NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

B.Tech.

Computer Science and Engineering

(Artificial Intelligence & Machine Learning)

(4 Year Program)

(Applicable for the Batches admitted from 2022-23)

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

Kotappakonda Road, Yellamanda (Post), Narasaraopet – 522601, Guntur District, AP
Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada, Code: 47,
Accredited by NBA & NAAC A+, RTA Approved Pollution test Centre, ISO 9001: 2015 Certified Institution
Phone: 08647-239905 Website: www.nrtec.in

CURRICULAR FRAMEWORK FOR REGULAR , MINORS AND HONORS B.TECH PROGRAMMES OF ALL BRANCHES

1. **PREAMBLE**

The rapid transformation in every sphere of life is augmenting the need to prepare the present fast-paced generation to adapt to the changing knowledge & skill requirement on a life-long basis, in the fields of science, engineering, technology and humanities to influence society positively. The future looks up to multi-disciplinary, competent leaders who are Information and Communication Technology ready and driven by strong ethical values.

NEC envisions to nurture knowledge, skills, and attitude and values of the aspiring youth to enable them to become global citizens and towards that process, the institution has evolved a flexible integrated academic curriculum.

NEC introduced Outcome Based Education (OBE) and Choice Based Credit System (CBCS), which emphasized on honing the skills and knowledge of the graduates.

The Engineering curriculum is revised with an objective to fill the gaps in the existing curriculum with reference to skill development. The revised curriculum underwent a reorganization making the engineering education enshrined with skill development ecosystem to suit the industry's needs and to ensure the graduates employability.

The curriculum mandates students to take up five skill courses, Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature. The students are also given the option of choosing between skill courses offered by the college and a certificate course offered by industry, a professional body, APSSDC or any other accredited body.

Another major change brought in the curriculum is the introduction of B.Tech with Honors or a B.Tech. with a Minor. This is to give an opportunity for the fast learners to earn additional credits either in the same domain or in a related domain, making them more proficient in their chosen field of discipline or be a graduate with multidisciplinary knowledge and job ready skills.

2. **PROGRAMS OFFERED BY THE COLLEGE**

Narasaraopeta Engineering College (NEC) offers a 4-year (8 semesters) **Bachelor of Technology** (B.Tech.) degree programme, under Choice Based Credit System (CBCS) for the following branches of Engineering.

S. No.	Name of the Program	Program Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Information Technology	12
7.	CSE (Artificial Intelligence and Machine Learning)	42
8.	CSE (Artificial Intelligence)	43
9.	CSE(Daga Science)	44
10.	CSE(Cyber Security)	46

3. **ELIGIBILITY FOR ADMISSION**

The total seats available as per the approved intake are grouped into two categories viz. category A and Category B with a ratio of 70:30 as per the state government guidelines vide G.O No.52.

The admissions for category A and B seats shall be as per the guidelines of Andhra Pradesh State Council for Higher Education (APSCHE) in consonance with government reservation policy.

a. Under Category A: 70% of the seats are filled through EAMCET counselling.
b. Under Category B: 30% seats are filled based on 10+2 merits in compliance with guidelines of APSCHE

Eligibility for Admission - Under Lateral Entry Scheme (LES)

Students with diploma qualification have an option of direct admission into 2nd year B. Tech. (Lateral Entry Scheme). Under this scheme 10% seats of sanctioned intake will be available in each course as supernumerary seats. Admissions to this three-year B.Tech. Lateral entry Programme will be through ECET.

4. **AWARD OF THE DEGREE:**

For Regular and LES(Lateral Entry Scheme) **students**

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

(a) Pursues a course of study in not less than four and not more than eight academic years for regular students. For LES students, pursue a course of study for not less than three academic years and not more than six academic years counted from the academic year of admission.

(b) He/she shall forfeit their seat in B. Tech course and their admission stands cancelled after eight academic years for regular students and six academic years for LES students starting from the academic year of admission.

(c) Registers for 160 credits and must secure all the 160 credits for Regular students. Registers for 121 credits and must secure all the 121 credits for LES students

(d) 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 160/121 credits and meet other specified requirements in the appropriate section of this document.

(e) A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

Academic Calendar

For all the eight/six semesters a common academic calendar shall be followed in each semester by having sixteen weeks of instruction, one week for the conduct of practical exams and with two weeks for theory examinations. Dates for registration, sessional and end semester examinations shall be notified in the academic calendar of every semester. The schedule for the conduct of all the curricular and co-curricular activities shall be notified in the planner.

4. Assigning of Credits:

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

1 Hr. Tutorial (T) per week - 1 credit

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

2 Hours Practical (Lab)/week - 1 credit

5. Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and

students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

A three-week induction program for first year B.Tech students is to be held in zero semester. Regular classes will start after the induction program.

The objectives of the program are as follows:

1. Assimilation in the ethos and culture of the institution
2. Exposure to a larger vision of life
3. Bonding among students and teachers
4. Learning a creative skill in arts
6. Regular lifestyle and professional discipline
7. Special assistance for needy students for improving proficiency in English and Mathematics

The above objectives will be achieved through the following activities:

1. Physical activity: Yoga, Mild Exercise, Games and sports etc.
2. Creative arts: Painting, Photography, music, dance etc.
3. Literary activity: General reading, writing summaries, debating, enacting a play etc.
4. Human Values: Discussion/Lectures in small groups of students with a faculty member
5. Lectures by eminent people: From industry, entrepreneurs, public life, social activists, alumni.
6. Exposure to department/branch, Innovation, Exploring Engineering.

6. DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject – wise with a maximum of 100 marks for Theory and 50 marks for Mini Project/Practical Training/Internship/ Research Project/ Community Service Project. The Project Work shall be evaluated for 200 marks.

THEORY

For all theory subjects consisting of 5 units in each subject, the assessment shall be for 30 marks through internal evaluation and 70 marks through external end semester examination of 3 hours duration.

INTERNAL EVALUATION

Internal evaluation is based on two **Cycle** examinations. Each **Cycle** consists of three components.

1) **Assignment Test – 1 (A1)**:

   A1 will be conducted after the completion of 1st unit of syllabus. 5 or 6 questions will be given to students before 1 week of the commencement of the test. On the day of test each student will be given two questions at random. A1 will be evaluated for 05 marks.

2) **Quiz - 1(Q1)**:

   After the first two and half Units of syllabus is over along with the descriptive test, online quiz test will be conducted for 20 marks and scaled down to 10 marks.

3) **Descriptive Test – 1(D1)**:

   Along with the Q1, a descriptive test will be conducted for 25 marks and scaled down to 15 marks. One 10 marks question from unit 1, one 10 marks question from unit 2, and one 5 marks question from first half of 3rd unit will be given.

   Cycle–I final marks = A1 (05 marks) + Q1 (10 marks) + D1 (15 marks) = 30 marks

   In the similar manner, Cycle–II Examination will be conducted as follows:

   A2 test will be conducted after 3.5 units of syllabus (covering syllabus from 2.5 to 3.5 units)

   Q2 and D2 will be conducted after 5th unit is over. For D2, one 5 marks question will be given from second half of third unit, two 10 marks questions will be given each from units 4 and 5.

   Cycle–II final marks = A2 + Q2 + D2 = 30 Marks.

   Final internal marks will be computed as **80 % of best cycle marks + 20% of least cycle marks.**

EXTERNAL EVALUATION

The semester end examinations will be conducted for 70 marks consist 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.

PRACTICALS

INTERNAL EVALUATION

For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows:

Day to day work - 5 marks,

Record-5 marks and

Internal laboratory test -5 marks.

EXTERNAL EVALUATION

For practical subjects there shall be an external examination at the end of the semester for 35 marks in the presence of external examiner. The examination duration is 3 hours.

DRAWING SUBJECTS

For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing etc.,) and estimation, the distribution shall be 30 marks for Internal Evaluation and 70 marks for End Examination. There shall be two internal tests in a semester.

The 30 internal marks will be evaluated as follows:

Cycle–I:
Internal Test : 15 marks. (1½ hour duration)
Day – to – day work: 15 marks (evaluation of charts)

In the Similar manner, **Cycle–II examination will be conducted for 30 marks**
The sum of 80% of the best and 20% of the least of two internal tests shall be considered.

The syllabus for the subject "**Machine drawing using Auto CAD**" consists of two major portions:

1. Unit I to III –Conventional drawing pattern.
2. Unit IV to VI-Computer lab pattern using any drafting packages

The distribution of internal and external marks is 30 and 70 marks respectively.

Internal Evaluation: Max Marks: 30

The total internal evaluation marks are distributed in the following two components:

1. Day-to-day work : 15 Marks (Evaluation of Charts)
2. Descriptive Test : 15 Marks

Cycle–I Examination – Conventional drawing pattern

In Cycle-I examination the 30 marks will be awarded as follows:

Day-to-day evaluation - 15 Marks

Descriptive Test - 15 Marks

In the Descriptive Test of duration 2 hours, 3 questions will be given to the student and he has to answer all the three questions (3x05M = 15M).

Cycle–II Examination – Computer lab pattern using any drafting packages for duration of 2 hours.

In Cycle-II examination the 30 marks will be awarded as follows:

Record - 10 Marks

Execution - 10 Marks

Paper Work - 10 Marks

Of two cycle examinations conducted during the semester, sum of 80% of the best and 20% of the least of two cycle examinations shall be considered for the award of internal marks.

End semester Examination (Total Duration: 4 hours, Max, marks: 70)

Conventional drawing pattern (Duration: 2 Hours, Marks: 35)

Computer lab pattern using any drafting packages (Duration: 2 Hours, Max:35)

(Note: Both Conventional drawing pattern and Computer lab pattern using any drafting packages are compulsory and are to be conducted in separate sessions)

Mandatory Course (M.C): Environmental Sciences/NSS/NCC, 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 college 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 SATISFACTORY(S)/NOT-SATISFACTORY (F) will be specified.

- There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0-0) or (2-1-0) and for all minors /honors, it shall be (4-0-0). 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.

- All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective 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.
- Students shall undergo mandatory summer internships for a minimum of six weeks duration at the end of second and third year of the Programme.
- There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course.
- Undergraduate Degree with Honors/Minor shall be issued by the Institute to the students who fulfil all the academic eligibility requirements for the B.Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.
- **Assessment:** The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory, 50 marks for practical subject. The distribution shall be 30% marks for Internal Evaluation and 70% marks for the End Semester Examinations. A student has to secure not less than 35% of marks in the end semester examination and minimum 40% of marks in the sum total of internal and end semester examination marks to earn the credits allotted to each course.

Mini Project/Practical Training/ Internship/ Research Project/ Community Service Project (1.5 Credits):

It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydal and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme.

Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 4 to 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted from the institute to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. 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; 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. A student shall secure a 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.

Mini Project/Practical Training/ Internship/ Research Project/ Community Service Project will be evaluated at the end of the semester for 50 marks (Record/Report: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner. There are no internal marks for the Mini Project/Practical Training/ Internship/ Research Project/ Community Service Project.

Major Project **(12 credits):**

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 and is evaluated for 140 marks.

MOOCS (1.5 Credits):

Meeting with the global requirements, to inculcate the habit of self-learning and in compliance with AICTE/ UGC guidelines, MOOC (Massive Open Online Course) have been introduced, Student has to complete an on-line course to fulfil the academic requirement of B.Tech course. He/she can start doing the course from II Year I semester and submit the MOOCs certificate before the commencement of the end examinations of IV year I sem. The student shall register for the course (Minimum of 8 weeks) offered by SWAYAM/NPTEL/ Any other reputed organization, through online with the approval of Head of the Department. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only after submission of the certificate.

Skill Oriented Courses (2 Credits)

1. For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted as per the decision of concerned BOS.
2. Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.
3. A pool of interdisciplinary job-oriented skill courses shall be designed by a common Board of studies by the participating departments/disciplines and the syllabus along with the pre requisites shall be prepared for each of the laboratory infrastructure requirements.
4. 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 as approved by the departmental committee.
5. The Board of Studies of the concerned discipline of Engineering shall review the skill advanced courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest courses based on industrial demand.
6. 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, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies as approved by the departmental committee.

Evaluation: The job oriented skill courses may be registered at the college or at any accredited external agency as approved by departmental committee. A student shall submit a record/report on the on the 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 and internal examiner. There are no internal marks for the job oriented skill courses.

Curricular Framework for Honors Programme

1. Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.
2. A student shall be permitted to register for Honors program at the beginning of 4^{th} semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2^{nd} semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4^{th} semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Honors Programme registration active.
3. 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.
4. 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).
5. 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 8/12weeks as recommended by the Departmental committee.
6. 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.

7. The concerned departmental committee 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 departmental committee. 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 departmental committee. 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 per the guidelines approved by the departmental committee.
8. 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.
9. 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 be mentioned 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.
10. In case a student fails to meet the SGPA 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.
11. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

Curricular Framework for Minor Programme:

1. a) 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

2. b) 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.
3. 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.
4. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.
5. There shall be no limit on the number of programs offered under Minor. The Institution 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.
6. 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.
7. 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) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd 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.
8. 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).
9. 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.

10. 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.
11. Student can opt for the Industry relevant minor specialization as approved by the concerned Departmental committee. 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 Departmental committee 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.
12. A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned Departmental committee. 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.
13. 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. None of the courses done under the dropped Minor will be shown in the transcript.
14. In case a student fails to meet the SGPA 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.
15. 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.

PASS MARK CRITERIA

A student shall be deemed to have satisfied the pass mark, if he secures not less than 35% of marks in the end examinations and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together as detailed below.

On passing a course of a program, the student shall earn the credits as assigned to that course.

S.No	Category of Subject	Max. Marks	Internal Marks	External Marks	External pass %	External pass mark	Over all pass %	Over all pass mark
1	Theory/ Drawing	100	30	70	35	25	40	40
2	Practical	50	15	35	35	12	40	20
3	Miniproject/Internship/Industrial Training /Skill development courses/ Research project/ Community service project	50	-	50	40%	20	40	20
4	Project Work	200	60	140	35	50	40	80
5	MOOCs(Credit Course)	Certificate must be submitted before the end semester examinations of that semester in which MOOCS course is offered.						

11. Attendance Requirements:

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

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this condonation concession is applicable only to any two semesters during the entire programme.

c) Shortage of Attendance below 65% in aggregate shall not be condoned.

d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee shall be payable towards condonation of shortage of attendance to the college. Students availing condonation on medical ground shall produce a medical certificate issued by the competitive authority.

g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.

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

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

j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

18. Promotion Rules:

a) A student shall be promoted from first year to second year if he fulfils the minimum attendance requirements.

b) A student will be promoted from II year to III year if he fulfils the academic requirement of 40% of credits up to 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.

c) A student shall be promoted from III year to IV year if he fulfils the academic requirements of 40% of the credits up to 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.

d) For LES, point C is only applicable.

19. Grading:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be

converted to a corresponding letter grade as given below, depending on the range in which

the marks obtained by the student fall.

Marks Range	Level	Letter Grade	Grade Point
≥ 90	Outstanding	A+	10
80-89	Excellent	A	9
70-79	Very Good	B	8
60-69	Good	C	7
50-59	Fair	D	6
40-49	Satisfactory	E	5
< 40	Fail	F	0
-	Absent	AB	-
-	Malpractice	MP	-

Calculation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (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.

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

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

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

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

Where 'Si' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester

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

iv. SGPA & CGPA will be calculated for those candidates who have passed all the subjects in that or up to that semester respectively.

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

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 Secured
First Class with Distinction	≥ 7.75 (With No subject failures)
First Class	≥ 6.75 (With subject failures)
Second Class	≥ 5.75 & < 6.75
Pass Class	≥ 4.75 & < 5.75

20. 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 institute 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.

REVALUATION

1. Student can submit the application for revaluation, along with the prescribed fee for revaluation evaluation of his answer script(s) of theory subject(s) as per the notification issued by the Controller of Examinations.
2. The Controller of Examinations shall arrange for revaluation of such answer script(s).
3. An evaluator, other than the first evaluator shall revaluate the answer script(s).

MINIMUM INSTRUCTION DAYS

The minimum instruction days for each semester shall be 90 working days.

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

WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college or if any case of indiscipline is pending against him, the result of such student will be kept withheld. His degree will be withheld in such cases.

TRANSITORY REGULATIONS

Discontinued or detained candidates are eligible for readmission as and when next offered. A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the subjects in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such subjects in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the subjects prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Transfer candidates (from non-autonomous college affiliated to JNTUK)

A student who is following JNTUK curriculum, transferred from other college to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that

batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Transfer candidates (from an autonomous college affiliated to JNTUK)

A student who has secured the required credits up to previous semester as per the regulations of other autonomous institutions shall also be permitted to be transferred to this college.

A student who is transferred from the other autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the subjects in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree.

However, exemption will be given in the subjects of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of studies.

The total number of credits to be secured for the award of the degree will be the sum of the credits up to previous semester as per the regulations of the college from which he has transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

Scope

1. The academic regulations should be read as a whole, for the purpose of any interpretation.
2. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
3. The college may change or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the date notified by the College Authorities.

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

- The Principal shall refer the cases of Malpractices in Internal Assessment Test and Semester end examinations to a malpractice prevention committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the students based on the recommendations of the committee.
- Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder:

	Nature of Malpractices/ Improper conduct	**Punishment**
	If the candidate:	
1(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the college.

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

	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.	
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 college 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 6to 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 college for further action to award suitable punishment.	

OTHER MATTERS:

1. Physically challenged candidates who have availed additional examination time and a scribe during their intermediate / EAMCET examinations will be given similar concessions on production of relevant proof / documents.
2. The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the departments shall be reported to the Academic Council for ratification.

