Types of dimensionality reduction techniques: Feature Selection vs. Feature Extraction, Principal Component Analysis (PCA): Mathematical foundations, Variance explanation and eigenvectors, Implementation using numpy/scikit-learn

Unit - 2

Linear Dimensionality Reduction Techniques, Linear Discriminant Analysis (LDA): Separability and class separations, Within-class and between-class scatter matrices, LDA for classification and dimensionality reduction, Factor Analysis: Latent variable models, Factor analysis vs. PCA Expectation-Maximization algorithm

Unit - 3

Non-Linear Dimensionality Reduction Techniques, t-Distributed Stochastic Neighbor, Embedding (t-SNE): Probability distributions and similarity measurement, Perplexity parameter Visualization of high-dimensional data, Isomap: Manifold learning and geodesic distances, Nearest neighbor graph construction, Embedding high-dimensional data in lower dimensions

Unit – 4

Model Validation Techniques, Overfitting and bias-variance tradeoff, Cross-Validation: k-fold cross-validation, Stratified cross-validation, Leave-One-Out cross-validation, Evaluation, Metrics: Accuracy, precision, recall, F1-score, ROC and AUC, Confusion matrix and its interpretation

Unit – 5

Ensemble Methods and Model Stacking, Ensemble Techniques: Bagging and boosting, Random Forest and Gradient Boosting, Stochastic Gradient Boosting, Model Stacking: Combining multiple models, Meta-learner and ensemble predictions, Stacking for improved performance

Course Objectives:

CO 1: Illustrates the Technique Selection and Application
CO 2: Infers the Mathematical Understanding for various methods
CO 3: Paraphrases the Implementation Proficiency

CO 4: Relates the Model Evaluation and Selection
CO 5: Infers the Effective Validation Strategies

TEXT BOOKS:

1 Pattern Recognition and Machine Learning by Christopher M. Bishop
2 Applied Multivariate Statistical Analysis by Richard A. Johnson and Dean W. Wichern
3 The Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4103 - C	Social Media Analytics	3	0	0	3

Course Objectives:

- Learn why social media web analytics are crucial for businesses and organizations to measure their online presence, track their performance, and make data-driven decisions.
- Get hands-on experience with various social media analytics tools and platforms.
- Stay abreast of the latest trends and advancements in social media web analytics, including new tools, techniques, and platforms.

Unit - 1

Introduction: Evolution of online communities - History and Evolution of Social Media- Social Media vs. traditional media - Social Media Audience and Goals for using Social Media - Understanding Social Media: Strong and weak ties — Influencers - How ideas travel — Viralness - Social theory and social media -technological determinism in popular discourse on social media technologies.

Unit - 2

Community Building and Management: Science of Social-Media - Keys to Community Building - Promoting social media pages - Linking Social Media Accounts - The Viral Impact of social media-Digital PR. Encourage Positive Chatter in Social Media - Identity in social media: formation of identities, communities, activist movements, and consumer markets - Social Media as business.

Unit – 3

Social Media Policies and Measurement: Social Media Policies-Etiquette, Privacy - ethical problems posed by emerging socialmedia technologies - The road ahead in social media - The Basics of Tracking SocialMedia - social media analytics - In-sights gained from Social Media - Customized Campaign Performance Reports - Observations of social media use.

Unit - 4

Web Analytics: Web Analytics - Present and Future, Data Collection - Importance and Options, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Web Analytics Fundamentals, Concepts, Proposals & Reports, Web Data Analysis.

Unit - 5

Search Analytics: Search Engine Optimization (SEO), non-linear media consumption, user engagement, user generated content, web traffic analysis, navigation, usability, eye tracking, online security, online ethics, content management system, data visualization, RSS feeds, Mobile platforms, User centered design, Understanding search behaviors.

Course Outcomes: On successful completion of the course student will be able to:

CO1 The students will be able to enhance the social media skills. Develop a clear understanding of what constitutes a community in the context of online platforms and social media

CO2 Recognize the significance of establishing clear and comprehensive social media policies within organizations.

CO3 Gain practical skills in creating customized campaign performance reports based on social media analytics data.

CO4 Understand the fundamentals and concepts of web analytics.