GENERAL:

1. The academic council may, from time to time, revise, amend or change the regulations, schemes of examinations and / or syllabi.
2. Where ever the words ‘’he’’ ‘’him’’ ‘’his’’, occur in the regulations, they include ‘’she’’, ’’her’’, ’’hers’’.
3. The academic regulation should be read as a whole for the purpose of any interpretation.
4. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

ANNEXURE-I
COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

As per the decision of the decision of the concerned department BoS

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 4 to 6 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The log book has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- TheCommunity Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
        - Agriculture
        - Health

- Marketing and Cooperation
- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following is the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, Andhra Pradesh (India)

For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

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

	Imprisonment upto		Fine Upto
Teasing, Embarrassing & 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 of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

COURSE STRUCTURE

I B.TECH - I SEMESTER

S.No	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC1101	Technical & Communicative English-I	HS	30	70	100	3	0	0	3
2	R20CC1102	Linear Algebra & Calculus	BS	30	70	100	2	1	0	3
3	R20CC1103	Engineering Chemistry	BS	30	70	100	3	0	0	3
4	R20CC1105	Problem Solving Using C	ES	30	70	100	3	0	0	3
5	R20CC1111	Electronic Devices and Logic Design	ES	30	70	100	3	0	0	3
6	R20CC11L1	Soft Skills and Communication Skills Lab	HS	15	35	50	0	0	3	1.5
7	R20CC11L2	Problem Solving Using C Lab	ES	15	35	50	0	0	3	1.5
8	R20CC11L5	Engineering Chemistry Lab	BS	15	35	50	0	0	3	1.5
9	R20CC11MC1	Environmental Studies	MC	-	-	-	2	0	0	0
TOTAL										**19.5**

I B.TECH – II SEMESTER

S.No.	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC1201	Differential Equations & Vector Calculus	BS	30	70	100	2	1	0	3
2	R20CC1205	Applied Physics	BS	30	70	100	3	0	0	3
3	R20CC1206	Problem Solving Using PYTHON	ES	30	70	100	3	0	0	3
4	R20CC1218	Technical and Communicative English-II	BS	30	70	100	3	0	0	3
5	R20CC12L10	Applied Physics Lab	BS	15	35	50	0	0	3	1.5
6	R20CC12L12	Problem Solving using PYTHON Lab	ES	15	35	50	0	0	3	1.5
7	R20CC12L15	IT Workshop	ES	15	35	50	0	0	3	1.5
8	R20CC1216	Unix Programming Lab	ES	15	35	50	0	0	3	1.5
9	R20CC12L14	Engineering Graphics	ES	15	35	50	0	0	3	1.5
TOTAL										**19.5**

II B.TECH - I SEMESTER

S.No	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC2106	Probability & Statistics	BS	30	70	100	2	1	0	3
2	R20CC2103	OOPs through Java	PC	30	70	100	3	0	0	3
3	R20CC2104	Data Structures	PC	30	70	100	3	0	0	3
4	R20CC2101	Computer Organization	PC	30	70	100	3	0	0	3
5	R20AC2105	Software Engineering	PC	30	70	100	3	0	0	3
6	R20CC21L1	Data Structures Lab	PC	15	35	50	0	0	3	1.5
7	R20CC21L2	OOPs through Java Lab	PC	15	35	50	0	0	3	1.5
8	R20AC21L3	Software Engineering and UML Lab	PC	15	35	50	0	0	3	1.5
9	R20CC21SC1	Data Science Lab	SC	-	50	50	0	0	4	2
10	R20CC21MC2	Constitution of India	MC	-	-	-	2	0	0	0
Total										**21.5**

II B.TECH – II SEMESTER

S.No.	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC2211	Mathematical Foundations of Computer Science	BS	30	70	100	3	0	0	3
2	R20CC2203	Database Management Systems	PC	30	70	100	3	0	0	3
3	R20CC2210	Numerical Methods & Transformations	BS	30	70	100	3	0	0	3
4	R20AM2205	Artificial Intelligence	PC	30	70	100	3	0	0	3
5	R20AC2204	Operating Systems	PC	30	70	100	3	0	0	3
6	R20DS22L1	Database Management Systems Lab	PC	30	70	100	0	0	3	1.5
7	R20CS22L3	Operating Systems Lab	PC	15	35	50	0	0	3	1.5
8	R20AC22L4	Front End Web Technologies Lab	PC	15	35	50	0	0	3	1.5
9	R20CC22SC3	Mobile Application Development Lab	SOC	-	50	50	0	0	4	2
TOTAL										**21.5**
10		**Honors/Minor Course**		30	70	100	4	0	0	4

III B.TECH. – I SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC3110	Principles Of Machine Learning	PC	30	70	100	3	0	0	3
2	R20CC3102	Data Warehousing and Data Mining	PC	30	70	100	3	0	0	3
3	R20CC3104	Computer Networks	PC	30	70	100	3	0	0	3
4	R20CS3105 R20CC3109 R20AM3101 R20AM3103	Professional Elective - I • Compiler Design • Devops • Computer Vision • High Performance Computing	PE	30	70	100	3	0	0	3
5	**Open Elective – I**		OE	30	70	100	3	0	0	3
6	R20CC31L4	Machine Learning Lab	PC	15	35	50	0	0	3	1.5
7	R20CC31L1	Data Warehousing and Data Mining Lab	PC	15	35	50	0	0	3	1.5
8	R20CC31SC1	Mean Stack Technologies Lab	SC	-	50	50	1	0	2	2
9	R20CSP	Community Service Project	PR	-	50	50	0	0	0	1.5
10	R20CC31MC01	Professional Ethics and Human Values	MC			-	2	0	0	0
TOTAL										**21.5**
11		**Honors/Minor Course**		30	70	100	4	0	0	4

III B.TECH. – II SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20AM3203	Deep Learning techniques	PC	30	70	100	3	0	0	3
2	R20CC3208	Design and Analysis of Algorithms	PC	30	70	100	3	0	0	3
3	R20AM3204	Soft Computing	PC	30	70	100	3	0	0	3
4	R20AM3205 R20CC3209 R20CC3201 R20AM3207	Professional Elective - II • Software Project Management • Artificial Neural Networks • Cryptography and Network Security • Distributed Systems	PE	30	70	100	3	0	0	3
5	**Open Elective – II**		OE	30	70	100	3	0	0	3
6	R20AM32L1	Deep Learning Lab	PC	15	35	50	0	0	3	1.5
7	R20AM32L2	Soft Computing Lab	PC	15	35	50	0	0	3	1.5
8	R20AM32L3	Artificial Intelligence and Neural Networks Lab	ES	15	35	50	0	0	3	1.5
9	R20CC32SC1	English Employability Skills	SC	-	-	50	0	0	4	2
10	R20CC32MC1	Essence of Indian Traditional Knowledge	MC			-	2	0	0	0
TOTAL										**21.5**
11		**Honors/Minor Course**		30	70	100	4	0	0	4

IV YEAR - I SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC4106 R20AM4103 R20CC4119 R20CCOE310 / R20IT4107	Professional Elective – III • Natural Language Processing • ETL Principles • Information Retrieval Systems • Blockchain Technologies	PE	30	70	100	3	0	0	3
2	R20CC4102 R20AM4104 R20AM4105 R20AM4105	Professional Elective – IV • Human Computer Interaction • Big Data Analytics • Recommender Systems • Feature Engineering	PE	30	70	100	3	0	0	3
3	R20CC4121 R20CC4118 R20AM4108 R20CC4120	Professional Elective - V • Reinforcement Learning • NoSQL Databases • Data Analytics & Visualization • AI Chatbots	PE	30	70	100	3	0	0	3
4	**Open Elective – III**		OE	30	70	100	3	0	0	3
5	**Open Elective – IV**		OE	30	70	100	3	0	0	3
6	R20CC4101 R20CC4117	1. Business Management Concepts for Engineers 2. Entrepreneurship and Innovation	HS	30	70	100	3	0	0	3
7	R20AM41SC1	Data Analytics & Visualization Lab	SC	-	50	50	0	0	4	2
8	R20INTERN	Summer Internship/Community Service Project	PR	-	50	50	0	0	0	1.5
9	R20CC41MC	MOOCS								1.5
TOTAL										**23**
10		**Honors/Minor Course**		30	70	100	4	0	0	4

IV B.TECH – II SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20DD42PW	Major Project & Internship	PR	60	140	200	-	-	-	12
TOTAL										**12**

LIST OF HONORS

1. The subjects opted for Honors should be advanced type which are not covered in regular curriculum.
2. Students has to acquire 16 credits with minimum one subject from each pool.
3. Concerned BoS can add or delete the subjects as per the decision of the board.
2. Pre requisites to be defined by the board for each course.
3. Compulsory MOOC / NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Pool 1: ARTIFICIAL MODELLING

S.No.	HONOR Subject Title	Sub Code	No.of periods per week			No.of Credits
			L	T	P	C
1	Applications of AIML	R20AMHN01	4	0	0	4
2	Intelligence Information Retrieval	R20AMHN02	4	0	0	4
3	Cognitive Science	R20AMHN03	4	0	0	4
4	Pattern Recognition	R20AMHN04	4	0	0	4
5	Knowledge Representation and Reasoning	R20AMHN05	4	0	0	4
6	Expert Systems	R20AMHN06	4	0	0	4

Pool 2: Cloud Computing and Virtualization Technology

S.No.	HONOR Subject Title	Sub Code	No.of periods per week.			No.of Credits
			L	T	P	C
1	Introduction to IT Infrastructure Landscape	R20CSHN13	4	0	0	4
2	Cloud Computing Virtualization	R20CSHN14	4	0	0	4
3	Cloud Computing Architecture	R20CSHN15	4	0	0	4
4	Cloud Computing Security & Management	R20CSHN16	4	0	0	4

Minors:

S.No.	Minor Title	Dept. Offering Subject	Sub Code	No. of Periods per week			No. of credits
				L	T	P	C
1	Software Engineering	CSE (AIML)	R20CCMN34	4	0	0	4
2	Database Management Systems	CSE (AIML)	R20CCMN43	4	0	0	4
3	Artificial Intelligence	CSE (AIML)	R20CCMN44	4	0	0	4
4	Principles of Machine Learning	CSE (AIML)	R20CCMN45	4	0	0	4
5	Deep Learning	CSE (AIML)	R20CCMN46	4	0	0	4
6	Reinforcement Learning	CSE (AIML)	R20CCMN47	4	0	0	4
In addition to any of the four subjects, MOOC/NPTEL courses for 04 credits (2 8-weeks courses @ 2 credits each) are compulsorily in the domain of AIML							

List of Open Electives offered by Department

S.No.	Open Elective -1 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC10E17	Mean Stack Technologies	30	70	100	3	0	0	3
2	R20CC10E18	Artificial Intelligence	30	70	100	3	0	0	3

S.No.	Open Elective -2 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC20E16	Cloud Computing	30	70	100	3	0	0	3
2	R20CC20E17	Principles Of Machine Learning	30	70	100	3	0	0	3

S.No.	Open Elective -3 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC30E17	Cryptography and Network Security	30	70	100	3	0	0	3
2	R20CC30E18 /R20CC4118	NOSQL Databases	30	70	100	3	0	0	3

S.No.	Open Elective -4 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC40E16/ R20CC4104	e-Commerce	30	70	100	3	0	0	3
2	R20CC40E17/ R20CC4106	Natural Language Processing	30	70	100	3	0	0	3

I B.TECH - I SEMESTER

S.No	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC1101	Technical & Communicative English-I	HS	30	70	100	3	0	0	3
2	R20CC1102	Linear Algebra & Calculus	BS	30	70	100	2	1	0	3
3	R20CC1103	Engineering Chemistry	BS	30	70	100	3	0	0	3
4	R20CC1105	Problem Solving Using C	ES	30	70	100	3	0	0	3
5	R20CC1111	Electronic Devices and Logic Design	ES	30	70	100	3	0	0	3
6	R20CC11L1	Soft Skills and Communication Skills Lab	HS	15	35	50	0	0	3	1.5
7	R20CC11L2	Problem Solving Using C Lab	ES	15	35	50	0	0	3	1.5
8	R20CC11L5	Engineering Chemistry Lab	BS	15	35	50	0	0	3	1.5
9	R20CC11MC1	Environmental Studies	MC	-	-	-	2	0	0	0
TOTAL										**19.5**

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1101	**TECHNICAL AND COMMUNICATIVE ENGLISH - I (Common to All Branches)**						

COURSE OBJECTIVES:

- To enable the engineering students develop their basic communication skills in English for academic and social purposes.
- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To integrate English Language learning with employability skills and training.
- To enhance the students' proficiency in reading skills enabling them meet the academic demands of their course.

COURSE OUTCOMES:

Learners are able to

CO1: Interpret explicit and implicit meaning of a text, recognize key passages; raise questions and summarize it. [K3]**.**

CO2: Compose paragraphs, essays, emails, letters, reports, resume and transfer information into tables, Pie and bar diagrams. **[K6].**

CO3: Build grammatically correct sentences using a variety of sentence structures**. [K3]**

CO4: Enhance word power and usage of lexicons **[K3].**

Teaching Methodology:

The methodology of teaching will be chalk and talk, PPT, audio-visual, flipped class and activity based teaching.

UNIT-I

Hours of Instruction per unit: 8

1. **A Drawer full of Happiness**
   - a. **Listening** : Dialogues, Task based listening activities.
   - b**. Speaking** : Asking and answering general questions.
   - c. **Reading** : Skimming, Scanning.
   - d. **Writing** : Punctuations, Paragraphs.
   - e. **Grammar & Vocabulary** : Nouns, Adjuncts, GRE Vocabulary, Technical Vocabulary.

UNIT-II

Hours of Instruction per unit: 8

2. Nehru's Letter to daughter Indira on her Birthday

- a. **Listening** : Individual and pair based listening to the audio track.
- b**. Speaking** : Discussion in pairs / small groups on specific topics.
- c. **Reading** : Identifying sequence of ideas; recognising verbal techniques.
- d. **Writing** : Summarising, Paraphrasing.
- e. **Grammar & Vocabulary** : Articles, Adjectives, Prepositions

Verbal Competence,
Synonyms & Antonyms,
Analogy,
GRE Vocabulary,
Technical Vocabulary.

UNIT-III
Hours of Instruction per unit: 8

3. Stephen Hawking- Positivity 'Benchmark'

a. **Listening** : Listening for global comprehension and summarising.
b**. Speaking** : Discussing specific topics in pairs (or) small groups and reporting the discussion, Complaining, Apologising.
c. **Reading** : Reading between the lines, Critical reading for evaluation.
d. **Writing** : Official Letter writing, E-Mail etiquette, General Netiquette, Covering Letter & Resume writing.
e. **Grammar & Vocabulary** : Phrasal verbs, Verbs, Tenses (Present, Past & Future), Concord: Subject-Verb Agreement, Verbal reason, Using equivalents, Word associations, GRE Vocabulary, Technical Vocabulary.

UNIT-IV
Hours of Instruction per unit: 8

4. Like a Tree, Unbowed: Wangari Maathai- Biography

a. **Listening** : Making predictions while listening to conversations (or) transactional dialogues.
b**. Speaking** : Role plays for practice of conversational English in academic contexts (formal and informal) .
c. **Reading** : Information transfer (Tables, Bar Diagrams, Line Graphs, Pie Diagrams)
d. **Writing** : Interpreting visual information, Statement of Purpose (SOP)
e. **Grammar & Vocabulary** : Gender inclusive language (Gendered Noun, Gender-neutral Noun), Quantifying expressions, Adjectives, Adverbs, Degrees of comparison, GRE Vocabulary, Technical Vocabulary.

UNIT-V
Hours of Instruction per unit: 8

5. "Stay Hungry, Stay Foolish"- Rushmi Bansal

a. **Listening** : Identifying key terms, understanding concepts, interpreting the concepts.
b**. Speaking** : Formal oral presentations on topics from academic contexts.

c. **Reading** : Reading comprehension, The RAP strategy for in-depth reading, Intensive reading and extensive reading.

d. **Writing** : Academic proposals, Poster presentation.

e. **Grammar & Vocabulary** : Reported Speech, Reporting verbs for academic purposes,
Corrections of sentences,
GRE Vocabulary,
Technical Vocabulary.

TEXTBOOKS:

1. INFOTECH ENGLISH , Maruthi Publications, Guntur- 522001.

REFERENCES:

1. Raymond Murphy, *Murphy's English Grammar,* Cambridge University Press 2004
2. Meenakshi Raman, Sangeeta Sharma, *Technical Communication: English Skills for Engineers*, Oxford University Press, 2009
3. Michael Swan, *Practical English Usage,* Oxford University Press, 1996

ONLINE SOURCES:

1. www.enchantedlearning.com
2. https://www.englisch-hilfen.de/en/
3. https://www.bbc.co.uk/learningenglish/
4. https://in.usembassy.gov/education-culture/american-spaces/american-space-new-delhi/collection/
5. https://www.talkenglish.com/speaking/basics/speaking_basics_ii.aspx
6. https://www.englishclub.com/speaking/
7. https://agendaweb.org/listening-exercises.html
8. https://www.esolcourses.com/content/topicsmenu/listening.html
9. https://www.esl-lab.com/
10. https://www.eagetutor.com/eage-fluent-english-speaking-search-p.htm?gclid=EAIaIQobChMIpr-F5OzH7QIVChsrCh1kBAkzEAMYASAAEgINpfD_BwE
11. https://www.myenglishpages.com/site_php_files/reading.php
12. https://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	-	30	70	100	3
SUBCODE: R20CC1102	**LINEAR ALGEBRA AND CALCULUS (Common to All Branches)**						

COURSE OBJECTIVES:

- Understanding basic concepts of linear algebra (systems of linear equations, matrix calculus).
- To become proficiency in solving computational problems of linear algebra.
- To acquire knowledge on mean value theorems in calculus.
- Familiarization about the techniques in calculus and multivariate analysis.

COURSE OUTCOMES:

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

CO 1: Solve the system of linear equations.[K3]

CO 2: Analyze the applications of matrices in various fields and obtain Eigen values and Eigenvectors.[K4]

CO 3: Apply the mean value theorems in calculus to Engineering problems.[K3]

CO 4: Apply the functions of several variables to evaluate the rates of change with respect to Time and space variables in engineering. [K3]

CO 5: Determine the area and volume by interlinking them to appropriate double and triple integrals. [K5]

SYLLABUS

UNIT-I:

LINEAR SYSTEMS OF EQUATIONS: (10 hours)

Rank of a matrix - Echelon form, Normal form, Solution of linear systems, Direct Methods, Gauss elimination, Gauss Jordon and Gauss Seidal Methods. Solutions of linear simultaneous equations: LU decomposition.

Application: Finding the current in a electrical circuit, Traffic flow

UNIT – II:

EIGENVALUES AND EIGENVECTORS (12 hours)

Eigenvalues, Eigenvectors, Properties, Cayley - Hamilton Theorem(without proof), Quadratic forms, Reduction of quadratic form to canonical form, Rank, Positive definite, negative definite, semi definite, index, signature.

Application: Finding powers and inverse of a square matrix using Cayley Hamilton's Theorem.

UNIT – III:

MEAN VALUE THEOREMS (8 hours)

Review on limits and continuity, Mean Value theorems (without proofs): Rolle's theorem, Lagrange's theorem, Cauchy's theorem, Taylor's (Generalized mean value) theorem, increasing and decreasing functions, Maxima and minima of function of single variable.

UNIT- IV:

PARTIAL DIFFERENTION: (8 hours)

Function of two or more variables, Partial derivatives, Total derivatives, change of variables, Jacobian - functional dependence, Taylor's theorem for Two variables. Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT-V:

MULTIPLE INTEGRALS: (10 hours)

Double and triple integrals, Change of Variables, Change of order of Integration, volume. Application: Momenta of Inertia.

TEXT BOOK :

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 43rd Edition, Khanna Publishers, 2012.
2. B.V. Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "*Engineering Mathematics*", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. Kreyszig E, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley, Singapore, 2001.
3. Greenberg M D, "*Advanced Engineering Mathematics*", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
4. Peter V. O'Neil, *"Advanced Engineering Mathematics"*, 7th Edition, Cengage Learning, 2011.
5. Bhavanari Satyanarayana, Pradeep Kumar T.V. & Srinivasulu D, "Linear Algebra and Vector Calculus", Studera Press, New Delhi, 2017.

WEB SOURCE REFERENCES:

1.https://nptel.ac.in/courses/122107036/32
2.https://nptel.ac.in/courses/122107036/27
3.https://nptel.ac.in/courses/122101003/downloads/Lecture-4.pdf
4.https://nptel.ac.in/courses/122101003/downloads/Lecture-6.pdf
5.https://nptel.ac.in/courses/122104017/28

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC1103	**ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)**						

COURSE OBJECTIVES:

- To analyze water for its various parameters and its significance in industrial and domestic allocations.
- To acquire the knowledge on types of polymers, fuels and their applications.
- To provide information on exciting advanced materials available in engineering.
- To apply the electrochemical principles, understand the fundamentals of corrosion and development of different techniques in corrosion control.
- To learn the importance of engineering materials used in daily life and industry.

COURSE OUTCOMES:

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

CO 1: Analyze the suitable method of water treatment depending on the quality treatment. [K4]

CO 2: Compare different types of polymers, fuels and their importance.[K4]

CO 3: Utilize the advanced materials as engineering materials and apply them in domestic and industrial life.[K3]

CO 4: Distinguish electrical energy sources and importance of corrosion science.[K4]

CO 5: Identify different types of engineering materials and applications in engineering. **[K3]**

SYLLABUS

UNIT-I: WATER CHEMISTRY

Characteristics of water: Sources, Impurities–Hardness & its units–Industrial water characteristics– Softening of water by external treatment methods (Lime soda process, Zeolite and Ion exchange process)–Numerical problems on lime soda process–Desalination of brackish water (Reverse osmosis and Electrodialysis).

Water analysis techniques: Alkalinity–hardness (Complexo-metric)–Break point chlorination–Free chlorine–DO–BOD and COD.

UNIT-II: POLYMERS AND FUEL CHEMISTRY

Polymers: Introduction to polymers–Chain growth (free radical, ionic)–Step growth polymerization–Coordination polymerization–Copolymerization with specific examples–Thermoplastics and thermosets–Plastic moulding methods (Compression & Injection moulding)–Rubbers–Natural rubber–Processing–Vulcanization.

Fuels-Types of fuels–Calorific value–Numerical problems based on calorific value–Analysis of coal–Liquid fuels–Refining of petroleum–Cracking of heavy oil–Knocking and anti knocking agents–Octane and cetane values.

UNIT-III: CHEMISTRY OF ADVANCED MATERIALS

Nano materials: Introduction–Sol-gel method & Chemical reduction method of preparation – Characterization by BET method and TEM methods–Carbon nano tubes and fullerenes: Types–Preparation–Properties and Applications.