CO5 Develop a solid understanding of the core concepts and principles of search analytics

TEXT BOOKS:

1. Christian Fuchs, Social-Media a critical introduction, SAGE Publications Ltd, 2014
2. Eric T. Peterson, Web Analytics Demystified, Celilo Group Media and Café Press, 2004.

REFERENCE BOOKS:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013.
2. Bittu Kumar, Social Networking, V & S Publishers, 2013
3. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4103 - D	Video Analytics	3	0	0	3

Course Objectives:

- To understand the need for video Analytics
- To understand the basic configuration of video analytics
- To understand the functional blocks of a video analytic system
- To get exposed to the various applications of video analytics

Unit – 1

Video Analytic Components: Need for Video Analytics-Overview of video Analytics-Foreground extraction- Feature extraction- classifier - Preprocessing- edge detection-smoothening- Feature space-PCA-FLD-SIFT features

Unit – 2

Foreground Extraction: Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations-erosion-Dilation- Tracking in a multiple camera environment

Unit - 3

Classifiers: Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier-Bayesian classifier-HMM based classifier

Unit - 4

Video Analytics for Security: Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion

Unit - 5

Video Analaytics for Business Intelligence & Traffic Monitoring and Assistance: Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

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

CO1	Infers the components of video analytics
CO2	Demonstrates foreground extraction methods
CO3	Relates classifiers for video analytics
CO4	Shows the security for video analytics
CO5	Demonstrates video analytics for business intelligence and various applications

TEXT BOOKS:

1. Computer Vision: Algorithms and Applications" by Richard Szeliski
2. Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods

REFERENCE BOOKS:

1. "Video Processing and Communications" by Yao Wang, Jôrn Ostermann, and Ya-Qin Zhang

IV - Year I - Semester	Name of the Course	L	T	P	C
PE4103 - E	Computer Vision	3	0	0	3

Course Objectives:

- Recall image processing techniques for computer vision
- Do shape and region analysis
- Elucidate Hough Transform and its applications to detect lines, circles, ellipses
- Apply three-dimensional image analysis techniques
- Exploit motion analysis
- Study real world applications of computer vision algorithms

Unit – 1

Image Processing Foundations: Fundamentals Of Image Processing Techniques – Classical Filtering Operations Thresholding Techniques – Edge Detection Techniques – Corner and Interest Point Detection –Mathematical Morphology –Texture

Unit – 2

Shapes and Regions: Binary Shape Analysis – Connectedness – Object Labeling and Counting – Size Filtering – Distance Functions – Skeletons and Thinning – Deformable Shape Analysis – Boundary Tracking Procedures – Active Contours – Shape Models and Shape Recognition – Centroidal Profiles – Handling Occlusion – Boundary Length Measures – Boundary Descriptors – Chain Codes – Fourier Descriptors – Region Descriptors – Moments

Unit – 3

Hough Transform: Line Detection – Hough Transform (HT) For Line Detection – Foot-of-Normal Method – Line Localization – Line Fitting – RANSAC For Straight Line Detection – HT Based Circular Object Detection – Accurate Center Location – Speed Problem – Ellipse Detection – Case Study: Human Iris Location – Hole Detection – Generalized Hough Transform – Spatial Matched Filtering – GHT For Ellipse Detection – Object Location – GHT For Feature Collation

Unit – 4

3D Vision and Motion: Methods For 3D Vision – Projection Schemes – Shape from Shading – Photometric Stereo –Shape from Texture – Shape from Focus – Active Range Finding – Surface Representations –Point-Based Representation – Volumetric Representations – 3D Object Recognition – 3D Reconstruction – Introduction to Motion – Triangulation – Bundle Adjustment – Translational Alignment – Parametric Motion – Spline-Based Motion – Optical Flow – Layered Motion

Unit – 5

Applications: Content Based Image Retrieval, Content Based Video Retrieval. Case Study: Face Recognition, Gait Recognition.

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

CO-1: Explain the basic image processing techniques
CO-2: Interpret in-shape, boundary tracking and apply chain codes in region detection
CO-3: Apply Hough transform for detection of geometric shapes like line, ellipse and objects.
CO-4: Illustrate 3D vision process and motion estimation techniques
CO-5: Apply computer vision in real time scenario

TEXT BOOKS:

1 E. R. Davies, (2012), ‚Computer & Machine Vision', Fourth Edition, Academic Press.
2 R. Szeliski, (2011) ‚Computer Vision: Algorithms and Applications', Springer 2011.
3 Simon J. D. Prince, (2012), Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
4 Mark Nixon and Alberto S. Aquado, (2012), Feature Extraction & Image Processing for Computer Vision', Third Edition, Academic Press.

REFERENCE BOOKS:

1 D. L. Baggio et al., (2012) ‚Mastering Open CV with Practical Computer Vision Projects', Packet Publishing,
2 Jan Erik Solem, (2012) ‚Programming Computer Vision with Python: Tools and algorithms for analyzing images', O'Reilly Media.

Online Resources:

1 http://kercd.free.fr/linksKCD.html
2 http://www.cs.ubc.ca/spider/lowe/vision.html
3 https://archive.nptel.ac.in/courses/106/106/106106224/

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4101 - A	Fundamentals and Principles of Internet of Things	3	0	0	3

Course Objectives:

- To study the introductory concepts, design procedures and enabling technologies of IoT
- To learn the concepts of networking and building blocks of IoT.
- To study changes in architectures of IoT and its challenges.
- To know the procedure of IoT Design Methodology.
- To learn about IoT solutions to different real time problems.

Unit - 1

Introduction: Introduction to Internet of Things, Block diagram of IoT, Definition and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT levels. (Basic concepts only).

Unit - 2

IoT & M2M: Machine to Machine, Difference between IoT & M2M, Software defined Networking, Network function virtualization, IoT Device and its basic building blocks

Unit - 3

Architecture and Challenges in IoT: Three, Four, Five and Seven layer, Cloud and Fog based, Social IoT and its representative architecture, Design challenges, Development challenges, Security challenges, Other challenges, Need for IoT systems management.

Unit - 4

IoT Platforms Design Methodology: Introduction, Step by step procedure of IoT Design Methodology, Development of domain and Information model for IoT systems, Example case studies.

Unit - 5

Domain Specific IoTs: Home automation, Smart cities, Environment, Energy, Retail, Logistics, Agricultural, Industry, Health and Lifestyle, Smart Automobile.

COURSE OUTCOMES:

CO1: Understand the concepts of Iot, designing procedures and levels.
CO2: Analyze the importance of netwotking aspects of iot devices
CO3: Understand the operation of various architectures and challenges to be considered
CO4: Apply the steps involved in desinging methodology to develop iot systems
CO5: Understand the applications of iot systems in various domain specific areas.

TEXT BOOKS:

1. Internet of Things: A Hands-on Approach, Arshdeep Bahga, Vijay Madisetti, Orient Blackswan Private Limited - New Delhi; First edition, ISBN: 8173719543
2. The Internet of Things Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, John Wiley & Sons Ltd, ISBN: 978-1-119-99435-0
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Florian Michahelles, Springer Heidelberg Dordrecht London New York, ISBN: 978-3-642-19156-5
4. Fundamentals of Wireless Sensor Networks: Theory and Practice, Waltenegus Dargie, Christian Poellabauer, John Wiley & Sons Ltd, ISBN: 978-0-470-97568-8

REFERENCE BOOKS:

1. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, David Easley, Jon Kleinberg, Cambridge University Press
2. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, daCosta Francis, Henderson Byron, Apress Publications, ISBN: 978-1-4302-5740-0CO4
3. Getting Started with the Internet of Things, CunoPfister, OReilly Media, N: 97CO58-1- 4493-935

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4101 - B	Graph Theory	3	0	0	3

Course Objectives:

- Understand the basics of graph theory and their various properties.
- Model problems using graphs and to solve these problems algorithmically
- Apply graph theory concepts to solve real world applications like routing, TSP/traffic control, etc.
- Optimize the solutions to real problems like transport problems etc.,

Unit - 1

Introduction to graph theory: Introduction, Mathematical preliminaries, definitions and examples of graphs, degrees and regular graphs, sub graphs, directed graphs, in degrees and out degrees in digraphs. **Basic concepts in graph theory**: Paths and cycles, connectivity, homomorphism and isomorphism of graphs, connectivity in digraphs

Unit - 2

Graph representations, Trees, Forests: Adjacency matrix of a graph, Incidence matrix of a graph, Adjacency lists, Trees and properties of trees, Characterization of trees, Centers of trees, Rooted trees, Binary threes, Spanning trees and forests, Spanning trees of complete graphs, An application to electrical networks, Minimum cost spanning trees.