Liquid crystals: Introduction–Types–Applications.

Composite materials: Introduction–Definition–Types–Applications–Cermets.

UNIT-IV: ELECTROCHEMISTRY AND CORROSION

Electrochemistry: Galvanic cells–Single electrode potential–Reference electrodes–Electrochemical series–Batteries (primary, secondary and fuel cells)–Applications of secondary batteries in E-vehicles.

Corrosion: Causes and effects of corrosion–Theories of corrosion (chemical and electrochemical corrosion)–Factors effecting corrosion–Corrosion control methods–Cathode protection–Sacrificial anodic, Impressed current methods–Surface coatings–Methods of application on metals (Hot dipping, Galvanizing, Tinning, Cladding, Electroplating, Electroless plating)–Organic surface coatings–Paints–Constituents and their functions–Pigment Volume Concentration.

UNIT-V: CHEMISTRY OF ENGINEERING MATERIALS

Lubricants: Introduction–Mechanism of lubrication–Classification of lubricants–Properties and testing of lubricating oils.

Cement & Refractories: Manufacture–Setting and hardening of cement–Failures of cement–Slag cement–Refractory: Introduction–Classification and properties of refractories.

TEXT BOOKS:

1. Shikha Agarwal, "**Engineering Chemistry**", ISBN 1107476410, 2nd Edition, Cambridge University Press, New Delhi, (2019).
2. O.G. Palana, "**Engineering Chemistry**", ISBN 0070146101, Tata McGraw Hill Education Private Limited, New Delhi, (2009).
3. B. Rama Devi, Ch. Venkata Ramana Reddy, Prashantharath, "**Text Book of Engineering Chemistry**", ISBN 9789353500511, Cenage Learning India Pvt. Ltd, (2016).

REFERENCE BOOKS:

1. P.C. Jain and M. Jain "**Engineering Chemistry**", ISBN 8187433175, 15/e, Dhanpat Rai & Sons, Delhi, (2015).
2. B.S Murthy and P. Shankar, "**A Text Book of NanoScience and NanoTechnology"**, University Press (2013).
3. K. Sesha Maheshwaramma and Mridula Chugh, "**Engineering Chemistry"**, Pearson India Edn services, (2016).
4. S.S. Dara, "**A Textbook of Engineering Chemistry"**, ISBN 8121932645, S.Chand Publisher, (2010)

WEB REFERENCES:

1. URL: https://www.youtube.com/watch?v=CWOJW4357Bg
2. URL: https://www.youtube.com/watch?v=H1Y1oxQ5eUA&t=627s
3. URL: https://www.youtube.com/watch?v=1xWBPZnEJk8
4. URL: https://www.youtube.com/watch?v=p9yPXdT0k48&t=225s
5. URL: https://www.youtube.com/watch?v=xb_xndPe4n0&t=390s

E-BOOKS:

1. "**Engineering Chemistry**" (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan.

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1105	**PROBLEM SOLVING USING C (Common to All Branches)**						

COURSE OBJECTIVE:

- To know the basic problem solving process using Flow Charts and algorithms.
- To understand the basic concepts of control structures in C.
- To learn concepts of arrays, functions, pointers and Dynamic memory allocation in C.
- To use the concepts of structures, unions, files and command line arguments in C.

COURSE OUTCOMES:

After completion of this course, the students would be able to:

CO1: Develop algorithms and flow charts for simple problems. [K3]
CO2: Utilize suitable control structures for developing code in C. [K3]
CO3: Make use of functions and arrays in developing modular programs. [K3]
CO4: Make use of structures and pointers to write well-structured programs. [K3]
CO5: Make use of file Operations in C programming for a given application. [K3]

SYLLABUS

UNIT I

Introduction to Algorithms and Programming Languages: Algorithm – Key features of Algorithms – Some more Algorithms – Flow Charts – Pseudo code – Programming Languages – Generation of Programming Languages – Structured Programming Language.

Introduction to C: Structure of C Program – Writing the first C Program -Compiling and Executing C Programs - Using Comments – Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Statements in C - Operators in C -Programming Examples – Type Conversion and Type Casting.

UNIT II

Decision Control and Looping Statements: Introduction to Decision Control Statements – Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statement – Goto Statement.

Functions: Introduction – using functions – Function declaration/ prototype – Function Definition – function call – return statement – Passing parameters – Scope of variables –Storage Classes – Recursive functions – Recursion vs Iteration.

UNIT III

Arrays: Introduction – Declaration of Arrays – Accessing elements of the Array – Storing Values in Array – Calculating the length of the Array – Operations on Array — Two Dimensional Arrays –Operations on Two Dimensional Arrays.

Strings: Introduction – Reading Strings – Writing Strings – String Manipulation functions - Array of Strings.

UNIT IV

Pointers: Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Passing Arguments to Functions using Pointer, Dynamic Memory Allocation.

Structure, Union, and Enumerated Data Types: Introduction – Nested Structures –Arrays of Structures – Structures and Functions – Self-referential Structures – Union –Enumerated Data Types.

UNIT V

Files: Introduction to Files – Using Files in C – Reading Data from Files – Writing Data To Files – Detecting the End-of-file – Error Handling during File Operations – Accepting Command Line Arguments – Functions for Selecting a Record Randomly - Remove – Renaming a File – Creating a Temporary File

TEXT BOOKS:

1. Reema Thareja**, "**Programming in C**"**, First **edition,** OXFORD University Press 2018.

REFERENCE BOOKS

1. REEMA THAREJA, "Introduction to C programming" OXFORD UNIVERSITY PRESS
2. Rachhpal Singh, "Programming in C", kalyani publishers.
3. E Balagurusamy, "computing fundamentals & c programming", isbn 978-0-07- 066909-3, Tata McGraw-Hill, Second Reprint, 2008.
1. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Edition Publications, 2002.
5. Dennis Richie and Brian Kernighan, "The C programming Language", 2nd edition.

WEB REFERENCES:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf
5. https://www.edx.org/learn/c-programming
6. https://www.programiz.com/c-programming

B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1111	**ELECTRONIC DEVICES AND LOGIC DESIGN**						

COURSE OBJECTIVES:

- To discuss the characteristics of semiconductor diodes.
- To illustrate the different types of Transistors and their applications.
- To demonstrate the basics of Boolean algebra and reduction techniques.
- To design of combinational circuits.
- To design sequential circuits like registers and counters.

COURSE OUTCOMES:

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

CO1: Apply P-N diodes and Special diodes in electronic circuits.[K3]
CO2: Compare different types of transistors (BJT, FET and MOSFET) with their working principles.[K2]
CO3: Make use of Boolean algebra and K-map and to minimize combinational functions.[K3]
CO4: Develop combinational circuits and sequential circuits.[K3]
CO5: Construct different types of registers and counters.[K3]

SYLLABUS:

UNIT I: Junction Diode Characteristics

Open circuited PN Junction, Forward and Reverse bias, V-I characteristics, Applications of Diode – Switch, Rectifiers (without and with filters), Zener Diode characteristics, Zener as voltage regulator, LED.

UNIT II: Transistors

BJT, Configuration of BJT, Input and Output Characteristics of CB, CE and CC Configuration, JFET, MOSFETs – Construction, Characteristics and Applications, Comparison between BJT and JFET, Comparison between JFET and MOSFET.

UNIT III: Number Systems, Logic Gates and Boolean algebra

Binary, Octal, Decimal and Hexadecimal Number Systems, Conversion of Numbers from one Radix to another Radix, 1's Complement and 2's Complement.
Basic Gates- AND, OR and NOT, Universal Gates- NAND and NOR, EX-OR and EX-NOR Gates, De-Morgan's Laws, Minimization of Logic Functions using Boolean Theorems and Karnaugh map method.

UNIT IV: Combinational and Sequential Logic Circuits

Combinational: Design of Half Adder, Full Adder, Half Subtractor, Full Subtractor, Design of Decoders, Encoders, Multiplexers, Demultiplexers. Sequential:Basic sequential logic circuits: Latch and Flip-Flop, Truth tables and excitation tables of RS, JK, T and D Flip-Flops.

UNIT V: Registers and Counters

Buffer Register, Control Buffer Register, Bidirectional Shift Registers, Universal Shift Registers. Synchronous Counter, Ripple Counter, Ring Counter, Modulus Counter.

TEXT BOOKS:

1. Electronic Devices and Circuits – J. Millman, C.C. Halkias, TMGH, 2nd Edition 1998.
2. Digital Design – M. Morris Mano, Pearson, 3rd Edition, 2009.

REFERENCES:

1. Electronic Devices and Circuits Theory- Robert L. Boylestad and Louis Nashelsky, Pearson Education, 9th Edition, 2008.
2. Fundamentals of Logic Design- Charles H. Roth, Jr, Thomson Learning, 5th Edition, 2005.

WEB REFERENCES:

1. Student Resources provided in https://www.electronics-tutorials.ws/ for basic electronic circuits
2. http://nptel.ac.in/courses/117105080/ on Electronics and Communication Engineering
3. http://www2.ece.ohio-state.edu/ee327/ Electronic Devices and Circuit laboratory
4. https://searchworks.stanford.edu/view/11352963 for fundamentals of Electronics available in Digital Library
5. https://archive.org/details/ElectronicDevicesCircuits
6. https://www.youtube.com/watch?v=CeD2L6KbtVM
7. http://onlinecourses.nptel.ac.in/noc20_ee70/preview

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC11L1	**SOFT SKILLS & COMMUNICATION SKILLS LAB (Common to All Branches)**						

COURSE OBJECTIVES:

- To build confidence in the students to communicate effectively in English.
- To strengthen the oral communication skills to enable them to interact with the people in various social situations.
- To enable the learners improve pronunciation with the knowledge of phonetics.
- To provide exposure to students to soft skills like Goal Setting, Time Management, Interpersonal Skills, and Intra Personal Skills.

COURSE OUTCOMES:

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

CO1: Communicate effectively with good pronunciation, overcoming mother tongue influence in academic and professional environment.[K3]

CO 2: Listen and comprehend several accents of English Language.[K4]

CO 3: Take part in various conversations/discourses using formal and informal expressions.[K4]

CO 4: Adapt soft skills successfully in personal and professional life.[K5]

UNIT– I

a. Introduction to Phonetics.
b. Listening - TEDx Talks (https://www.ted.com/talks/ashweetha_shetty_how-education-helped-me-rewrite-my-life?language-en#t-623369)
c. Self-Introduction

UNIT–II

a. Pronunciation Rules & Common Errors in Pronunciation.
b. Listening -TEDx Talks(https://www.youtube.com/watch?v=Dk20-E0yx_s)
c. Role Play

UNIT–III

a. Situational Dialogues (Inviting, Accepting and Declining Invitations)
b. Listening - TEDx Talks (https://www.youtube.com/watch?v=IgAnj6r1O48)
c. JAM

UNIT-IV

a. Situational Dialogues (Commands, Instructions and Requests)
b. Listening -TEDx Talks(https://youtu.be/SKvMxZ284AA)
c. Telephonic Etiquette.

UNIT-V

a. Time Management.
b. Goal Setting.
c. Interpersonal Skills & Intra personal skills.

TEXT BOOKS:

"Strengthen Your Communication Skills", Maruthi Publications, 2013.

REFERENCE BOOKS:

1. Meenakshi Raman, Sangeeta Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2015
2. J.D.O Conner, Better English Pronunciation, Cambridge University Press 1980.
3. T.Balasubramanian, "A Text Book of English Phonetics for Indian Students", Macmillan,1981
4. Penny ur Grammar Practice Activities, Cambridge University Press, 2010.
5. Mark Hancock, Pronunciation in Use, Oxford University Press 2007.
6. K. R Lakshmi Narayanan, T. Murugavan, Managing Soft Skills,Scitech Publications, 2010.
7. K V S G Murali Krishna, K V K K Prasad, Placement and Personality Development, Second Edition, Reem Publications Pvt. Limited, 2012
8. Shiv Khera, You can Win, Bloomsbury Publication, 2014
9. Stephen R. Covey, The 7 Havits of Highly Effective People, Free Press, 1989

ONLINE SOURCES:

1. www.enchantedlearning.com
2. https://www.englisch-hilfen.de/en/
3. https://www.bbc.co.uk/learningenglish/
4. https://in.usembassy.gov/education-culture/american-spaces/american-space-new-delhi/collection/
5. https://www.talkenglish.com/speaking/basics/speaking_basics_ii.aspx
6. https://www.englishclub.com/speaking/
7. https://agendaweb.org/listening-exercises.html
8. https://www.esolcourses.com/content/topicsmenu/listening.html
9. https://www.esl-lab.com/
10. https://www.eagetutor.com/eage-fluent-english-speaking-search-p.htm?gclid=EAIaIQobChMIpr-F5OzH7QIVChsrCh1kBAkzEAMYASAAEgINpfD_BwE
11. https://www.myenglishpages.com/site_php_files/reading.php
12. https://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC11L2	**PROBLEM SOLVING USING C LAB (Common to All Branches)**						

COURSE OBJECTIVE:

- The purpose of this course is to introduce to students to the field of language. The students will be able to enhance their analyzing and problem solving skills and use the same for writing programs in C.

COURSE OUTCOMES:

After completion of this C Programming Lab, students would be able to:

CO 1: Study, analyze and understand logical structure of computer programming and different constructs to develop programs in C Language. [K4]

CO 2: Compare and contrast various data types and operator precedence. [K2]

CO 3: Analyze the use of conditional and looping statements to solve problems associated with conditions and repetitions. [K4]

CO 4: Analyze simple data structures, use of pointers and dynamic memory allocation techniques. [K4]

CO5: Make use of functions and file I/O operations in developing C Programs. [K3]

EXERCISE 1

Construct Flowcharts for the following through Raptor:

i) Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.

ii) Calculate simple and compound interest for various parameters specified by the user.

iii) Calculate the average of n numbers.

EXERCISE 2

a) Write a C Program to calculate the area of triangle using the formula Area = $\sqrt{(s*(s-a)*(s-b)*(s-c)}$where s= (a+b+c)/2.

b) Write a C Program to find the largest of three numbers using ternary operator.

c) Write a C Program to swap two numbers without using a temporary variable.

EXERCISE 3

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

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

EXERCISE 4

a) Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number.

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

EXERCISE 5

a) Write a C Program to print the multiplication table of a given number n up to a given

value, where n is entered by the user.

b) Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number.

c) Write a C Program to check whether the given number is Armstrong number or not.

EXERCISE 6

a) Write a C program to interchange the largest and smallest numbers in the array.

b) Write a C program to input two m x n matrices, check the compatibility and perform addition and multiplication of them.

EXERCISE 7

a) Write a C Program to find sum of following series for a given n value.

i. 1+(1+2)+(1+2+3)+(1+2+3+4)+(1+2+3+4+5)+...+(1+2+...+n).

ii. 1+(2+2)+(3+3+3)+(4+4+4+4)+…+(n+n+n+n..+n).

b) Write a C Program to display following patterns for a given n value

i.
```
    1
  2   2
3   3   3        if n =3
```

i.
```
    1
  2   2
3   3   3
  2   2
    1            if n=3.
```

EXERCISE 8

Draw a flow chart using Raptor and write C programs that use both recursive and non-recursive Functions for the following

i) To find the factorial of a given integer.

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

EXERCISE 9

a) Write a C Program to find Fibonacci sequence.

b) Write C programs illustrating call by value and call by reference concepts.

EXERCISE 10

Write C Programs for the following string operations without using the built in functions - to concatenate two strings

a) To append a string to another string

b) To compare two strings

EXERCISE 11

Write C Programs for the following string operations without using the built in functions

a) To find whether a given string is palindrome or not

b) Write a C Program to count number of occurrences of each character in a given string. Example: if input 'APPLE' then output is 'A count 1, P count 2, L count 1, E count 1'

EXERCISE 12

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

a) To insert a sub-string in to given main string from a given position.

b) To delete n Characters from a given position in a given string.

c) To replace a character of string either from beginning or ending or at a specified location

EXERCISE 13

a) Write a C Program to Implement Taylor series method
b) Write a C Program to Implement Euler's method
c) Write a C Program to Implement Runge Kutta method

EXERCISE 14

a) Write C Program to reverse a string using pointers
b) Write a C Program to compare two arrays using pointers
c) Write a C program to swap two numbers using pointers

EXERCISE 15

a) Write the following C Programs using Dynamic memory management functions.
   i. Accept size of array from user then read n elements into two arrays and store sum of those two arrays in third array, display three arrays using pointers.
   ii. User will specify data type and data to store, use generic pointer to store that data and display given input.

EXERCISE 16

Examples which explores the use of structures, union and other user defined variables

EXERCISE 17

a) Write a C program which copies one file to another.
b) Write a C program to count the number of characters and number of lines in a file.
c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

EXERCISE 18

Virtual Lab: http://cse02-iiith.vlabs.ac.in/ /

Any three programs must be submitted with result from the above link.

** At the end of the semester the student has to submit a Mini-Project on Computer Programming. The list of Mini-Projects is available in the department.*

Virual Lab : http://ps-iiith.vlabs.ac.in/

TEXT BOOKS:

1. Reema Thareja, " Programming in C", OXFORD.
2. The C programming Language by Dennis Richie and Brian Kernighan 2nd ed.

REFERENCE BOOKS:

1. Dr.E.Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill Education.
2. Hanly, "Problem Solving and Program Design in C", Koffman, 7th ed, PEARSON.
3. Forouzan, Gilberg, Prasad ,"C Programming, A Problem Solving Approach", CENGAGE.
4. Programming in C, Second Edition by Ashok N.Kamthane, Pearson.

WEB REFERENCES:

1. https://www.topcoder.com/community/competitive-programming/

2. https://cboard.cprogramming.com/c-programming/158586-project-euler-problem-2-solution.html
3. https://www.hackerrank.com/domains/c
4. https://leetcode.com/discuss/general-discussion/144138/C-programming-solutions/

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC11L5	**ENGINEERING CHEMISTRY LAB (COMMON TO ALL BRANCHES)**						

COURSE OBJECTIVES:

- To provide the students with a solid foundation in chemistry laboratory required to solve the engineering problems.
- To expose the students in practical aspects of the theoretical concepts.
- To train the students on how to handle the instruments.

COURSE OUTCOMES:

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

CO 1: Develop and perform analytical chemistry techniques to address the water related problems (hardness, alkalinity, Chlorine, DO). [K6]

CO 2: Explain the functioning of different analytical instruments.[K5]

CO 3: Compare viscosity and surface tension of different oils.[K4]

CO 4: Measure molecular/system properties such as strength of solutions, conductance of solutions and acid number of lubricating oils, etc.[K5]

LIST OF EXPERIMENTS

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

1. Estimation of NaOH using standard HCl solution
2. Determination of hardness of water sample by EDTA method
3. Determination of alkalinity of water sample
4. Determination of Dissolved Oxygen content of water sample by Winkler's method
5. Determination of Dissolved Chlorine by Mohr's method
6. Estimation of Fe+2 by using KMnO4
7. Preparation of phenol formaldehyde resin/Urea formaldehyde
8. Conductometric titration between strong acid and strong base
9. Determination of viscosity of a liquid by Ostwald's viscometer
10. Determination of surface tension of a liquid by Stalagnometer
11. Determination of moisture content present in given coal sample
12. Determination of acid value of an oil

VIRTUAL LABS:

1. Soil Analysis- Determination of pH of soil
2. Water analysis - Determination of Physical parameters

TEXT BOOKS:

1. N.K Bhasin and Sudha Rani "**Laboratory Manual on Engineering Chemistry**" 3/e, Dhanpat Rai Publishing Company (2007).
2. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B "**Vogel's Quantitative Chemical Analysis**" 6/e, Pearson publishers (2000).
3. Sudharani, "**Lab manual on Engineering Chemistry**" Dhanpat Rai Publications, Co., New Delhi. (2009).

WEB REFERENCES:

1. URL: https://vlab.amrita.edu

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	-	-	-	-	-	0
SUBCODE: R20CC11MC1	**ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)**						

COURSE OBJECTIVES:

- To make the students aware about the environment and it's inter–disciplinary, to familiarize the concept of ecosystem and their importance, basic understanding of the ecosystem and its diversity.
- Overall understanding of the natural resources.
- To bring the awareness among students about the importance of biodiversity and the need for its conservation.
- To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities. Awareness on the social issues, environmental legislation and global treaties understanding the environmental policies and regulations.