Unit - 3

Fundamental properties of graphs and digraphs: Bipartite graphs, Eulerian graphs, Hamiltonian graphs, Hamiltonian cycles in weighted graphs, Eulerian digraphs.

Planar graphs, Connectivity and Flows: Embedding in surfaces, Euler's formula, Characterization of planar graphs, Kuratowski's theorem, Dual of a planar graphs.

Unit - 4

Matchings and Factors: Min-Max theorem, Independent sets and covers, Dominating sets, maximum bipartite matching.

Coloring of graphs: The chromatic number of a graph, Results for general graphs, The chromatic polynomial of a graph, Basic properties of chromatic polynomial, chordal graphs, powers of graphs, Edge coloring of graphs

Unit - 5

Graph algorithms: Graph connectivity algorithms, Breadth first search and Depth first search, Shortest path algorithms, Dijikstra's shortest path algorithm, Minimum cost spanning tree algorithms, Algorithm of Kruskal's and Prim's.

Course Outcomes:

CO1: Understand and explore the basics of graph theory
CO2: Analyse the significance of graph theory in different engineering disciplines
CO3: Demonstrating graph coloring problems and applications
CO4: Demonstrate algorithms used in interdisciplinary engineering domains.
CO4: Evaluate or synthesize any real world applications using graph theory

TEXT BOOKS:

1. Douglas B. West, "Introduction to graph theory", 2nd Edition, PHI, 2001, ISBN-9780130144003, 0130144002

REFERENCE BOOKS:

1. Geir Agnarsson, Raymond Greenlaw, "Graph Theory, modeling, Applications and Algorithms", Pearson Education, 1st Edition,2008, ISBN- 978-81-317-1728-8
2. Cormen T.H., Leiserson C. E, Rivest R.L., Stein C., Introduction to Algorithms, 3rd Edition, PHI 2010, ISBN:9780262033848

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4101 - C	Computational Number Theory	3	0	0	3

Course Objective:

- The emphasis of the course is on the application of the number theory in the design of cryptographic algorithms. Putting them together we will see how we can design se veral cryptographic algorithms.
- The course will start with the notion of time complexity and with several elementary number theoretic algorithms.
- Computational number theory is a very important area of mathematics that became m ore prominent in the 70's due to newly discovered applications to cryptography, codi ng theory, communications and other areas of applied science and technology. It is not an e xaggeration that electronic commerce, for example, would be impossible without these recent advances.

Unit – 1

Algorithms for integer arithmetic: Divisibility, GCD Computation: (Euclid's Algorithm, Extended Euclid's Algorithm), Modular Arithmetic (Groups, Solving Modular Linear Equations. Chinese Remainder Theorem. Modular Exponentiation, Discrete Logarithm Problem), Montgomery arithmetic, congruence, Hensel lifting, orders and primitive roots, integer and modular square roots, prime number theorem, continued fractions and rational approximations.

Unit - 2

Representation of finite fields: Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials.

Algorithms for polynomials: Root-finding and factorization, Lenstra-Lenstra ovasz algorithm, polynomials over finite fields.

Unit – 3

Elliptic curves: The elliptic curve group and method, elliptic curves over finite fields, Schoof's point counting algorithm.

Primality testing algorithms: Pseudo primality Testing, Quadratic Residues, Randomized Primality Test & Deterministic Polynomial Time Algorithm, Fermat test, Miller- Rabin test, Solovay-Strassen test, AKS test.

Unit – 4

Integer factoring algorithms: Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method.

Computing discrete logarithms over finite fields: Baby-step-giant-step method, Pohlig-Hellman method, index calculus methods, linear sieve method, Coppersmith's algorithm.

Unit - 5

Key Exchange and Applications of Number Theory: Diffie Hellman, ElGamal, MasseyOmura. Computation of Generators of Primes, Algebraic coding theory, cryptography.

Course Outcome: On successful completion of this course, the student should be able to:

CO1 Understand different number theory algorithms used for design of various cryptographic algorithms.

CO2 Understand different number theory algorithms used coding theory, communications and other areas of applied science and technology.

CO3 Demonstrates elliptic curves and testing algorithms

CO4 Illustrates factoring algorithms and discrete logarithms

CO5 Infers key exchange algorithms with applications

TEXT BOOKS:

1. V. Shoup, A computational introduction to number theory and algebra, Cambridge University Press

REFERENCE BOOKS:

1. M. Mignotte, Mathematics for computer algebra, Springer-Verlag.
2. I. Niven, H. S. Zuckerman and H. L. Montgomery, An introduction to the theory of numbers, John Wiley.
3. J. von zur Gathen and J. Gerhard, Modern computer algebra, Cambridge University Press.

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4101 - D	E-Waste Management	3	0	0	3

Course objectives:

- To provide a better understanding of the key aspects of e- waste management and international case studies, legal aspects, and effective management practices of e-waste.

Unit–1

Introduction: E- Waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal.

Unit–2

E- Waste legislation: E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDFs. The international legislation: The Basel Convention; The Bamako Convention. The Rotterdam Convention. Waste Electrical and Electronic Equipment, Restrictions of Hazardous Substances (RoHS) Directive.

Unit–3

E-Waste hazardous on Global trade: Essential factors in global waste trade economy, Waste trading as a quint essential part of electronic recycling, Free trade agreements as a means of waste trading. Import of hazardous ewaste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India.

Unit–4

E-Waste control measures: Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source.

Unit–5

E-Waste management Techniques: Basic principles of E waste management, Component of E waste management, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials, occupational and environmental health perspectives of recycling e-waste in India

Course Outcomes: Upon successful completion of the course, the student will be able to
CO1 Know about the environmental impacts of e-waste.

CO2 Analyze the E- waste management measures proposed under national and global legislations
CO3 Apply various concept learned under e-waste management hierarchy.
CO4 Distinguish the role of various national and internal act and laws applicable
CO5 Know about E-waste management and handling.

TEXT BOOKS:

1. Hester R.E., and Harrison R.M. 2009. Electronic Waste Management. Science.
2. Fowler B. 2017. Electronic Waste – 1 st Edition (Toxicology and Public Health Issues). Elsevier.

REFERENCE BOOKS:

1. Johri R., "E-waste: implications, regulations, and management in India and current global best practices," TERI Press, New Delhi

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4102 - A	Supply Chain Management	3	0	0	3

Course objectives:

- The main objective is to understand the importance of Supply chain management in present Business context.

Unit–1

Logistics and Competitive strategy: Competitive advantage – Gaining Competitive advantage through logistics-Integrated supply chains– Competitive performance - Models in Logistics Management - Logistics to Supply Chain Management – Focus areas in Supply Chain Management Customer service and retention- Basic service capability Value added services

Unit–2

Measuring logistics costs and Performance: The concept of Total Cost analysis – Principles of logistics costing – Logistics and the bottom-line – Impact of Logistics on shareholder value - customer profitability analysis – direct product profitability – cost drivers and activity-based costing.

Unit–3

Logistics and Supply chain relationships: Benchmarking the logistics process and SCM operations –Mapping the supply chain processes – Supplier and distributor benchmarking – setting benchmarking priorities – identifying logistics performance indicators –Channel structure – Economics of distribution –channel relationships –logistics service alliances.

Unit–4

Sourcing, Transporting and Pricing Products: Sourcing decisions and transportation in supply chain – infrastructure suppliers of transport services – transportation economics and pricing – documentation - pricing and revenue management Lack of coordination and Bullwhip Effect - Impact of lack of coordination. - CRM – Internal supply chain management.

Unit–5

Managing Global Logistics and global Supply Chains: Logistics in a global economy – views of global logistics- global operating levels – interlinked global economy – The global supply chains -Global supply chain business processes – Global strategy – Global purchasing – Global logistics – Channels in Global logistics – Global alliances – Issues and Challenges in Global Supply Chain Management.

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

CO1 Growing importance of Logistics and Supply Chain Management

CO2 LSCM Costs and Performance

CO3 Benchmarking in SCM

CO4 Sourcing and transportation
CO5 Global aspects in SCM

TEXT BOOKS:

1. Donald J. Bowersox and David J.Closs: "Logistical Management" The Integrated Supply Chain Process, TMH, 2011.
2. Edward J Bradi, John J Coyle: "A Logistics Approach to Supply Chain Management, Cengage Learning, New Delhi, 2012.
3. Sunil Chopra and Peter Meindl: "Supply chain Management: Strategy, Planning and Operation", Pearson Education, New Delhi 2013

REFERENCE BOOKS:

1. Rahul V Altekar: Supply Chain Management, PHI Learning Ltd, New Delhi, 2009
2. Deepak P, Milind M.Oka: "Supply Chain Management" Everest Publishing House, New Delhi

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4102 - B	Fuzzy Sets, Logic and Systems	3	0	0	3

Course objectives:

- This course introduces students to the basic concepts of modeling in systems using fuzzy sets.
- The concepts of fuzzy sets are introduced and their role in applications of semantic interpreters, control systems and reasoning systems.