COURSE OUTCOMES:

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

CO 1: Explain the concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web.[K2]

CO 2: Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.[K4]

CO 3: Explain the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.[K2]

CO 4: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management practices.[K4]

CO 5: Interpret Environmental policy, legislation, environmental assessment and the stages involved in EIA Environmental audit.[K2]

UNIT – I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness. Institutions and people in Environment.

Ecosystems:

Definitions and concepts – Characteristics of ecosystem – Structural and functional features – Producers, consumers and decomposers and food webs – Types of ecosystems – Forests, grassland, desert, crop land, pond, lake, river and marine ecosystems – Energy flow in the ecosystem – Ecological pyramids – Ecological successions.

UNIT – II

Natural Resources: Water resources–Use and over utilization of surface and natural resourced ground water–Floods, drought, conflicts over water, dams–benefits and problems on tribal population & Environment. Forest resources: Use and over–exploitation, deforestation.

Mineral resources: Use and exploitation, tribal & environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer–pesticide problems, water logging, salinity–concept

of sustainable agricultural methods.
Energy Resources: Renewable (wind energy, tidal energy) and non-renewable energy resources (Fossil fuels, coal).

UNIT – III

Biodiversity: Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity
Conservation of biodiversity: Threats to biodiversity: habitat loss, man wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity: In-Situ conservation and Ex- situ conservation.

UNIT – IV

Environmental Pollution and Control Technologies: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, and nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Good Agricultural Practices – Drip irrigation, soil erosion and desertification.
Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.Covid-19- and environmental Health –Impact of the Coronavirus-Precautions and infection control.

UNIT – V

Environmental Policy, Legislation and Environmental Management: Environmental ethics: Issues and possible solutions. Environmental Protection Act, Legal aspects -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.
Impact Assessment and its significance - various stages of EIA, preparation of EMP and EIS, Environmental audit, Ecotourism.
Visit to some local Polluted Site: Study of an industrially Polluted area.

TEXT BOOKS:

1. AnubhaKaushik& C. P. Kaushik, Environmental Studies,NewAge International (P) Ltd., New Delhi. Fourth edition,2014.
2. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. ManjulaRani,Environmental Studies, Pearson Education, Chennai.ISBN 978-93-325-2052-3,Secondedition-2014.

REFERENCE BOOKS:

1. Deekshita Dave & P. UdayaBhaskar, Text Book of Environmental Studies CengageLearning.
2. Shaashi Chawla, a Textbook of Environmental Studies, TMH, NewDelhi.
3. Benny Joseph Environmental Studies, Tata McGraw Hill Co, NewDelhi.
4. Dr.K.V.S.G. Murali Krishna, Environmental Studies VGS Publishers, Vijayawada, First Edition2016.
5. Bharucha, E. Text book of Environmental Studies, First edition, Universities Press (India) Pvt., Ltd., Hyderabad,2005.

WEB REFERENCES:

1.URL: https://www.youtube.com/watch?v=7G3eXI_DPn8
2.URL: https://www.eolss.net/sample-chapters/C09/E6-70-05-01.pdf
3.URL: https://www.youtube.com/watch?v=QuRL6NbyvEQ
4.URL: https://google/ Introduction to Environmental Studies5JM1G2
5.URL: http://www.teacherspayteachers.com/Product/Food-Chains-Trophic-Levels-and-Ecological-Pyramids-PowerPoint Click theabove

I B.TECH – II SEMESTER

S.No.	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC1201	Differential Equations & Vector Calculus	BS	30	70	100	2	1	0	3
2	R20CC1205	Applied Physics	BS	30	70	100	3	0	0	3
3	R20CC1206	Problem Solving Using PYTHON	ES	30	70	100	3	0	0	3
4	R20CC1218	Technical and Communicative English-II	BS	30	70	100	3	0	0	3
5	R20CC12L10	Applied Physics Lab	BS	15	35	50	0	0	3	1.5
6	R20CC12L12	Problem Solving using PYTHON Lab	ES	15	35	50	0	0	3	1.5
7	R20CC12L15	IT Workshop	ES	15	35	50	0	0	3	1.5
8	R20CC1216	Unix Programming Lab	ES	15	35	50	0	0	3	1.5
9	R20CC12L14	Engineering Graphics	ES	15	35	50	0	0	3	1.5
TOTAL										**19.5**

I B.TECH-II-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: R20CC1201	**DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to Civil, EEE, ME, ECE, CSE(AI-ML), CSE(DS) and CSE(CS))**						

COURSE OBJECTIVES:

1. To formulate and solve first order ordinary differential equations.
2. To solve second order differential equations of various kinds.
3. To find the solution of first order linear and non-linear partial differential equations.
4. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.
5.

COURSE OUTCOMES:

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

1. Apply first order ordinary differential equations to real life situations. [**K3**]
2. Identify and apply suitable methods in solving the higher order differential equations.[**K3**]
3. Solve the partial differentiation equations. [**K3**]
4. Interpret the physical meaning of different operators as gradient, curl and divergence.[**K2**]
5. Estimate the work done against a field, circulation and flux using vector calculus. **[K5]**

UNIT I: DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE: (10 hours)

Linear-Bernoulli's-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-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER: (10 hours)

Finding the complementary functions, Inverse operator, Rules for finding the particular integrals, Method of variation of parameters. Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients.

Application: L-C-R Circuit problems.

UNIT – III: FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS: (10 hours)

Formation of partial differential equation by elimination of arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange's) equations.

UNIT- IV: VECTOR DIFFERENTIATION: (8 hours)

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT- V: VECTOR INTEGRATION: (10 hours)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

TEXT BOOKS :

1. Dr. B.S. Grewal, "*Higher Engineering Mathematics*", 43rd Edition, Khanna Publishers, 2012.
2. B.V.Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.
3. Bhavanari Satyanarayana, Pradeep Kumar T.V. & Srinivasulu D, "Linear Algebra and Vector Calculus", Studera Press, New Delhi, 2017.

REFERENCES:

1. Kreyszig E, "*Advanced Engineering Mathematics*", 8th Edition, John Wiley, Singapore, 2001.
2. Greenberg M D, "*Advanced Engineering Mathematics*", 2nd Edition, Pearson Education, Singapore, Indian Print, 2003.
3. Peter V. O'Neil, *"Advanced Engineering Mathematics"*, 7th Edition, Cengage Learning, 2011.
4. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "*Engineering Mathematics*", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1205	**APPLIED PHYSICS (Common to ECE,EEE,CSE,IT,CAI,CSC,CSD&CSM)**						

COURSE OBJECTIVES:

- To impart knowledge in basic concepts of wave optics, fiber optics, properties of solid crystal materials and magnetic materials, acoustics, superconductors.
- To familiarize the applications of materials relevant to engineering field.

COURSE OUTCOMES:

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

CO 1: Interpret the experimental evidence of wave nature of light and interference in thin films, Diffraction grating and Polarization in various fields. **[K2]**
CO 2: Analyze and understand various types of lasers & optical fibers.[**K4]**
CO 3: Identify the crystal structures and XRD techniques. **[K3]**.
CO 4: Apply the magnetic materials in engineering field. [**K3]**
CO 5: Identify the various applications of semiconductors in engineering field. **[K3]**

SYLLABUS

UNIT– I

Interference & Diffraction: Introduction -Interference in thin films by reflection – Newton's rings, introduction to diffraction – difference between Fresnel's and Fraunhofer diffraction - Fraunhofer diffraction at single slit (qualitative) - Diffraction grating.
Polarization: Introduction – Types of Polarization – Double refraction – Nicol's prism- Quarter wave plate and Half Wave plate – Applications.

UNIT–II

Lasers: Introduction – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Population inversion – Ruby laser – Helium Neon laser-Applications.
Fiber Optics: Introduction- Basic Structure and Principle of optical fiber - Acceptance angle – Acceptance cone - Numerical Aperture-Applications.

UNIT–III

Crystallography : Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC,BCC and FCC.
X-Ray Diffraction: Directions and planes in crystals – Miller indices – Separation between successive (h k l) planes – Bragg's law.

UNIT-IV

Electromagnetic Fields: Gauss divergence theorem - Stokes theorem (Quantitative) – Fundamental laws of electromagnetism – Maxwell's Electromagnetic Equations.
Magnetic materials: Magnetic Susceptibility- Magnetic permeability –Classification of Magnetic materials – Dia, Para, and Ferro – Hysteresis Loop- Soft and Hard magnetic materials – Applications- Superconductivity- Properties, Meissner effect - Type-I and Type-II super conductors.

UNIT-V

Quantum Mechanics: Introduction –de-Broglie's concept of Matter waves – Physical significance of wave function - Schrodinger Time Independent wave equations – Particle in a one dimensional potential box.

Semiconductor Physics: Origin of energy band formation in solids- classification of materials into conductors, semiconductors and insulators, Intrinsic and Extrinsic semiconductor- Hall Effect.

REFERENCE BOOKS:

1. Charles Kittle, "Introduction to solid state physics" ISBN: 9788126578436, Willey India Pvt.Ltd, 5TH edition, 2012.
2. M.Arumugam, "Applied Physics", ISBN: 81-89638-01-7, Anuradha Agencies, 4th edition, 2013.
3. D.K.Bhattacharya, "Engineering Physics", ISBN: 0198065426, 9780198065425, Oxford University press, 2nd edition, 2010.
4. Sanjay D Jain and Girish G Sahasrabudhe "Engineering Physics", University Press ISBN: 8173716781,1st edition, 2010.

1. B.K.Pandey & S. Chaturvedi "Engineering Physics" ISBN: 8131517616, Cengage Learning, 1st edition, 2012.

WEB REFERENCES:

1. http://link.springer.com/physics
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

E-BOOKS:

1. http://www.peaceone.net/basic/Feynman
2. http://physicsdatabase.com/free-physics-books
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1206	**PROBLEM SLOVING USING PYTHON** (Common to CSE, IT,CSC,CSD&CSM)						

COURSE OBJECTIVE:

- To teach problem solving through flow charting tool-Raptor.
- To elucidate problem solving through python programming language.
- To introduce function oriented programming paradigm through python.
- To train in development of solutions using modular concepts.

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

CO 1: Summarize the fundamental concepts of python programming. [K2]
CO 2: Interpret object oriented and event driven programming in python. [K2]
CO 3: Apply the suitable data structures to solve the real time problems. [K3]
CO 4: Apply regular expressions for many different situations. [K3]

SYLLABUS:

UNIT-I

Introduction to python: Numbers, strings, variables, operators, expressions, Indentation, String operations and functions, math function calls, Input/output statements, conditional if, while and for loops,

UNIT-II

Functions: user defined functions, parameters to functions, recursive functions, and lambda function.

Event driven programming: Turtle graphics, Turtle bar chart, Widgets, key press events, mouse events, timer events.

UNIT-III

Data structures: List- list methods & functions, Tuple-tuple methods & functions, Dictionaries-dictionary methods & functions, traversing dictionaries. Sets-methods & functions, Files.

UNIT-IV

OOP: class, object, methods, constructors, inheritance, inheritance types, polymorphism, operator overloading, abstract classes, exception handling.

UNIT-V:

Regular expressions: Power of pattern matching and searching using regex in python, Meta characters and Sequences used in Patterns, Password, email, URL validation using regular expression, Pattern finding programs using regular expression.

TEXT BOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs" , ISBN-13: 978-1337560092,cengage learning publishers, first edition,2012.
2. Allen B. Downey, "think python: how to think like a computer scientist", ISBN-13: 978-1491939369, O'reilly, 2nd edition, 2016.
3. Reema Thareja, "Python Programming using Problem Solving Approach", ISBN-13:978-0-19-948017-3, Oxford University Press, 2017.

REFERENCE BOOKS:

1. Vamsi kurama, "Python programming : A modern approach", ISBN-978-93-325-8752-6,pearson,2018.
2. Mark Lutz , "Learning python", ISBN: 1-56592-464-9,Orielly, 4th edition, 1999 .
3. W.Chun, "Core python programming", ISBN-13: 978-0132269933, pearson, 2nd edition, 2016.

WEB RESOURCES:

1. https://raptor.martincarlisle.com/
2. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
4. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
5. https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf
6. https://nostarch.com/scratchplayground
7. http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce-e3aa315888a1/scratchreferenceguide14.pdf

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC1218	**TECHNICAL AND COMMUNICATIVE ENGLISH - II (**Common to All Branches**)**						

COURSE OBJECTIVES:

- To equip the students with appropriate oral and written communication skills.
- To inculcate the skills of listening, reading and critical thinking.
- To enhance the students' proficiency in reading skills enabling them meet the academic needs of theircourse.
- To enable the engineering students develop their basic communication skills in English for academic andsocial purposes.

COURSE OUTCOMES:

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

CO 1: Infer explicit and implicit meaning of a text, recognize key passages; raise questionsand summarize it **(Apply-3).**

CO2: Compose paragraphs, essays, emails, letters, reports, resume and transfer informationinto tables, Pie and bar diagrams. **(Creating-5).**

CO3: Build grammatically correct sentences using a variety of sentence structures **(Apply3).**

CO4: Enhance word power and usage of lexicons **(Apply3).**

UNIT– I

1. *A Proposal to Gridle the Earth, Nellie Bly*

a) **Placement Papers**.
b) **Reading**: Skimming for main idea, scanning for specific piece of information.
c) **Writing**: Note – making flowed by paragraph writing, effective opening sentences, introducing thetopic, key words, main idea, summarize the main idea.
d) **Grammar and Vocabulary**: Content words and function words, verbs, nouns, adjectives and adverbs. Basic sentence structure and simple question form, framing jargon, technical vocabulary (15 words)

UNIT–II

2. *The District School As It Was by One who Went to It, Warren Burton*

a) Placement Papers.
b) **Reading**: Identifying the sequence of ideas and recognizing verbal techniques to link the ideas ina paragraph.
c) **Writing**: Paragraph writing, using key words/phrases and organizing points in a coherent manner.
d) **Grammar and Vocabulary**: Linkers, articles and prepositions.

UNIT–III

3. *The future of Work- Jacob Morgan*

a) **Placement Papers**.
b) **Reading**: Sequencing of ideas and recognizing verbal techniques to link the ideas in a paragraph.

c) **Writing**: Paragraph writing, using key words/phrases and organizing points in a coherent manner.
d) **Grammar and Vocabulary**: Cohesive devices, articles and prepositions.

UNIT-IV

4. *H.G.Wells and the Uncertainties of Progress, Peter J. Bowler*

a) **Placement Papers**.
b) **Reading**: Understand and interpret graphic elements used in texts.
c) **Writing**: Information transfer.
d) **Grammar and Vocabulary**: Adjectives, adverbs and antonyms.

UNIT-V

5. *Leaves from the Mental Portfolio of a Eurasian, Sui Sin Far*

a) **Placement Papers**.
b) **Reading:** Reading for comprehension.
c) **Writing**: Essay writing
d) **Grammar and Vocabulary**: Articles, prepositions, tenses, subject verb agreement and technicaljargon (15 words)

TEXT BOOKS:

1. English All Round -I (Communication skills for Under Graduate Learners)– Orient Black Swan Pvt.Ltd.Publisher, 1stedition,2019

REFERENCE BOOKS:

1. Raymond Murphy, *Murphy's English Grammar*, Cambridge University Press 2004
2. Meenakshi Raman, Sangeeta Sharma, *Technical Communication: English Skills for Engineers*, OxfordUniversity Press, 2009
3. Michael Swan, *Practical English Usage*, Oxford University Press, 1996

WEB REFERENCES:

1. https://www.grammarly.com/blog
2. https://www.englishclub.com/
3. www.nonstopenglish.com/
4. https://www.fluentu.com/blog/english/
5. https://beta.freerice.com/
6. https://prepinsta.com/cognizant/
7. https://www.geeksforgeeks.org/tcs-placement-paper-mcq-1/
8. https://www.firstnaukri.com/career-guidance/infosys-placement-papers-with-solutions-2019-firstnaukri-prep
9. https://in.usembassy.gov/education-culture/american-spaces/dostihouse-mumbai/library-services/
10. https://www.youtube.com/user/bbclearningenglish
11. https://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
12. https://englishlive.ef.com/blog/language-lab/5-simple-ways-improve-written-english/

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20CC12L10	**APPLIED PHYSICS LAB (Common to CSE, ECE, IT,CAI,CSC,CSD,CSM,EEE)**						

COURSE OBJECTIVES:

To impart physical measurement skills and make the students understand coherence between theoretical and practical knowledge.

COURSE OUTCOMES:

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

CO1: Apply the principle of physics in engineering field **(K3)**

CO2: Utilize the modern engineering physics techniques and tools in real time applications. **(K3)**

CO3: Analyse characteristics, usage and the behaviour of materials**. (K4)**

LIST OF EXPERIMENTS:

1. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
2. Determination of wavelength of a source-Diffraction Grating-Normal incidence
3. Newton's rings –Radius of Curvature of Plano Convex Lens.
4. Determination of thickness of thin wire- Air wedge method
5. Determination of wavelength of Laser Source-single slit diffraction.
6. Determine the Numerical aperture of an optical fiber.
7. Melde's experiment – Transverse and Longitudinal modes.
8. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
9. Verification of laws of stretched string by using Sonometer.
10. Calculate the energy loss in a given ferromagnetic material by plotting B-H Curve.
11. Energy Band gap of a Semiconductor p - n junction.
12. Characteristics of Thermistor – temperature coefficient

TEXT BOOKS:

1. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links).
2.Physics Practical Manual, Lorven Publications
3.S. Balasubramanian , M.N. Srinivasan " A Text book of Practical Physics"- S Chand Publishers, 2017.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=NDsSPtL9dyQ
2. https://www.youtube.com/watch?v=9agoJRCnu4w
3. https://www.youtube.com/watch?v=bv-lLJreyCU
4. http://vlab.amrita.edu/index.php

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC12L12	**PROBLEM SOLVING USING PYTHON LAB** (Common to CSE,IT,CSC,CSD & CSM)						

COURSE OBJECTIVE:

- To introduce programming through Visual programming tool - Scratch
- To teach problem solving through Flow charting tool - Raptor
- To elucidate problem solving through python programming language
- To introduce function-oriented programming paradigm through python
- To train in development of solutions using modular concepts
- To teach practical Python solution patterns

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

CO1: Develop interactive visual programs using Scratch.[K3].
CO2: Develop Python programs for numerical and text based problems. [K3].
CO3: Develop graphics and event based programming using Python. [K3].
CO4: Develop Python programs on object oriented programming and regular expressions. [K3].

LABORATORY EXPERIMENTS

WEEK-1:

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, and Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.

WEEK-2:

3. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
4. Design a Python script to determine if a given string is a Palindrome using recursion

WEEK-3:

5. Design a Python script to sort numbers specified in a text file using lists.
6. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format 0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31 following the leap year rules.

WEEK-4:

7. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
8. Design a Python Script to determine the time difference between two given times in HH:MM:SS format. 0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59.
9. Write a Python program to convert a date of yyyy-mm-dd format to dd-mm-yyyy format.

WEEK-5:

10. Design a Python Script to convert a given number to words
11. Design a Python Script to convert a given number to roman number.

WEEK-6:

12. Design a Python Script to generate the frequency count of words in a text file.
13. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.

WEEK-7:

14. Write a Python program to convert a given tuple of positive integers into an integer.

15. Write a Python program to create a dictionary grouping a sequence of key-value pairs into a dictionary of lists.
    Original list:
    [('yellow', 1), ('blue', 2), ('yellow', 3), ('blue', 4), ('red', 1)]
    Grouping a sequence of key-value pairs into a dictionary of lists:
    {'yellow': [1, 3], 'blue': [2, 4], 'red': [1]}

WEEK-8:

16. Write a Python program to remove the intersection of a 2nd set from the 1st set.
17. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
    SampleList:['abc','xyz','aba','1221']
    Expected Result : 2

WEEK-9:

18. Design a Python script to generate statistical reports Minimum, Maximum, Count, Average, Sum etc) on public datasets.
19. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.

WEEK-10:

20. Write a Python program to replace all occurrences of space, comma, or dot with a colon.
21. Write a Python program to match a string that contains only upper and lowercase letters, numbers, and underscores.

WEEK-11:

22. Write a Python program to check that a string contains only a certain set of characters in this case a-z, A-Z and 0-9
23. Write a Python program to find the occurrence and position of the substrings within a string.

WEEK-12:

24. Design a Python script on oop's concepts: Class variables and instance variable
    i. Robot ii) ATM Machine
25. Virtual Lab: http://ps-iiith.vlabs.ac.in/ any three programs must be submitted with result from the above link.

TEXT BOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs" , ISBN-13: 978-1337560092,cengage learning publishers, first edition,2012.
2. Allen B. Downey, "think python: how to think like a computer scientist", ISBN-13: 978-1491939369, O'reilly, 2nd edition, 2016.
3. Reema Thareja, "Python Programming using Problem Solving Approach", ISBN-13:978-0-19-948017-3, Oxford University Press, 2017.

REFERENCE BOOKS:

1. Vamsi kurama, "Python programming : A modern approach", ISBN-978-93-325-8752-6,pearson,2018.
2. Mark Lutz , "Learning python", ISBN: 1-56592-464-9,Orielly, 4th edition, 1999 .
3. W.Chun, "Core python programming", ISBN-13: 978-0132269933, pearson, 2nd edition, 2016.

WEB RESOURCES:

1. https://raptor.martincarlisle.com/
2. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
4. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
5. https://www.cse.msu.edu/~stockman/ITEC/Scratch/BGC2011Scratch-Rev1.pdf
6. https://nostarch.com/scratchplayground
7. http://fusecontent.education.vic.gov.au/9f79537a-66fc-4070-a5ce-e3aa315888a1/scratchreferenceguide14.pdf

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC12L15	**IT WORKSHOP**						

COURSE OBJECTIVES:

- Enabling the student to understand basic hardware and software tools through practical exposure.

COURSE OUTCOME:

After completion of this course, the student should be able to

CO1: Demonstrate the need of PC hardware components, applications and softwares.[K2]
CO2: Explain the knowledge of networks, internet and World Wide Web, Search engines, Netiquette. [K2]
CO3: Install and use different software like Windows XP, Linux.
CO4: Identify and fix the defective PC and software related issues.[K3]
CO5: Formalize with parts of windows word, Excel and Power point.

PC Hardware

Task 1: Identification of the peripherals of a computer. To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices.

Task 2: (Optional): A Practice on disassembling the components of a PC and assembling them to back to working condition.

Task 3: Examples of Operating Systems- DOS, MS Windows, Installation of MS windows on a PC

Task 4: Introduction to Memory and Storage Devices, I/O Port, Device Drivers, Assemblers, Compilers, Interpreters, Linkers, Loaders.

Task 5: Hardware Troubleshooting (Demonstration): Identification of a problem and fixing a defective PC (improper assembly or defective peripherals).
Software Troubleshooting (Demonstration): Identification of problem and fixing the PC for any software issues.

Internet & Networking Infrastructure

Task 6: Demonstrating Importance of Networking, Transmission Media, Networking Devices-Gateway, Routers, Hub, Bridge, NIC, Bluetooth technology, Wireless Technology, Modem, DSL, and Dialup Connection.
Orientation & Connectivity Boot Camp and Web Browsing: Students are trained to configure the network settings to connect to the Internet. They are trained to demonstrate the same through web browsing (including all tool bar options) and email access.

Task 7: Search Engines & Netiquette:
Students are enabled to use search engines for simple search, academic search and any other context based search (Bing, Google etc).Students are acquainted to the principles of micro-blogging, wiki, collaboration using social networks, participating in online technology forums.

Task 8: Cyber Hygiene (Demonstration) : Awareness of various threats on the internet. Importance of Security patch updates and Anti-Virus solution Ethical Hacking, Firewalls, Multi-factors authentication techniques including Smart card Biometrics and also practiced.

Word

Task 9: MS Word Orientation: Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting, Drop Cap, Applying Text effects, Using Character Spacing, OLE in Word, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving.

Task 10 : Creating Project : Abstract Features to be covered:-Formatting Styles, Inserting Table, Bullets and Numbering, Changing Text Direction, Cell alignment, footnote, Hyperlink, Symbols, Spell Check, Track Changes, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

Excel

Task 11: Using spread sheet features of EXCEL including the macros, formulae, pivot tables, graphical representations.

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

Task 12: Performance Analysis: Features to be covered:-Split cells, freeze panes, group and outline, Sorting, Boolean and Logical operators, Conditional Formatting.

Power Point

Task 13: Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes:- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in PowerPoint.

Task 14: Focusing on the power and potential of Microsoft power point Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes:- Master Layouts (slide, template and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background , textures, Design Templates, Hidden slides, OLE in PPT.

TEXT BOOKS:

Faculty to consolidate the workshop manuals using the following references.

1. Anita Goel , Computer Fundamentals, Pearson
2. Scott. Mueller QUE , Scott Mueller's Upgrading and Repairing PCs, 18/e, Pearson, 2008

REFERENCE BOOKS:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr.N.B.Venkateswarlu.
2. G Praveen Babu, M V Narayana, "Information Technology Workshop", BS Publications, 3e
3. Vikas Gupta, "Comdex Information Technology", Dreamtech.

WEB REFERENCES:

1. https://www.microsoft.com/en-us/garage/profiles/script-lab/
2. https://algonquincollege.libguides.com/slc/library-lab
3. https://technology.ku.edu/services/training-workshops
4. https://appsource.microsoft.com/en-us/product/office/wa104380862?tab=overview

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20CC12L16	**UNIX PROGRAMMING LAB**						

COURSE OBJECTIVES:

- Facility with UNIX command syntax and semantics.
- Ability to read and understand specifications, scripts and programs.
- Individual capability in problem solving using the tools presented within the class.

COURSE OUTCOMES:

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

CO 1: Apply the fundamental UNIX utilities. [K3]
CO 2: Utilize the Unix file system[K3]
CO 3: Experiment with shell and UNIX filters. [K3]
CO 4: Analyze the Shell Programming constructs to develop shell scripts. [K4]

LIST OF EXPERIMENTS

WEEK1

1. Execution of various basic and file related commands in unix.
   basic and file related commands: man, echo, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, ln.

WEEK2

2. Execution of various disk related commands.
   disk related commands: df, dfspace, du, ulimit
3. Execution of various process related commands.
   process related commands: ps, kill, nice, at, batch, crontab

WEEK3

4. Use the following file permission related commands.
   a) chmod, b) chown, c) chgrp d) umask
5. Execution of various basic filters in unix.
   Filters: head, tail, cut, paste, sort, uniq, cmp, diff, comm and tr

WEEK4

6. Use the following shell metacharacters.
   a) I/O Redirection (>, <, >>, <<, |)
   b) Filename substitution (?, *, […..])
   c) Quoting metacharacters (\, "…", '….', ` cmd`)
   d) Process execution (;, (), &, &&, ||)
   e) Positional parameters ($1 to $9)

WEEK5

7. a) Write a grep command that selects the lines from the file1 that have exactly three characters
   b) Write a grep command that selects the lines from the file1 that have at least three characters.

c) Write a grep command that selects the lines from the file1 that have three or fewer characters

d) Write a grep command that selects the lines from the file1 that have the string UNIX.
e) Write a grep command that selects the lines from the file1 that have only the string UNIX.

WEEK6

8. a) Write a sed command that deletes the first character in each line in a file
   b) Write a sed command that deletes the character before the last character in each line in a file.

WEEK7

9. a) Write an awk command to print the lines and line number in the given input file
   b) Write an awk command to print first field and second field only if third field value is >=50 in the given input file.

WEEK8

10. a) Write A shell script that takes a command –line argument and reports on whether it is directory, a file, or something else
    b) Write a shell script that accepts one or more file name as a arguments and converts all of them to uppercase, provided they exist in the current directory
    c) Write a shell script that determines the period for which a specified user is working on the system

WEEK9

11. a) Write a shell script that accepts a file name starting and ending line numbers as arguments and displays all the lines between the given line numbers
    b) Write a shell script that deletes all lines containing a specified word I one or more files supplied as arguments to it.

WEEK10

12. a) Write a shell script that computes the gross salary of an employee according to the following
    1) If basic salary is <1500 then HRA 10% of the basic and DA =90% of the basic
    2) If basic salary is >1500 then HRA 500 and DA =98% of the basic
    The basic salary is entered interactively through the key board

    b) Write a shell script that accepts two integers as its arguments and computes the value of first number raised to the power of the second number

WEEK 11

13. a) Write an interactive file handling shell program. Let it offer the user the choice of copying, removing, renaming or linking files. Once the user has made a choice, have the program ask the user for necessary information, such as the file name ,new name and so on.
    b) Write a shell script that takes a login name as command–line argument and reports when that person logs in

c) Write a shell script which receives two files names as arguments. It should check whether the two file contents are same or not. If they are same then second file should be deleted.

WEEK 12

14. a) Write a shell script that displays a list of all files in the current directory to which the user has read write and execute permissions
    b) Develop an interactive script that asks for a word and file name and then tells how many times that word occurred in the file.

    c) Write a shell script to perform the following string operations.
        1) To extract a sub string from a given string
        2) To find the length of a given string

WEEK 13

15. a) Write a shell script to display reverse numbers from given argument list
    b) Write a shell script to display factorial value from given argument list
    c) Write a shell script to search given number using binary search.
    d) Write a shell script to sort the elements in a array using bubble sort technique

WEEK 14

16. a) Write a C program that simulate the following unix commands
        1. mv
        2. cp
    b) Write a C program that simulates ls command.

TEXT BOOKS:

1. The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
2. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

REFERENCE BOOKS:

1. Unix and shell programming by B.M. Harwani, OXFORD university press.
2. Unix Concepts and Applications by Sumitabha Das, 4thEdition., Tata McGraw Hill.

WEB REFERENCES:

2. https://www.learnshell.org
3. https://www.udemy.com/shellprogramming/ 3
4. https://www.edureka.co/unix
5. https://www.goeduhub.com/8761/online-tutorial-training-certification-in-linux-unix

I B. TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	0	4	30	70	100	3
SUBCODE: R20CC12L14	ENGINEERING GRAPHICS (for AI&ML, Data Science & Cyber Security)						

COURCE OBJECTIVES:

- The students to use drawing instruments and to draw polygons, engineering Curves & engineering scales.
- The students use to make orthographic projections, projections of points, simple lines & projections of the lines inclined to both the lines.
- The students use to draw the projections of the plane inclined to both the plane.
- Develop surfaces of regular solids, and solids inclined to one Axis using drafting software.
- Convert and develop the isometric views onto orthographic views.

COURSE OUTCOMES:

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

CO 1: construct the geometrical shapes of regular polygons, Engineering Curves, and scales. CO 2: illustrate the orthographic projections, projections of points, and lines.

CO 3: construct the projection of planes inclined to both the planes. CO 4: construct the projection of solids for engineering applications.

CO 5: construct the conversion of isometric views to orthographic views vice versa.

UNIT– I

THE BASIC CONCEPTS IN ENGINEERING DRAWING: introduction to engineering drawing instruments, lettering and dimensioning practice. Geometrical constructions- Constructing regular polygons by general methods.

CURVES USED IN ENGINEERING PRACTICE: Introduction to conic sections, construction of ellipse, parabola, hyperbola by eccentricity method. Construction of ellipse by - Arcs of circles Method, Concentric Circles Method and Oblong Method, & parallelogram methods.

UNIT–II

ORTHOGRAPHIC PROJECTIONS- introduction to type of projections, first angle and third angle projections. Projection of points: Principles of orthographic projection – Convention – First angle projections, projections of points.

PROJECTIONS OF STRAIGHT LINES: Projections of straight lines parallel to both the planes, parallel to one plane and inclined to the other plane. Lines inclined to both the planes - Projections of straight lines inclined to both the planes- determination of true lengths, angle of inclination and traces.

UNIT–III

PROJECTIONS OF PLANES: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.

UNIT-IV

INTRODUCTION TO AUTOCAD SOFTWARE: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs,

Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line, The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

PROJECTIONS OF SOLIDS: introduction to projections of solids, types of solids: prisms, pyramids, cones and cylinders –simple positions and the axis inclined to one of the planes.

UNIT-V

Introduction of isometric views, isometric projections & orthographic projections. Conversion of isometric views to orthographic views and orthographic views to isometric views.

TEXT BOOKS

1. Engineering Drawing by N.D. Butt, Chariot Publications.
2. Engineering Drawing & Graphics by K.Venu gopal, New age international Publishers.
3. Dhananjay A Jolhe, "Engineering Drawing with an introduction to AutoCAD", Tata McGraw- Hill Publishing company limited.
4. D.M. Kulkarni, A.P. Rastogi and A.K.Sarkar; "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi.

REFERENCE BOOKS:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers.
2. Engineering Drawing by Basant Agarwal & CM. Agarwal, Tata McGraw Hill Publishers.
3. Venugopal. K, "Engineering Drawing and Graphics+ AutoCAD", NewAge International.

Web References:

1. https://nptel.ac.in/courses/112103019/17

E-Books:

1. https://www.pdfdrive.com/textbook-of-engineering-drawing-e28918244.html

II B.TECH - I SEMESTER

S.No	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC2106	Probability & Statistics	BS	30	70	100	2	1	0	3
2	R20CC2103	OOPs through Java	PC	30	70	100	3	0	0	3
3	R20CC2104	Data Structures	PC	30	70	100	3	0	0	3
4	R20CC2101	Computer Organization	PC	30	70	100	3	0	0	3
5	R20AC2105	Software Engineering	PC	30	70	100	3	0	0	3
6	R20CC21L1	Data Structures Lab	PC	15	35	50	0	0	3	1.5
7	R20CC21L2	OOPs through Java Lab	PC	15	35	50	0	0	3	1.5
8	R20AC21L3	Software Engineering and UML Lab	PC	15	35	50	0	0	3	1.5
9	R20CC21SC1	Data Science Lab	SC	-	50	50	0	0	4	2
10	R20CC21MC2	Constitution of India	MC	-	-	-	2	0	0	0
Total										**21.5**

II B.TECH-I-SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R20CC2106	PROBABILITY AND STATISTICS CSE(AI-ML), CSE(Cyber Security)), CSE(Data Science)						

COURSE OBJECTIVES:

1. To familiarize the students with the foundations of probability and statistical methods
2. To impart probability concepts and statistical methods in various applications Engineering

COURSE OUTCOMES:

Upon successful completion of this course, the student should be able to

1. Classify the available data to apply in the domain of data science. [Analyzing – K4]
2. Select the associated characteristics in view of correlation and regression. [Apply – K3]
3. Apply discrete and continuous probability distributions. [Apply – K3]
4. Design the components of a classical hypothesis test [Creating – K6]
5. Apply the statistical methods based on small and large sampling tests. [Apply – K3]

UNIT I: Descriptive statistics and methods for data science (10 hours)

Descriptive statistics and methods for data science: Data science – Statistics Introduction – Population vs Sample – Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability (spread or variance) – Skewness Kurtosis.

UNIT II: Correlation and Curve fitting: Correlation (8 hours)

Correlation and Curve fitting: Correlation – correlation coefficient – rank correlation – regression coefficients and properties – regression lines – Method of least squares – Straight line – parabola – Exponential – Power curves.

UNIT III: Probability and Distributions: (10 hours)

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

UNIT IV: Sampling Theory: (10 hours)

Sampling Theory: Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, □ 2 and F- distributions – Point, and Interval estimations – Maximum error of estimate.

UNIT V: Tests of Hypothesis: (10 hours)

Tests 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 and two means (Large and Small samples) – Tests on proportions

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 l. 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.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC2103	**OOPS THROUGH JAVA** (Common to CSE,IT,CSC,CSD & CSM)						

COURSE OBJECTIVE:

- The course provides fundamentals of object-oriented programming in Java and development of user interface.

COURSE OUTCOMES:

After completion of this course, the students would be able to:

CO1: Interpret the syntax and semantics of java programming language and OOPs concepts. [K2]

CO2: Make use of different predefined classes and packages and interfaces to develop programmes using OOPs concepts. [K3]

CO3: Apply exception handling and multithreading mechanisms on java programs.[K3]

CO4: Develop java programmes using collection framework & I/O. [K3]

CO5: Make use of AWT, Applets and Event-Handling to develop GUI. [K3]

SYLLABUS:

UNIT I

Oriented Languages (Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism), Procedural languages Vs. OOP. The History and Evolution of Java, Java Buzzwords, java program structure.

Data Types, Variables, and Arrays: The primitive types, variables, type conversion and casting, Automatic Type Promotion in Expressions, Arrays, Operators, Control statements.

Introducing Classes : Class fundamentals, Declaring the objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this keyword, Garbage Collection, the finalize() Method.

UNIT-II

A Closer Look at Methods and Classes: Overloading Methods, Using objects as Parameters, Returning Objects, Understanding static , Nested and Inner Classes.

Inheritance: Inheritance Basics and types of inheritance, Using super, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, using final with Inheritance, The Object class. **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces, Default Interface Methods, Use static Methods in an Interface.

UNIT-III

String Handling: String class, StringBuffer class, StringBuilder Class

Exception Handling: Fundamentals, Exception types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.

Multithreaded Programming : The Java Threaded Model, The Main Thread , Creating a
Thread, Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Inter Thread Communication, Suspending, Resuming, Stopping Threads.

UNIT-IV

Collections Framework in Java- Introduction to Java collections, Overview of Java collection frame work, Commonly used Collection classes- ArrayList,LinkedList, HashSet, Hash table, HashMap, TreeSet,TreeMap , StringTokenizer.

Input/Output: reading and writing data - Byte Stream, Console, Character Stream, Buffered Byte Stream, Buffered Character Stream; java.io package.

UNIT-V

The Applet Class: Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, Requesting Repainting, The HTML APPLET Tag, Passing Parameters to Applets.
Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, The KeyEvent Class, Sources of Events, Event Listener Interfaces, Using The Delegation Event Model, Adapter Classes , Inner Classes.
Introducing the AWT: java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar.

TEXT BOOKS:

1. Herbert Schildt, “The Complete Reference Java”, 8/e, , TMH, 2011. (UNITS : I, IV, V 2. Sachin Malhotra, Saurabh Choudhary, “Programming in JAVA”, 2/e, , Oxford, 2014. (UNITS: I, II & III)

REFERENCE BOOKS:

1. JAVA Programming, K. Rajkumar,1/e, Pearson,2013.
2. Core JAVA, Black Book, Nageswara Rao, Wiley, 1/e, Dream Tech, 2012.

WEB REFERENCES:

https://www.tutorialspoint.com/java/index.html

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CC2104	**DATA STRUCTURES (Common to CSE, IT, CAI, CSC, CSD, CSM)**						

COURSE OBJECTIVE:

- Comprehensive knowledge of data structures and exposure to algorithmic complexities, recursive algorithms, searching, sorting and hashing techniques
- Applying Stack and Queue techniques for logical operations
- Understand Linked-list representation models in various types of applications
- Implementation of tree in various forms, orientation on graphs, representation of graphs, graph traversals, spanning trees Graphs

COURSE OUTCOMES:

After the completion of this course the student should be able to:

CO1 : Apply Searching, Sorting and Hashing techniques to solve problems.[K3]
CO2 : Analyze basic data structures such as Stacks, Queues and Linked List. [K4]
CO3 : Solve problems involving Advanced concepts of Trees. [K3]
CO4 : Analyze variety of Graph data structures that are used in various applications. [K4]

SYLLABUS:

UNIT – I

Introduction to Data Structures and Algorithms: Basic Terminology – Preliminaries of algorithms. Data Structures, Abstract Data Types (ADTs) Algorithms, Time and Space Complexity (worst-case, average-case, best-case).

UNIT-II

Searching and Sorting : Introduction to Searching, Linear Search, Binary Search, Fibonacci Search. Introduction to Sorting, Bubble sort, Selection sort, Insertion sort , Merge sort Algorithm, Heap sort, Quick sort Algorithm.

UNIT – III

Stacks: Definition, Representation of Stack, Stack ADT, Applications, Implementation, Reversing List. **Queues:** Definition, Representation of Queue, Queue ADT, Implementation of Queue using two Stacks, Exceptions, Applications, Circular Queues , Priority Queues. Infix to Postfix Conversion, Factorial Calculation,

UNIT - IV

Linked Lists: Introduction, Singly linked list, Representation of Single Linked List, Operations of SLL-Insertion, Deletion, Applications of Single Linked List: Polynomial Expression Representation. Doubly linked list, Representation of Double Linked List, Operations of Double Linked List- Insert, Delete. Circular linked list, Representation of Circular Linked List, Operations of Circular Linked List.