Unit – 1

Fuzzy Sets: Basic concepts of fuzzy set – t-norm – t-conorms – Membership function – α-cut – Algebra of fuzzy sets – Distance between fuzzy sets – Fuzzy relation.

Unit – 2

Fuzzy Arithmetic: Fuzzy numbers – Arithmetic operations of fuzzy numbers – Extension principle – Interval arithmetic – Defuzzification.

Unit – 3

Fuzzy Function: Fuzzy valued functions – Fuzzy equations, fuzzy inequalities , system of fuzzy linear equations – Maximum and minimum of fuzzy functions.

Unit – 4

Fuzzy Logic: Classical Logic – Multi-valued Logics – Fuzzy Propositions – Fuzzy Quantifiers – Linguistic hedges – Inference from conditional Fuzzy proposition.

Unit – 5

Applications of Fuzzy Set Theory: Fuzzy sets in Decision making – Optimization in Fuzzy environment – Fuzzy set application in image processing – Fuzzy set application in pattern reorganization.

Course Outcomes :

CO1 Understand basic knowledge of the fuzzy sets, operations and their properties
CO2 Understand the fundamental concepts of Fuzzy functions and Fuzzy logic
CO3 Apply the concepts of Fuzzy sets in image processing, pattern reorganization and decision making
CO4 Apply the concepts of Fuzzy logic in image processing
CO5 Identify the applications of fuzzy sets.

TEXT BOOKS:

1 George J.Klir and Bu Yuan, Fuzzy sets and Fuzzy logic Theory and applications , Prentice Hall of India, New Delhi.

REFERNCE BOOKS:

1. Didier Bubois and Henri Prade , “Fuzzy sets and systems” , Academic Press..
2. James J Buckley , Esfandiar Eslami , “An Introduction to Fuzzy logic and Fuzzy sets” (Springer).
3. H.J.Zimmernman , “Fuzzy set theory and application” (Allied Publication in Association with KLUWER)

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4102 - C	Soft Computing	3	0	0	3

Course Objectives:

- The main objective of the course is to expose the students to soft computing, various types of soft computing techniques, and applications of soft computing.

Unit – 1

Soft Computing: Introduction to soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.

Artificial Intelligence: Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hillClimbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies.

Unit – 2

Neural Network: Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference b/w ANN and human brain, characteristic and applications of ANN, single layer network.

Unit – 3

Perceptron: Perceptron training algorithm, Linear separability , Widrow & Hebb's learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA.

Counter propagation network: architecture , functioning & characteristics of counter Propagation network, Hop field/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

Unit – 4

Fuzzy Logic: Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions.

Fuzzy rule base system : Fuzzy propositions, formation, decomposition& aggregation of fuzzy Rules, fuzzy reasoning, fuzzy inference systems,fuzzy decision making & Applications of fuzzy logic.

Unit – 5

Genetic algorithm: Fundamental, basic concepts, working principle,encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion,

mutation operator, Bitwise operator ,Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

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

CO1 Learn about soft computing techniques and their applications
CO2 Analyze various neural network architectures
CO3 Understand perceptrons and counter propagation networks.
CO4 Define the fuzzy systems
CO5 Analyze the genetic algorithms and their applications.

TEXT BOOKS:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

REFERENCE BOOKS:

1. N.K.Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998.
2. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1stEdition, 2009.
3. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.
4. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic,Theory & Applications, PHI Publication, 1st Edition, 2009.
5. Martin T Hagen, Neural Network Design, Nelson Candad, 2ndEdition, 2008.

Web references:

1. www.myreaders.info/html/soft_computing.html

IV - Year I - Semester	Name of the Course	L	T	P	C
OE4102 - D	Robotics	3	0	0	3

Course Objectives:

- Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications..
- Make the system follow a given trajectory and react to unexpected obstacles.
- Create a useful mathematical representation of a physical system.