UNIT – V

Trees: Introduction, Binary Trees, Traversing a Binary Tree. Binary Search Trees, operations on Binary Search Trees (insertions and deletions), AVL Trees.

Graphs: Introduction, Graph Terminology, Directed Graphs, Representations of Graphs, Adjacency Matrix Representation, (Adjacency List Representation), Applications(Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra's shortest path)

TEXT BOOKS:

1. "Data Structures and Algorithmic Thinking with Python", Narasimha Karumanchi, IIT Bombay, CareerMonk Publications, First Edition, 2018.
2. Data Structures and Algorithms in Python, Michael T. Goodrich, Second Edition,2013.

REFERENCE BOOKS:

1. Python Data Structures and Algorithms, Benjamin Baka, Kindle Edition.
2. Hands-On Data Structures and Algorithms with Python, Dr. Basant Agarwal and Benjamin Baa, 2nd Edition.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=YWnBbNj_G-U
2. https://www.youtube.com/watch?v=RBxS6niE6q4

II B.TECH. I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CI2101	**COMPUTER ORGANIZATION (Common to CSE, IT, CAI, CSC, CSD & CSM)**						

COURSE OBJECTIVES:

- Comprehensive knowledge of computer system including the analysis and design of components of the system.
- Describes different parameters of a memory system, organization and mapping of various types of memories.
- Illustrates algorithms for basic arithmetic operations using binary representation.
- Describes the means of interaction of devices with CPU, their characteristics and operating modes.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO 1: Interpret the computer system from user's perspective and can explain how Arithmetic Logic Unit works. [K2]

CO 2: Explain of basic components of the system and illustrate data paths and control flow for sequencing in CPUs. [K2]

CO 3: Interpret the Micro operations and Microprogramming for design of control unit of CPU. [K2]

CO 4: Develop Main Memory Interfacing Circuit and can apply various cache memory mapping techniques. [K3]

CO 5: Apply algorithms to perform arithmetic operations on binary representation of fixed point data. [K3]

CO 6: Interpret various I/O interface devices. [K2]

SYLLABUS:

UNIT - I

Introduction: Types of Computers, Functional units of Basic Computer (Block diagram of Micro Computer).

Register Transfer and Micro-operations: Register Transfer language, Register Transfer, Bus and memory transfers - Three-State Bus Buffers, Memory Transfer; Arithmetic micro operations, Binary Adder, Binary Adder _Subtractor, Binary Incrementer, Arithmetic Circuit; Logical micro operations- List of Logic Microoperations, Hardware Implementation, Some Applications; Shift micro operations- Hardware Implementation, Arithmetic logic shift unit.

UNIT - II

Basic Computer Organization and Design: Instruction codes – Stored Program Organization, Indirect Address, Computer Registers – Common Bus Systems, Computer instructions – Instruction Set Completeness, Timing and control, Instruction cycle – Fetch and Decode, Determine the Type of Instruction, Register Reference Instructions, Memory – Reference Instructions – AND to AC, ADD to AC, LDA :Load to AC,STA: Store AC, BUN: Branch Unconditionally, BSA: Branch and Save Return Address, ISZ: Increment and Skip if Zero, Control Flow Chart, Input – Output Instructions and Interrupt – Input – Output Configuration, Input-Output Instructions.

UNIT III

Central Processing Unit: Instruction formats – Three Address Instructions, Two Address Instructions, One Address Instructions, Zero Address Instructions, RISC Instructions, Addressing modes – Numerical Example, Data Transfer and manipulation – Data Transfer Instructions, Data Manipulation Instructions, Arithmetic Instructions, Logical and Bit Manipulation Instructions, Shift Instructions, Program control – Status Bit Conditions, Conditional Branch Instructions, Subroutine Call and Return, Program Interrupt, Types of Interrupts, Reduced Instruction Set Computer – CISC Characteristics, RISC Characteristics. Micro Programmed Control Unit: Control memory, Address sequencing – Conditional Branching, Mapping of Instructions, Subroutines, Micro program example – Computer Configuration, Microinstruction Format, Symbolic Microinstructions, The Fetch Routine, Symbolic Microprogram, Design of control unit – Microprogram Sequencer.

UNIT - IV

The Memory System: Memory Hierarchy, Main memory - RAM and ROM Chips, Memory Address Maps, Memory Connection to CPU, Auxiliary memory – Magnetic Disks, Magnetic Tape, Associative Memory – Hardware Organization, Match Logic, Cache Memory – Associative Mapping, Direct Mapping, Set- Associative Mapping, Writing into Cache. Computer Arithmetic: Addition and subtraction – Addition and Subtraction with Signed Magnitude Data, Hardware Implementation, Hardware Algorithm, Addition and Subtraction with Signed 2's Complement Data, Multiplication Algorithms –Booth Multiplication Algorithm.

UNIT – V

Input-Output Organization: Peripheral Devices – ASCII Alphanumeric Characters, Input Output Interface – I/O Bus and Interface Modules, I/O vs Memory Bus, Isolated vs Memory Mapped I/O, Example of I/O Interface, Asynchronous data transfer – Strobe Control, Handshaking, Asynchronous Serial Transfer, Modes of Transfer – Example of Programmed I/O, Interrupt Initiated I/O, Priority Interrupts – Daisy Chaining Priority, Parallel Priority Interrupt, Priority Encoder, Interrupt Cycle, Direct memory Access – DMA Controller, DMA Transfer.

TEXT BOOKS:

1. M. Morris Mano, "Computer System Architecture", Third Edition, Pearson.2008

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", McGraw Hill, 5/e, 2002.
2. William Stallings, "Computer Organization and Architecture", Pearson 6/e, 2006.
3. Structured Computer Organization, Andrew S. Tanenbaum, Pearson, 4/e, 2005.
4. Sivarama P. Dandamudi, "Fundamentals of Computer Organization and Design", Springer, 2006.

WEB REFERENCES:

1. nptel.ac.in/courses/106106092
2. nptel.ac.in/courses/106103068

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	40	60	100	3
SUBCODE: R20AC2105	**SOFTWARE ENGINEERING**						

COURSE OBJECTIVE:

The student will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

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

CO1: Compare and contrast basic software engineering methods and practices. [K2].
CO2: Analyze the project management essentials [K4].
CO3: Analyze the software process models. [K4].
CO4: Outline the importance of software testing and quality control approaches [K2].

SYLLABUS:

UNIT - I

Introduction to Software Engineering: Software-Software classification, Engineering Discipline; Software Crisis, Software Engineering definition, Evolution of SoftwareEngineering Methodologies - exploratory, structured, data structure, object oriented, component based development; Software Engineering Challenges- problem understanding, quality and product, cycle time and cost, reliability, change and maintenance, usability and reusability, repeatability and process maturity, estimation and planning.

Software Processes: Software Process- software process model, elements of software process, characteristics of software process; Phased development life cycle- phased life cycle activity; Software Development Process Models- classical waterfall model, iterative waterfall, prototyping, incremental, spiral, agile process, RUP process model.

UNIT - II

Requirements Engineering: Software Requirements- business, user, system, functional and nonfunctional; Requirements engineering Process, Requirements elicitation-fact finding techniques; Requirements Analysis, Structured Analysis - data flow diagram, data dictionary, Structured analysis, pros and cons of structured analysis; Prototyping Analysis- throwaway, evolutionary; Requirements Specification- characteristics, components, structure,requirement specification methods; Requirements Validation- review, inspection, test case generation, reading, prototyping; Requirements Management.

UNIT - III

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles- abstraction, information hiding, functional decomposition, design strategies, modularity; Modular Design- coupling, cohesion; Design Methodologies- function oriented design, object oriented design; Structured Design- structure chart, structure vs flow chart; Structured Design Methodology- review and refine data flow diagram, identify boundaries between input process and output segments, apply design principles modularization criteria.

UNIT - IV

Implementation: Coding Principles- information hiding, structure programming, max cohesion and min coupling, code reusability, kiss, simplicity extensibility , code verification, code documentation; Coding Process- traditional coding process, test driven development.

Software Testing: Testing Fundamentals- errors, faults, failures, cost of defects, testing process, role of software testers; Test Planning- create a test plan, design test cases, test stubs and test drivers, test case execution, test summary report, defect tracking and statistics; BlackBox Testing- equivalence class partitioning, boundary value analysis, cause effect graphing, error guessing; White Box Testing- control flow based, path, data flow based, mutation; Levels of Testing- unit, integration, system, acceptance.

UNIT - V

Project Planning and Estimation: Project Planning activities, Software Metrics and measurements, Project Size Estimation - lines of code, functional point analysis; EffortEstimation Techniques- COCOMO cost models, analytical estimation.

Software Quality: software quality concept, Software Quality Factors, Verification & Validation, Software Quality Assurance- SQA activities, SQA plan; Capability Maturity Model (CMM) - SEI-CMM vs ISO standard.

TEXT BOOKS:

1. Ugrasen Suman, “Software Engineering, concepts and practices”, Cengage learning, 1/e, 2015.

REFERENCE BOOKS:

1. W S Jawadekar, “Software Engineering principles and practice”, TMH, 2006
2. Sommerville, “Software Engineering”, 8/e, , Pearson.
3. Roger S. Pressman, “Software Engineering”, 7/e, TMH

ADDITIONAL RESOURCES:

1. nptel.ac.in/courses/106101061

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC21L1	**DATA STRUCTURES LAB (Common to CSE, IT,CAI,CSC,CSD & CSM)**						

COURSE OBJECTIVES:

- To teach efficient storage mechanisms of data for an easy access
- To design and implementation of various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

COURSE OUTCOMES:

After the completion of this course the student should be able to

CO 1: Analyze algorithms, Searching, Sorting and hashing Techniques.[K4]

CO 2: Make use of elementary data structures such as stacks, Queues and linked list to develop their applications.[K3]

CO 3: Examine different tree traversal techniques. [K4]

CO 4: Experiment with different graph traversal techniques.[K4]

LABORATORY EXPERIMENTS

WEEK - 1

a) Write a recursive Python program which computes the nth Fibonacci number, for appropriate values of n.

b) Write recursive Python programs for the following

i) Factorial of a given number

ii) GCD Computation

iii)Towers of Hanoi

WEEK - 2

a) Write a Python program that use both recursive and non-recursive functions to perform linear search.

b) Write a Python program that use both recursive and non-recursive functions to perform binary search.

WEEK - 3

a) Write a Python program to implement Bubble sort.

b) Write a Python program to implement Insertion sort.

c) Write a Python program to implement Selection sort.

WEEK - 4

a) Write a Python program to implement Quick sort.

b) Write a Python program to implement Merge sort.

c) Write a Python program to implement Heap sort.

WEEK - 5

a) Write a Python program to implement Stack operations using arrays
b) Write a Python program to implement Queue operation using arrays.

WEEK – 6

a) Write a Python program to convert infix expression into postfix expression using Stack.

WEEK - 7

a) Write a Python program to implement Stack operation using Linked list.
b) Write a Python program to implement Queue operations using Linked lists.

WEEK - 8

Write a Python program to implement the following operations on a singly linked using functions

i) Insertion
ii) Deletion
iii) Displaying
iv) Reversing

WEEK - 9

a) Write a Python program to store a polynomial expression in memory using linked list
b) Write a Python program to representation the given sparse matrix using arrays.

WEEK - 10

a) Write a Python program to implement following Operations on a Binary Tree
i) Create
ii) In-order traversal
iii) Pre-order traversal
iv) Post-order traversal
b) Write a Python program to implement following Operations a Binary Search Tree
i) Create
ii) Insert
iii) Delete

WEEK - 11

a) Write a Python program to compute the shortest path of a graph using Dijkstra's algorithm
b) Write a Python program to find the minimum spanning tree using Krushkall's Algorithm.

WEEK - 12

Virtual Lab: http://cse01-iiith.vlabs.ac.in/
Any three programs must be submitted with result from the above link.

II B.TECH I SEMESTER	L	T	P	INTERNAL MAR	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC21	**OOPS THROUGH JAVA LAB**						

COURSE OBJECTIVE:

- The course provides user interface and application development program implementation using core java principles.

COURSE OUTCOMES:

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

CO1: Develop java programs by using OOP concepts. [K3]

CO2: Make use of interfaces, exception handling and threads to develop JAVA programs. [K3]

CO3: Make use of exception handling and collections in Java Programming. [K3]

CO4: Develop GUIs with AWT, Applets and Event Handling. [K3]

LIST OF PROGRAMS:

1. Write a JAVA program to display default value of all primitive data types of JAVA.
2. Write a JAVA program to display the Fibonacci sequence
3. Write a JAVA program give example for command line arguments.
4. Write a JAVA program to sort given list of numbers.
5. Write a JAVA program to search for an element in a given list of elements (linear search).
6. Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
7. Write a JAVA program to determine multiplication of two matrices.
8. Write a JAVA program to sort an array of strings
9. Write a JAVA program to check whether given string is palindrome or not.
10. Write a JAVA program to give the example for ‘this’ operator. And also use the ‘this’ keyword as return statement.
11. Write a JAVA program to demonstrate static variables, methods, and blocks.
12. Write a JAVA program to give the example for ‘super’ keyword.
13. Write a JAVA program that illustrates simple inheritance.
14. Write a JAVA program to maintain Student Grading Database using multilevel inheritance. Student is Super class, which contains roll no, name, address. Marks derived from Student class, which contains subject names and respective marks. Result is derived from Marks class, which contains total, grade.
15. Write a JAVA program demonstrating the difference between method overloading and method overriding.
16. Write a JAVA program demonstrating the difference between method overloading and constructor overloading.
17. Write a JAVA program to create a package named pl, and implement this package in Ex class.
18. Write a JAVA program to create a package named mypack and import it in Circle class.
19. Write a JAVA program illustrating multiple inheritance using interfaces.
20. Write a JAVA program for example of try and catch block. In this check whether the given array size is negative or not.
21. Write a JAVA program for creation of user defined exception.

22. Write a JAVA program to illustrate creation of threads using runnable interface (start method start each of the newly created thread. Inside the run method there is sleep() for suspend the thread for 500 milliseconds).
23. Write a JAVA program to create a class MyThread in this class a constructor, call the base class constructor, using super and starts the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.
24. Write a JAVA program to create an abstract class named Shape, that contains an empty method named numberOfSides ().Provide three classes named Trapezoid, Triangle and Hexagon, such that each one of the classes contains only the method numberOfSides (), that contains the number of sides in the given geometrical figure.
25. Write a Java Program to Implement HashMap API.
26. Write a Java Program to Implement HashSet API.
27. Write a Java Program to Implement ArrayList API.
28. Write a Java Program to Implement TreeSet API.
29. Write a Java Program to Implement TreeMap API.
30. Write a JAVA program using StringTokenizer class, which reads a line of integers and then displays each integer and the sum of all integers.
31. Write a JAVA program that displays number of characters, lines and words in a text file.
32. Write a JAVA program that describes the life cycle of an applet.
33. Write a JAVA program that describes passing parameters to an applet.
34. Write a JAVA program that allows user to draw lines, rectangles and ovals.
35. Write a JAVA program that displays the x and y position of the cursor movement using Mouse.
36. Write a JAVA program to create a border layout control.
37. Write a JAVA program to create a grid layout control.
38. Write a JAVA program to create a simple calculator.

Virtual Lab: http://ps-iiith.vlabs.ac.in/, www.w3schools.com
Any three programs must be submitted with result from the above link.

II B.TECH- I-SEMESTI	L	T		INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0		15	35	50	1.5
SUBCODE: R20AC21L3	**SOFTWARE ENGINEERING AND UML LAB**						

COURSE OBJECTIVES:

- To Classify the requirements and prepare software requirement documents for analyzing the projects.
- To learn importance of modelling in Software Development Life Cycle.
- To know about different diagrams and relationships.
- To develop a unified application for a system.

COURSE OUTCOMES:

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

CO 1: Compare the process of requirements development and requirements management and Examine the importance of requirements classification. [K4]
CO 2: Build use case diagrams that specify requirements for a software system.[K3]
CO 3: Develop class diagrams that demonstrate design model of a software system. .[K3]
CO 4: Make use of interaction diagrams to model the dynamic aspects of a software system[K3]
CO 5: Develop various applications using unified modeling language. .[K3]

LIST OF EXPERIMENTS

1. Requirements Development
2. Requirements Classification and Verification
3. Learning the usage of Rational Rose Software and different tools that are helpful to implement UML.
4. Create UML for Library Management system
5. Create UML for ATM system
6. Create UML for Online Railway Reservation system.
7. Create UML for Banking System.
8. Create UML for Airlines System.
9. Create UML for Student Information System.

ONLINE REFERENCES:

1. https://www.udemy.com/uml-fundamentals/
2. https://www.youtube.com/watch?v=OkC7HKtiZC0&list=PLGLfVvz_LVvQ5G-LdJ8RLqe-ndo7QITYc
3. https://www.youtube.com/watch?v=RRXe1omEGWQ&list=PLD4EF3E3AD055F3C7

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4	0	50	50	2
SUBCODE: R20CC21SC1	**DATA SCIENCE LAB**						

COURSE OBJECTIVE:

- To familiarize students with how various statistics like mean median etc. can be collected for data exploration in Python
- To provide a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world

COURSE OUTCOMES:

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

CO 1: Demonstrate the basic arithmetic programming in python[K3]

CO 2: Analyze different data structures and choose suitable one for a given problem[K4]

CO 3: Demonstrate Data cleaning, processing for the given dataset using respective packages.[K3]

CO 4: Perform Data visualization[K3]

CO 5: Solve the problems related to Descriptive and Inferential Statistics for a given scenario.[K4]

SYLLABUS:

EXPERIMENT 1: Basic Arithmetic with Python

A. Develop a python program to calculate the Greatest Common Divisor for two numbers. Create twoseparate procedures(functions) to illustrate the iterative and recursive solutions.

B. Develop a python program to calculate the next number in the Fibonacci series for a given number(which may or may not be in the Fibonacci series).

C. Develop a python program to calculate the square root of (N+1)th Prime number for a given number Nusing binary search with a precision of upto 7 decimal places.(Avoid built-in square root function)

D. Design a Python program to determine the difference in days for two dates in YYYY:MM:DDformat(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.

Experiment 2: Text file processing & Basic Statistics

A. Develop Python program to generate count of words in a text file

B. Write a program in Python with functions to calculate the following for comma-separated numbers in atext file(.txt)

a. 3rd Maximum number

b. 9th Minimum number

c. Total Unique Count

d. Mean

e. Standard Deviation

f. Number(s) with maximum frequency

g. Number(s) with minimum frequency

Experiment 3: Exploring the Numpy library for multi-dimensional array processing

A. Develop programs in Python to implement the following in Numpy
a. Array slicing, reshaping, concatenation and splitting
b. Universal functions in Numpy
c. Aggregations
d. Broadcasting
e. Fast sorting

Experiment 4: Data cleaning and Processing with Pandas

A. Develop the following programs in Python
a. Implementing and querying the Series data structure
b. Implementing and querying the DataFrame data structure
c. Perform DataFrame indexing
d. Merge DataFrames

Experiment 5: Advanced Data Processing and Transformation

A. Implement the following using the Pandas library
a. Pandas idioms
b. Groupby
c. Scales
d. Pivot tables

Experiment 6: Data Visualization-I

A. Write programs to demonstrate different plots like Line Chart, Bar Chart, Histogram, Pie Chart,Stacked Bar Chart, Scatter Plot, Box Plot, Heat Map by loading the real-time data.
B. Write programs to create subplots.

Experiment 7: Data Visualization-II

A. Write programs to illustrate different plotting data distributions like Univariate Distributions, BivariateDistributions.
B. Write programs to demonstrate plotting Categorical and Time-Series Data.

Experiment 8: Probability Distributions

A. Generate and Visualize Discrete and continuous distributions using the statistical environment.Demonstration of normal, binomial and Poisson distributions.
B. Generate artificial data using and explore various distributions and its properties. Various parameterchanges may be studied.

Experiment 9: Building Confidence in Confidence Intervals

A. Populations Versus Samples
B. Large Sample Confidence Intervals
C. Simulating Data Sets
D. Evaluating the Coverage of Confidence Intervals

Experiment 10: Perform Tests of Hypotheses

A. Perform tests of hypotheses about the mean when the variance is known. Compute the p-value.Explore the connection between the critical region, the test statistic, and the p-value

TEXT BOOKS:

1. EMC Education Services "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing andPresenting Data", Wiley Publishers, 2012.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. Jiawei Han, Micheline Kamber and Jian Pei, Data Mining: Concepts and Techniques, 3rd ed.

REFERENCE BOOKS:

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013.
3. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
4. Hastie, Trevor, et al., "The elements of statistical learning: Data Mining, Inference, and Prediction",Vol. 2. No. 1. New York: Springer, 2009.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	-	-	-	-	-	0
SUBCODE: R20CC21MC2	**CONSTITUTION OF INDIA (MC)**						

COURSE OBJECTIVES:

- To train students in understanding the basic structure of Indian Constitution
- To aware the students about the role of constitution in a democratic society
- To prepare students to live better and happily with other fellow beings through the application of Fundamental Rights in their lives.
- To know about the powers of Union Government and State Government

COURSE OUTCOMES:

*CO1: **Examine salient features of Indian Constitution and live accordingly in society & interpret the meaning of Fundamental Rights of State Policy.***

CO2: Discover various aspects of Union Government legislation and live up to the expectations of the rules.

CO3: Critically examine State Government legislation and improve your living standards by following the rules strictly

CO4: Examine powers and functions of local bodies such as Municipalities and Panchayats and, take advantage of available resources for better living

CO5: Analyze the powers and functions of Election Commission and The Union Public Service Commission and decide upon it for safe and secured life.

UNIT-I:

INTRODUCTION TO INDIAN CONSTITUTION & FUNDAMENTAL RIGHTS:
Meaning of the term Indian Constitution –Preamble- Constituent Assembly- Salient Features of Indian Constitution. Fundamental Rights -Fundamental Duties -The Directive Principles of State Policy.

UNIT-II:

UNION GOVERNMENT: Union Government -Union Legislature (Parliament) -Lok Sabha and Rajya Sabha (with Powers and Functions) -Union Executive -President of India (with Powers and Functions) -Prime Minister of India (with Powers and Functions) -Union Judiciary (Supreme Court) -Jurisdiction of the Supreme Court

UNIT-III:

STATE GOVERNMENT : State Government -State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) -Powers and Functions of the State Legislature -State Executive-Governor of the State (with Powers and Functions) -The Chief Minister of the State (with Powers and Functions) -State Judiciary (High Courts)

UNIT-IV:

LOCAL SELF GOVERNANCE: Powers and functions of Municipalities, Panchyats, ZP's and Co – Operative Societies

UNIT-V:

SOVEREIGN BODIES : Election Commission of India (with Powers and Functions) -The Union Public Service Commission (with Powers and Functions)

TEXT BOOKS:

1. Introduction to constitution of India, Durga Das Basu, Lexis Nexis Publications
2. Constitution of India by PRFESSIONAL BOOK PUBLISHERS
3. The Constitution of India by Arun K Tiru vengadam, Blooms bury publishers.
4. The constitution of India by PM Bakshi, Universal law publishing co
5. The Constitution of India by S.R. Bhansali, Universal law publishing co

II B.TECH – II SEMESTER

S.No.	Subject Code	SUBJECT	Cat. Code	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	L	T	P	CREDITS
1	R20CC2211	Mathematical Foundations of Computer Science	BS	30	70	100	3	0	0	3
2	R20CC2203	Database Management Systems	PC	30	70	100	3	0	0	3
3	R20CC2210	Numerical Methods & Transformations	BS	30	70	100	3	0	0	3
4	R20AM2205	Artificial Intelligence	PC	30	70	100	3	0	0	3
5	R20AC2204	Operating Systems	PC	30	70	100	3	0	0	3
6	R20DS22L1	Database Management Systems Lab	PC	30	70	100	0	0	3	1.5
7	R20CS22L3	Operating Systems Lab	PC	15	35	50	0	0	3	1.5
8	R20AC22L4	Front End Web Technologies Lab	PC	15	35	50	0	0	3	1.5
9	R20CC22SC3	Mobile Application Development Lab	SOC	-	50	50	0	0	4	2
TOTAL										**21.5**
10		**Honors/Minor Course**		30	70	100	4	0	0	4

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC2211	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (CSE,IT,CSC,CSD,CSM)**						

COURSE OBJECTIVE:

- The course provides with the basic mathematical implication for computer science, applications of mathematics in computer science.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO 1: Apply the logical statements, connectivity among the statements and forms different types of normal forms. [K3]

CO 2: Analyze the theory of Inference for statement calculus. [K4]

CO 3: Classify the types of graphs and trees to formulate computational problems.[K4]

CO 4: Apply DNF and CNF on Boolean algebraic functions to simplify the digital (logic) circuits. [K3]

CO 5: Solve mathematical problems with recurrence relations using different methods. [K3]

SYLLABUS

UNIT – I: Mathematical Logic: (10 hours)

Statements and Notations, Connectives - Negation, Conjunction, Disjunction, Statement Formulas and Truth tables, Conditional Statements, Bi Conditional Statements, Well-formed Formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Functionally Complete Sets of Connectives, Other Connectives; Normal Forms - Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms, Principal Conjunctive Normal Forms, Ordering and Uniqueness of Normal Forms.

UNIT – II: THE THEORY OF INFERENCE FOR THE STATEMENT CALCULUS: (10 hours)

Validity Using Truth Tables, Consistency of Premises and Indirect method of proof.

Predicate calculus: Predicates, Statement Function, Variables and Quantifiers, Free and Bound Variables, Inference Theory of Predicate Calculus, Exercises.

Mathematical Induction: Principle of Mathematical Induction, Exercises.

UNIT – III: GRAPH THEORY: (12 hours)

Definitions, finite and infinite graphs, incidence and degree, isolated pendant vertices, isomorphism, sub graphs, walk, path and circuit, connected and disconnected graphs, components, Euler graphs, Euler graph theorem, operations on graphs, decomposition of Euler graphs into circuits, arbitrarily traceable Euler graphs, Hamiltonian paths and circuits, number of edge disjoint Hamiltonian circuits in complete graph with odd number of vertices, travelling salesman problem.

Trees: Some properties of trees, pendant vertices, distance and centers, rooted and binary trees, spanning trees, fundamental circuit, shortest spanning trees, Kruskal's algorithm

UNIT – IV: RECURRENCE RELATION: (8 hours)

Recurrence Relations, Formation of Recurrence Relations, Solving linear homogeneous recurrence Relations by substitution method, generating functions and The Method of Characteristic Roots. Solving Inhomogeneous Recurrence Relations.

UNIT – V: BOOLEAN ALGEBRAS & COMBINATORICS: (8 hours)

Boolean Algebras: Boolean Algebras, Boolean Polynomials, Disjunctive and Conjunctive Normal forms, Switching Circuits and Applications.

Combinatorics: Basic Counting Principles, Permutations and Combinations: Permutations, Combinations, Restricted Combinations, Pigeonhole Principle and its Application.

TEXT BOOKS:

1. Tremblay & Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TMH.
2. Bhavanari Satyanarayana and Kunchan Syam Prasad "Discrete Mathematics", PHI, India, ISBN: 978-81-203-4948-3.
3. Bhavanari Satyanarayana, T. V. Pradeep, Sk. Mohiddin Shaw, "Mathematical Foundation for Computer Science", B.S Publications, Hyd: 2016, ISBN: 978-93-83635-81-8.

REFERENCE BOOKS:

1. Rosen, "Discrete Mathematics and its Applications with combinatorics and graph theory", 7th edition, TMH
2. Purna Chandra Biswal, "Discrete Mathematics and Graph theory", 3rd rd, PHI.
3. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", 2nd Edition, PHI.

ADDITIONAL RESOURCES:

1. nptel.ac.in/courses/106106094
2. nptel.ac.in/courses/106108054 (Graph Theory)

II B.TECH. II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUB CODE: R20CC2203	**DATABASE MANAGEMENT SYSTEMS** (Common to CSE, IT,CAI,CSC,CSD & CSM)						

COURSE OBJECTIVE:

- Provides students with theoretical knowledge and practical skills in the design, use of databases and database management systems in information technology applications.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1 : Interpret the fundamentals of DBMS. [K2]
CO2 : Analyze DB design methodology and normalization process. [K4]
CO3 : Develop Queries in RDBMS. [K3]
CO4 : Compare and Contrast various transaction and concurrency management techniques. [K2]
CO5 : Analyze various file organizations and indexing techniques. [K4]

SYLLABUS:

UNIT I:

Introduction: History of Data base Systems, Data base System Applications, purpose of database systems, View of Data, Database Languages, Database Access from applications Programs, data base System Structure, data base Users and Administrators, Transaction Management, Storage Manager, the Query Processor.

UNIT-II:

Introduction to Database Design: Data base design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Case Study .

The Relational Model: Introduction to the Relational Model, Integrity Constraint Over relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design ER to Relational, Introduction to Views, Destroying /altering Tables and Views.

UNIT III:

Relational Algebra: Relational Algebra.

SQL: Queries, Constraints, Triggers:- Form of Basic SQL Query, Union, Intersect and Except, Nested Queries, Aggregative Operators, NULL values, Complex Integrity Constraints in SQL, Triggers and Active Data bases.

UNIT IV:

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, reasoning about FDS, FIRST, SECOND and THIRD Normal forms, BCNF, Properties of Decomposition, Multi valued Dependencies, FOURTH Normal Form.

UNIT V:

Transactions: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation.

Concurrency Control: Lock-based protocols, Timestamp-based protocols.

Overview of Storage and Indexing:
Data on External Storage, File Organization and Indexing, Index data Structures
Tree Structured Indexing: Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic index Structure.

TEXT BOOKS:

1. Raghuram Krishnan, Johannes Gehrke, "Database Management Systems", TMH, 3/e, 2008.
2. Silberschatz, Korth, "Database System Concepts", TMH, 6/e, 2010.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", PEA, 6/e, 2011.
2. C J Date, "Introduction to Database Systems", PEA, 8/e, 2006.
3. Database System Concepts, Peter ROB, Coronel, Ceneage, 6/2, 2011.

WEB REFERENCES:

1. nptel.ac.in/courses/106106093
2. nptel.ac.in/courses/106104135

II B.TECH-	L	T	P	INTERNAL	EXTERNAL	TOTAL	CREDITS

II SEMESTER				MARKS	MARKS	MARKS	
	3	0	0	30	70	100	3
Code:R20CC2210	**NUMERICAL METHODS AND TRANSFORMATIONS** (CSE(AI-ML), CSE(DS), CSE(CS))						

COURSE OBJECTIVES:

1. To elucidate the different numerical methods to solve nonlinear algebraic equations.
2. To propagate the use of different numerical techniques for carrying out numerical integration.
3. Explore the use of Laplace transform method to solve with initial value problems of ODE.
4. To acquire fundamental Knowledge of Fourier series and Fourier Transform and able to give Fourier expansions of a given function.

COURSE OUTCOMES:

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

1. Evaluate approximating roots of polynomials and transcendental equations by different algorithms. [**Evaluating – K5**]
2. Apply Newton's forward backward and Lagrange's interpolation for equal and unequal intervals. [**Apply – K3**]
3. Apply different algorithms for approximating solutions of ordinary differential equation to its analytical computations. [**Apply – K3**]
4. Select appropriate technique of Laplace transforms in solving differential equations. [**Apply – K3**]
5. Apply Fourier series, integral, transforms techniques in their core. [**Apply – K3**]

UNIT –I: ITERATION METHODS: (6 hours)

Solution of Algebraic and Transcendental Equations: Introduction- Bisection method, Method of false position, Iteration method, Newton-Raphson method (One variable and simultaneous Equations).

UNIT –II: INTERPOLATION: (8 hours)

Interpolation: Introduction- Errors in polynomial interpolation – Finite differences- Forward differences- Backward differences –Central differences – Symbolic relations and separation of symbols - Differences of a polynomial-Newton's formulae for interpolation – Interpolation with unequal intervals – Newton's Divided difference formula, Lagrange's interpolation formula.

UNIT –III: NUMERICAL DIFFERENTIATION AND INTEGRATION: (10 hours)

Numerical Differentiation, Ordinary differential equations-Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Numerical integration- trapezoidal rule, Simpson's 1/3rd and 3/8th rules.

UNIT – IV: FOURIER SERIES & FOURIER TRANSFORMS: (12 hours)

Introduction, Euler's formulae, Periodic functions, Dirichlet's conditions, conditions for a Fourier expansion, functions of any period, functions having points of discontinuity, odd and even functions - half range series. Fourier integral theorem (without proof), Fourier cosine and sine integrals, Fourier transform, Fourier sine and cosine transforms, properties of Fourier Transforms, convolution theorem (without proof).

UNIT-V: LAPLACE & Z- TRANSFORMATIONS: (12 hours)

Laplace transform and its properties, Transform of derivatives and integrals, Multiplication by tn, division by t, Unit step function and unit impulse function. Transform of periodic functions, Evolutions of integrals by Laplace Transforms. Finding inverse transforms by the method of partial fractions, other methods of finding inverse Laplace Transforms, Convolution theorem(without proof), Solutions of Initial and Boundary Value Problems.

z-transform: Introduction, properties, Damping rule, Shifting rule, Initial and Final value theorems, Inverse z-transform, Convolution theorem, Solutions of difference equations.

TEXT BOOK:

1. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publisher.
2. B.V.Ramana, "Higher Engineering Mathematics", 32nd Edition, McGraw Hill Education, 2018.

REFERENCES:

1. N.P. Bali, Bhavanari Satyanarayana, Indrani Promod Kelkar, "Engineering Mathematics", University Science Press, (An Imprint of Lakshmi Publications Pvt., Ltd) New Delhi, 2012.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEditiwiley-India.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage Learning, 2011.

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4	15	35	50	2
SUBCODE: R20AM2205	**ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents:Search, Knowledge representation, inference, logic and learning.
- The knowledge of artificial intelligence plays a considerable role in some applications students developfor courses in the program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO 1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO 2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]
CO 3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO 4: Apply the basic knowledge on learning and reinforcement learning. [K3]
CO 5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

UNIT - I

Introduction to AI, Problems, Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the Design of Search Programs.

UNIT - II

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Knowledge Representation Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

Weak slot-and-filler structures: Semantic Nets, Frames,

Strong slot-and-filler structures: Conceptual dependency, Scripts

UNIT - IV

Learning: Rote learning, learning by taking advice, learning in problem solving,

Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm, temporaldifference Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and PragmaticProcessing, Statistical Natural language Processing, Spell Checking,

Parallel and Distributed AI: Parallelism in Reasoning Systems, Distributed Reasoning Systems.

TEXT BOOKS:

1. Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint2008.
2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003
3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES

1. https://www.coursera.org/learn/machine-learning
2. https://www.simplilearn.com/big-data-and-analytics/machine-learning
3. https://www.appliedaicourse.com/course/applied-ai-course-online
4. http://nptel.ac.in/courses/106105152

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
Code: R20AC2204	**OPERATING SYSTEMS**						

COURSE OBJECTIVES:

- To gain knowledge about the Operating Systems concepts such as process, main memory management, secondary memory management, Deadlocks, CPU and disk scheduling etc.,

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1 : Classify various operating system functionalities and generations. [K2]
CO2 : Interpret process management and exemplify the process synchronization techniques. [K2]
CO3 : Apply various process scheduling algorithms. [K3]
CO4 : Distinguish various memory management techniques and apply various deadlock techniques. [K4]
CO5 : Compare and contrast various disk scheduling algorithms and can interpret the file system implementations. [K2]

SYLLABUS:

UNIT - I

Computer System and Operating System Overview: Overview of Operating System - What operating systems do, User view, System view, defining operating systems; Operating Systems functions- Process Management, Memory Management, Storage Management, File- System Management, Mass-Storage Management, Caching, Protection and security; Distributed systems, Special purpose systems, Real-Time Embedded Systems, Multimedia Systems, Handheld Systems, Operating Systems Structures, Simple Structure, Layered Approach, Micro Kernels, Modules; Systems Calls- Process control, File management, Device management, Information maintenance, Communication; Operating systems generation.

UNIT - II

Process Management: Process, Process States, Process Control Block, Process Scheduling Scheduling Queues, Schedulers; Operations- Process Creation, Process termination; Inter process communication- Shared-Memory Systems, Message-Passing Systems, Naming, Synchronization, Buffering; Multi Thread programming models- Many to one, One to one, Many to Many model;
Process Scheduling Criteria- CPU scheduler, Pre-emptive scheduling, Dispatcher, Scheduling Criteria; CPU Scheduling Algorithms- First Come First Serve, Shortest job first, Priority Scheduling, Round robin scheduling.

UNIT - III

Concurrency: Process Synchronization, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware. Semaphores- Usage, Implementation, Deadlock and Starvation; Classic Problems of Synchronization- Bounded buffer problem, Readers writers' problem, Dining-Philosophers problem; Monitors- Usage, Dining-Philosophers solution using monitors.

Memory Management: Swapping, Contiguous Memory Allocation- Memory Allocation, Fragmentation; Paging- Basic Method, Hardware Method, Protection, shared pages; Structureof the Page table- Hierarchical Paging, Hashed Page Tables. Segmentation- Basic Method, hardware.

UNIT - IV

Virtual Memory Management: Virtual Memory. Demand Paging- Basic concept, copy on write; Page-Replacement Algorithms- Basic page replacement, FIFO page replacement, optimal page replacement, LRU page replacement, LFU page replacement; Thrashing- Cause of Thrashing, Working set model, Page fault frequency.

Principles of Deadlock: Deadlock System Model. Deadlock Characterization- Necessary Conditions, Resource allocation graph; Deadlock Prevention- Mutual exclusion, Hold andwait, No pre-emption, Circular wait; Deadlock Detection and Avoidance- Resource allocationGraph algorithm, Banker's algorithm, Single instance of each resource type, several instances of each resource type; Recovery Form Deadlock- Process termination, Resource pre-emption.

UNIT - V

File System: The Concept of a File- file attributes, file operations, file types, file structures;Access Methods- sequential access, direct access, other access methods; Directory Structure-single level directory, two level directories, tree structured directory, general graph directory;File Sharing-multiple users, remote file systems; Protection- types of access, access control. **Implementing File System:** File System Structure. File System Implementation- overview,partitions and mounting, virtual file systems; Allocation Methods- contiguous allocation,linked allocation, indexed allocation; Free-Space Management- linked list, grouping,counting. **Disk Scheduling**- FCFS scheduling, SSTF scheduling, SCAN scheduling,C-SCAN scheduling, LOOK scheduling.

TEXT BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", JohnWiley, 7/e, 2016.

REFERENCE BOOKS:

1. William Stallings, "Operating Systems – Internal and Design Principles", PearsonEducation, 6/E, 2005.
2. D.M.Dhamdhere, "Operating Systems – A Concept based Approach" –, TMH, 2/e, 2005.
3. Crowley, "Operating System a Design Approach", TMH, 1/e, 2005.
4. Andrew S Tanenbaum , "Modern Operating Systems", PHI, 3/e, 2013.

WEB REFERENCES:

1. nptel.ac.in/courses/106108101
2. nptel.ac.in/courses/106106144

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC22L1	**DATABASE MANAGEMENT SYSTEMS LAB** (Common to CSE, IT, CAI,CSC,CSD & CSM)						

COURSE OUTCOMES:

After Completion of this course student must be able to

CO1 : Apply SQL commands like DDL, DML and DCL to perform different Database operations [K3].

CO2 : Develop PL/SQL block statements, control statements and cursors. [K3]

CO3 : Develop PL/SQL programs using functions and procedures. [K3]

CO4 : Develop PL/SQL programs using packages and Triggers. [K3]

PROGRAMS LIST:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints.
   Example:- Select the roll number and name of the student who secured fourth rank in the class.
5. i) Creation of simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
   ii) Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.
11. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
12. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

TEXT BOOKS:

1. SCOTT URMAN, “ORACLE DATA BASE LOG PL/SQL Programming”, Tata Mc-Graw Hill.

REFERENCES:

1. Benjamin Rosenzweig, Elena Silvestrova “ORACLE PL/SQL by example”, Pearson Education 3/e
2. Dr.P.S. Deshpande, “SQL & PL/SQL for Oracle 10g”, Black Book.
3. Pranab kumar Das Gupta, P Radha Krishna, “Data Base Management System, Oracle SQL and PL/SQL” , PHI.