Unit - 1

Introduction: Automation and robotics – History of robots -Robot anatomy – classification of robots, major components-robot specifications, selection of robots.

Unit - 2

Robot actuators- Pneumatic, Hydraulic actuators, electric & stepper motors.
End Effectors- types of end effectors, grippers and tools, Requirements and challenges of end effectors.

Unit - 3

Robot Programming: - Robot programming languages - programming methods - off andon-line programming - Lead through method - Teach pendent method, simple programs.

Unit - 4

Sensors used in robots: Sensor devices, Types of sensors - contact, position and displacement sensors, Force and torque sensors - Proximity and range sensors - acousticsensors –slip sensors, Robot vision systems.

Unit - 5

Applications of robots: Application of robots in industry - material handling, processing operations, assembly, and inspection operations.

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

CO1 Understand the basic anatomy of robots, actuators, endeffectors, robot sensors, programming and applications.
CO2 Understand the working principles of robot actuators,end effectors
CO3 Demonstrates robot programming skills
CO4 Relates the knowledge of robot sensors to robot
CO5 Shows the applications of robots in industries

TEXT BOOKS:

1. Mikell P. Groover. Industrial Robotics Technology Programming and Applications, McGraw Hill Co., Singapore, 1995.
2. Robotic Engineering by Richard D.Klafter, Prentice Hall

REFERENCE BOOKS:

1. Introduction to Robotics – Saeed B.Niku, Prentice Hall
2. Introduction to Robotics – John J. Craig, Addison Wesley

E-Resources & other digital Material:

1 http://nptel.ac.in/downloads/112101098/

IV - Year I - Semester	Name of the Course	L	T	P	C
SOC4101	MongoDB	1	0	2	2

Course Objectives:

- The objectives of studying MongoDB typically revolve around understanding its features, capabilities, and use cases in the context of modern database management.

Unit - 1

Overview of MongoDB: Introduction of MongoDB, No SQL Database, Advantage over RDBMS, MongoDB Data Types, Install MongoDB, MongoDB Data Modeling

MongoDB Operators: Query & Projection Operator, MongoDB Update Operator, Aggregation Pipeline Stages, MongoDB limit(), MongoDB sort(), Query Modifiers

Unit - 2

Commands: Aggregation Commands, Geospatial Command, Query and Write Operation Commands, Query Plan Cache Commands, Authentication Commands, User Management Commands, Role Management Commands, Replication Command, Shading Commands, Session Commands

Database: Create Database, Drop Database

Collection: Create Collection, Drop Collection

Unit - 3

CRUD: Documents, Inset Documents, Update Documents, Delete Documents, Query Documents, SQL to MongoDB Mapping, MongoDB text search, Partial Updates & Document Limits, Removing Documents, Multi Update, Upsert, Wire Protocol, Bulk() Operations and Methods, Common Commands, db.runCommand(), db.isMaster(), db.serverStatus(), db.currentOp() & db.killOp(), collection.stats() & collection.drop()

Unit - 4

MongoDB Shell: MongoDB Shell, Shell Collection Methods, Cursor Method, MongoDB Database Commands, Query Plan Cache Methods, User Management Method, Role Management Method, MongoDB Replication Methods

MongoDB Cloud: MongoDB Stitch, MongoDB Atlas, MongoDB Cloud Manager, MongoDB Ops Manager

Unit - 5

MongoDB Tools: MongoDB Compass, MongoDB BI connector Connectivity, Java MongoDB, PHP MongoDB, Python MongoDB

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

CO1 Outlines the basics of MongoDB and MongoDB operators
CO2 Lists the commands in MongoDB
CO3 Computes all database operations using mongoDB
CO4 Demonstrates MongoDB shell and cloud
CO5 Relates the usage of various MongoDB tools

TEXT BOOKS:

1. NoSQL with MongoDB in 24 Hours, Sams Teach Yourself 1st Edition, Kindle Edition
2. MongoDB Fundamentals: A hands-on guide to using MongoDB and Atlas in the real world by Amit Phaltankar, Juned Ahsan, Michael Harrison , Liviu Nedov

IV - Year II - Semester	Name of the Course	L	T	P	C
PROJ4201	Project	0	0	0	8
CSP	Community Service Project	0	0	0	4