WEB REFERENCES:

3. nptel.ac.in/courses/106106093
4. nptel.ac.in/courses/106104135
5. https://www.edx.org/course/databases-5-sql
6. https://www.coursera.org/projects/introduction-to-relational-database-and-sql

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	20	30	50	1.5
CODE:R20AM22L3	OPERATING SYSTEMS LAB						

COURSE OBJECTIVE:

- To enlighten the student with knowledge base in Operating Systems

COURSE OUTCOMES:

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

- **CO 1:** Apply various scheduling, page replacement and Deadlock avoidance algorithms for effective utilization of the CPU. [K3]
- **CO 2:** Demonstrate various Memory Management Techniques. [K2]

LIST OF EXPERIMENTS

Week 1: Simulate the following CPU scheduling algorithms.
a) FCFS b) SJF c) Round Robin d) Priority.

Week 2: Write a C program to simulate producer-consumer problem using Semaphores

Week 3: Write a C program to simulate the concept of Dining-philosophers problem.

Week 4: Simulate MVT and MFT.

Week 5: Write a C program to simulate the following contiguous memory allocation Techniques
a) Worst fit b) Best fit c) First fit.

Week 6: Simulate all page replacement algorithms
a)FIFO b) LRU c) OPTIMAL

Week 7: Simulate all File Organization Techniques
a) Single level directory b) Two level directory.

Week 8: Simulate all file allocation strategies
a) Sequential b) Indexed c) Linked.

Week 9: Simulate Bankers Algorithm for Dead Lock Avoidance.

Week 10: Simulate Bankers Algorithm for Dead Lock Prevention.

Week 11: Write a C program to simulate disk scheduling algorithms.
a) FCFS b) SCAN c) C-SCAN

REFERENCE BOOKS:

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7thEdition, John Wiley.

WEB REFERENCES:

1. https://www.udemy.com/uml-fundamentals/
2. https://www.youtube.com/watch?v=OkC7HKtiZC0&list=PL GLfVvz_LVvQ5G- LdJ8RLqe-ndo7QITYc
3. https://www.youtube.com/watch?v=RRXe1omEGWQ&list=PLD4EF3E3AD055F3C7

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	-	3	15	35	50	1.5
SUBCODE: R20CC21L3	**FRONT END WEB TECHNOLOGIES LAB**						

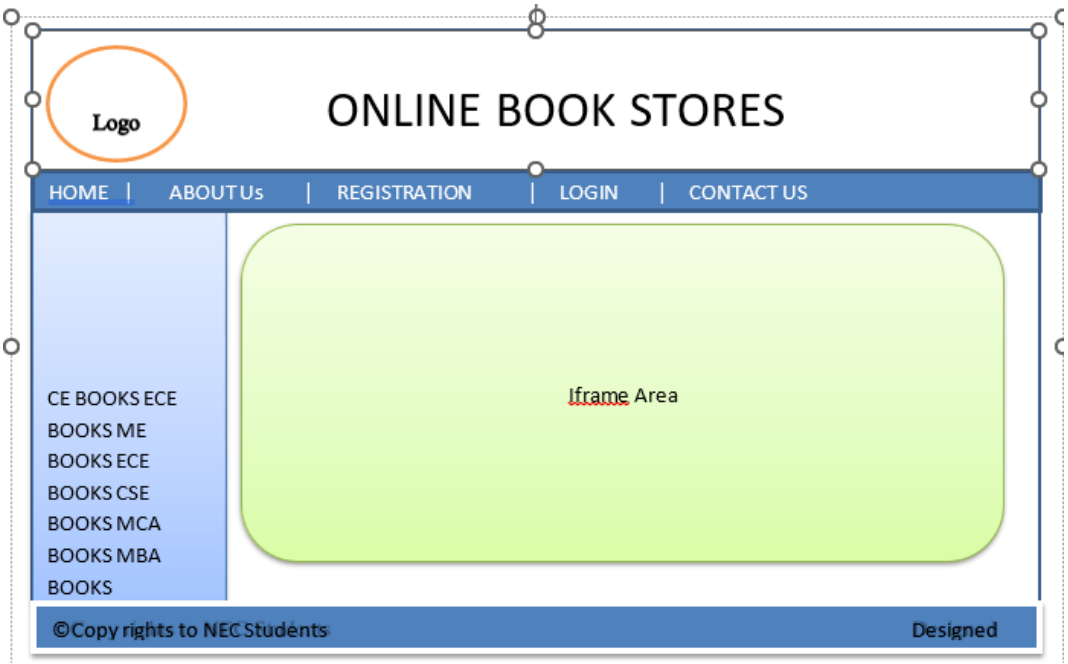
COURSE OBJECTIVES:

- This course provide students with theoretical and practical skills in the design and development of web pages using HTML5,CSS, JS and jQery.

COURSE OUTCOMES:

After Completion of this course, students would be able to:
CO 1: Develop static html pages [K3].
CO 2: Develop Interactive Web Pages with different styles and client side validations[K3].
CO 3: Make use of JQuery programming to develop Web pages [K3].
CO 4: Apply JQuery UI to HTML pages [K3].

LIST OF PROGRAMS:



LAB 1: Create the following web

1. Welcome.html
   It explain about website
   (Hint: Heading the website (Preferable H1, Describe website) it includes minimum two paragraphs)

2. Aboutus.html (Hint: About owner of website)
3. Contactus.html
4. List.html (Hint: Mention List of courses)

Lab 2:

a. Create web pages for each course. Example cse.html (Hint: It contains Heading and List of subjects in tabular form) Example

SNo	Title Book	Author	Publisher	Price	Image
--	--	--	--	--	--

b. Create Registration and Login forms
   Registration Form: It contains Student Name, Roll Number, Password, Gender, Email ID, Phone Number, opted course and languages known.
   Login Form: It contains roll number as User ID, password, submit button and cancel button.

Lab 3: Apply CSS 3 on web-pages created on Lab 1 and Lab2.
Make use of the selectors like class, id, html elements, pseudo classes and elements

Lab 4:

a. Apply validation on Registration and Login forms.
b. In contactus.html web-page add Google maps.

Lab 5:

a. Design HTML5 web page by embedding Audio, Video elements.
b. Write HTML5 and JavaScript code to draw Arc, Circle, Rectangle and Triangle using Canvas.

Lab 6: Bootstrap Concepts on Grid System, Menus

Lab 7: Create index.html page and design it as shown in above screen (Hint: Use Bootstrap Grid System, Horizontal and vertical menus, footer, table etc.)

Lab 8: Write a jQuery code to make draggable Rectangle

Lab 9: Write jQuery code to demonstrate the usage of important options disabled, delay, distance and clone in the drag function of jQuery UI.

Lab 10: Write jQuery code to demonstrate three options addClass, disable and tolerance in the drop function of jQuery UI.

Lab 11: Write jQuery code to demonstrates the use of two options delay and distance of selectable() method.

Lab 12: Write jQuery code to demonstrate Accordion and Date Picker.

Lab 13: Virtual Lab : www.w3schools.com

WEB REFERENCES:

1. https://www.w3schools.com/
2. https://jqueryui.com/
3. https://api.jquery.com/
4. https://www.educba.com/software-development/software-development-tutorials/html-tutorial/

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	-	**-**	**3**	**20**	**30**	**50**	**1.5**
SUBCODE: R20CC22SC3	**MOBILE APPLICATION DEVELOPMET LAB**						

COURSE OBJECTIVES:

- To enlighten the student with knowledge base in Android Applications Development.

COURSE OUTCOMES:

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

CO1 : Demonstrate various components of Android Framework.[K2].
CO2 : Develop user Interfaces for the Android Application.[K3].
CO3 : Develop Android Applications using Android API and Services.[K3].
CO4 : Develop Android Applications which access data from Internet.[K3].

LIST OF EXPERIMENTS

1. Create Hello World Android App using **Android Studio** and explain each step in detail.
2. Create an Activity that receive name form the user and displays **Hello Name** to the user using Android Studio.
3. Create an Activity that demonstrates the Life Cycle of an Activity.
4. Create an Android Application which receives URL form the user and open appropriate page in the system browser with the help of Implicit Intents using Android Studio.
5. Create an Android App which receives name form the user and displays welcome name in Second Activity.
6. Create Login Screen Application which shows Home screen if Login success otherwise displays error message using Android Studio.
7. Write an Android application program that demonstrate the use of
   a. RelativeLayout.
   b. LinearLayout.
   c. GridLayout.
   d. TableLayout.
8. Write an Android application program that demonstrates the use ImageView.
9. Write an Android application program that demonstrates the use of ListView and ArrayAdapter.
10. Write an Android application program that demonstrates how to create Custom ListView and Custom Adapters.
11. Write an Android application program that demonstrates the use of SQLite Database and Cursor.
12. Write an Android application program that demonstrates the use AsyncTask.
13. Write an Android application program that demonstrates Notifications.
14. Write an Android application program that demonstrates Shared Preferences.
15. Write an Android application program that connect to the internet, gets JSON data and displays the result in UI by parsing JSON data.

ONLINE REFERENCES:

1. https://developer.android.com/index.html
2. http://nptel.ac.in/courses/106106147/10

3. https://www.edx.org/course/introduction-mobile-application-hkustx-comp107x-2
4. https://www.coursera.org/specializations/android-app-development

III B.TECH. – I SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC3110	Principles Of Machine Learning	PC	30	70	100	3	0	0	3
2	R20CC3102	Data Warehousing and Data Mining	PC	30	70	100	3	0	0	3
3	R20CC3104	Computer Networks	PC	30	70	100	3	0	0	3
4	R20CS3105 R20CC3109 R20AM3101 R20AM3103	Professional Elective - I • Compiler Design • Devops • Computer Vision • High Performance Computing	PE	30	70	100	3	0	0	3
5	**Open Elective – I**		OE	30	70	100	3	0	0	3
6	R20CC31L4	Machine Learning Lab	PC	15	35	50	0	0	3	1.5
7	R20CC31L1	Data Warehousing and Data Mining Lab	PC	15	35	50	0	0	3	1.5
8	R20CC31SC1	Mean Stack Technologies Lab	SC	-	50	50	1	0	2	2
9	R20CSP	Community Service Project	PR	-	50	50	0	0	0	1.5
10	R20CC31MC01	Professional Ethics and Human Values	MC			-	2	0	0	0
TOTAL										**21.5**
11		**Honors/Minor Course**		30	70	100	4	0	0	4

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3110	**PRINCIPLES OF MACHINE LEARNING**						

COURSE OBJECTIVES:

The course is introduced for students to

- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about Dimensionality reduction

COURSE OUTCOMES:

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

CO1 : Analyze practical issues in machine learning application. [K4]
CO2 : Apply decision tree algorithms for appropriate problem domains. [K3]
CO3 : Apply and interpret statistical techniques. [K4]
CO4 : Apply ML techniques to solve classification. [K3]
CO5 : Apply ML techniques to solve regression problems. [K3]

SYLLABUS:

UNIT-I

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT-II

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT-III

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

UNIT-IV

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

UNIT-V

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.

Instance Based Learning:
Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,

TEXT BOOKS:

1. T.M. Mitchell, "Machine Learning", McGraw-Hill, 1997.
2. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

REFERENCE BOOKS:

1. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

E-RESOURCES:

1. https://www.youtube.com/watch?v=FeGe35iYTXU&list=PL4gu8xQu0_5JBO1FKRO5p20wc8DprlOgn

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3102	**DATA WAREHOUSING AND DATA MINING**						

COURSE OBJECTIVES:

- Identify the scope and necessity of Data Mining & Warehousing for the society.
- Describe the design of Data Warehousing so that it can be able to solve the root problems.
- Categorize and carefully differentiate between situations for applying different data mining techniques: mining frequent patterns, association, correlation, classification, prediction, and cluster analysis.
- Evaluate the performance of different data mining algorithms.
- To develop further interest in research and design of new Data Mining Techniques.

COURSE OUTCOMES:

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

CO 1: Interpret the data mining terminology and types of data to be mined. [K2]
CO 2: Outline the need and importance of pre-processing techniques and apply them.[K2]
CO 3: Interpret data warehousing concepts and operations. [K2]
CO 4: Compare and contrast different dominant Data Mining Algorithms for Classification and Clustering and apply them. [K4]
CO 5: Analyze the performance of Association Rules. [K4]

SYLLABUS

UNIT– I

Introduction to data mining: -What Is Data Mining, -Motivating Challenges, -The Origins of Data Mining, -Data Mining Tasks, -Types of Data: Attributes and Measurement, Types of Data Sets, -Data Quality: Measurement and Data Collection Issues, Issues Related to Applications.

UNIT–II

Data:- Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature Creation, Discretization and Binarization, Variable Transformation, -Measures of similarity and dissimilarity: Basics, Similarity and Dissimilarity between Simple Attributes, Dissimilarities between Data Objects, Similarities between Data Objects, Examples of Proximity Measures.

Exploring data: -The Iris Data set, -Summary Statistics: Frequencies and the Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Multivariate Summary Statistics, Other Ways to Summarize the Data.

UNIT–III

Data Warehouse and OLAP Technology for Data Mining: -What is a Data Warehouse, -A Multidimensional Data Model: From tables to data cubes, Stars, snowflake, and fact constellations(schemas for multidimensional databases), Examples for defining star, snowflake and fact constellation schemas, Measures(their categorization and computation), Introducing concept hierarchies, OLAP operations in the multidimensional data model, A starnet query model for querying multidimensional databases, -Data Warehouse Architecture: Steps for the design and construction of

data warehouses, A three-tier data warehouse architecture, OLAP server architectures: ROLAP vs. MOLAP vs. HOLAP, SQL extensions to support OLAP operations, Data Warehouse implementation: Efficient computation of data cubes, Indexing OLAP data, Efficient processing of OLAP queries, Metadata repository, Data warehouse back-end tools and utilities, -Further development of data cube technology: Discovery-driven exploration of data cubes, Complex aggregation at multiple granularities (Multifeature cubes), -From data warehousing to data mining: Data warehouse usage, From online analytical processing to online analytical mining.

UNIT-IV

Classification: Basic Concepts, Decision Trees, and Model Evaluation: -Preliminaries, - General Approach to Solving a Classification Problem, Decision Tree Induction: How a Decision Tree Works, How to Build a Decision Tree, Methods for Expressing Attribute Test Conditions, Measures for Selecting the Best Split, Algorithm for Decision Tree Induction, -Model Overfitting: Overfitting Due to Presence of Noise, Overfitting Due to Lack of Representative Samples, Evaluating the Performance of a Classifier: Holdout Method, Random Subsampling, Cross Validation, Bootstrap.
Classification: alternative techniques: -Bayesian classifier: Bayes Theorem, Using Bayes theorem for classification, Naïve Bayesian classifier.

UNIT-V

Association Analysis: Basic Concepts and Algorithms: -Problem Definition, -Frequent Itemset Generation: The Apriori principle, Frequent Itemset Generation in the Apriori Algorithm, Candidate Generation and Pruning, Support Counting, -Rule Generation: Confidence-Based Pruning, -Compact Representation of Frequent Itemsets: Maximal Frequent Itemsets, Closed Frequent Itemsets, -FP-Growth algorithms: FP-Tree Representation, Frequent Itemset Generation in FP-Growth Algorithm.

Cluster Analysis: Basic Concepts and Algorithms: -Overview: What is Cluster Analysis? Different Types of Clustering, Different Types of Clusters, -K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, K-means and Different Types of Clusters, Strengths and Weaknesses, -Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm, Specific Techniques, -DBSCAN: Traditional Density (center based approach), The DBSCAN algorithm, Strengths and Weaknesses**.**

TEXT BOOKS:

1. Pang-Ning tan, Michael Steinbach, Vipin kumar, “Introduction to Data Minin”, Addision- Wesley.
2. Jiawei Han, Micheline Kamber, “Data Mining, Concepts and Techniques”, Elsevier, 2/e, 2006.

REFERENCE BOOKS:

1. Margaret H Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson, 2008.
2. GK Gupta, “Introduction to Data Mining with Case Studies”, Prentice Hall.
3. Jarke, Lenzerini, Vassiliou, Vassiliadis, “Fundamentals of data warehouses”, 2/e, Springer. 4. Soman, Diwakar, Ajay, “Data Mining Theory and Practice", PHI, 2006.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs14
2. www.oracle.com/Data/Warehousing
3. www.databaseanswers.org/data_warehousing.html
4. https://www.wileyindia.com/data-warehousing-data-mining.html

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3104	**COMPUTER NETWORKS**						

COURSE OBJECTIVES:

To provide knowledge on the fundamental concepts of the Computer Networks and problem solving techniques on Networks.

COURSE OUTCOMES:

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

- **CO1 :** Summarize basic concepts of Data Communication and Networking. [K2]
- **CO2 :** Analyse the issues in data link layer. [K4]
- **CO3 :** Interpret data link layer services and multiple access protocols. [K2]
- **CO4 :** Analyse different routing protocols. [K4]
- **CO5 :** Illustrate the essential principles of different transport layer, application layer protocols. [K2]

SYLLABUS:

UNIT – I

Introduction: OSI Overview, TCP/IP and Other Network Models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies: WAN, LAN, MAN.

UNIT – II

Data Link Layer: Design Issues- Framing, Services Provided to Network Layer, Flow Control, Error Control, Error Detection and Correction-CRC, Checksum-Idea, One's Complement, Hamming code.
IEEE Standards: 802.3, 802.11.

UNIT – III

Elementary Data Link Layer Protocols: Simplex Protocol, Simplex Stop and Wait, Simplex Protocol for Noisy Channel.
Sliding Window Protocol: One Bit, Go Back N, Selective Repeat-Stop and Wait Protocol, Examples of Data Link Protocols- HDLC, PPP.
Medium Access Control Sub Layer: Chanel Allocation Problem, ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance,

UNIT – IV

Network Layer: Network Layer Design Issues- Store And Forward Packet Switching, Service Provided to Transport Layer, Connection Oriented and Connection Less Service, Comparison of Virtual Circuit and Datagram Subnets.
Routing Algorithms: Optimality Principle, Shortest Path Routing, Flooding, Hierarchical Routing, Broad Cast, Multi Cast, Distance Vector Routing, Link State Routing.
Network Layer in Internet: IP Protocol, IP Address, IPv4 frame format.

UNIT –V

Transport Layer: The Transport Services- Services Provided to the Upper Layer, Transport Service Primitives, Elements of Transport Protocol-Addressing, Connection Establishment, Connection Release.

The Internet Transport Protocols: TCP and UDP.
Application Layer: DNS (Domain Naming System)-DNS Namespace, Name Servers, Electronic Mail- Architecture And Services, Message Format-MIME, Sending and Receiving E-mail, Message Transfer- SMTP.
The World Wide Web- Architecture Overview, URL, HTTP.

TEXT BOOKS:

1. Andrew S Tanenbaum, "Computer Networks, Pearson Education/PHI, 4th Edition.
2. Behrouz A.Forouzan, "Data Communications and Networks", TMH, Third Edition,

REFERENCE BOOKS:

1. S.Keshav, "An Engineering Approach to Computer Networks", Pearson Education 2nd Edition,
2. W.A. Shay, Thomson, "Understanding Communications and Networks", 3rd Edition.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs38.
2. https://in.udacity.com/course/computer-networking--ud436.
3. https://www.class-central.com/subject/computer-networking.
4. https://www.youtube.com/watch?v=3DZLItfbqtQ&list=PL32DBC269EF768F74.

III B.TECH I SEMESTER (P.E.- I)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CS3105	**COMPILER DESIGN**						

COURSE OBJECTIVES:

- Understand the process involved in a Compiler.
- Create an overall view of various types of translators, linkers, loaders, and phases of a compiler.
- Understand the Syntax Analysis, Various types of Parsers, like the Top-Down approach, and the Bottom- Up approach parsers.
- Gives a view of Intermediate Code Generation, Type Checking,
  Understand the role of Symbol Table and its organization.
- Describe Code Generation, Machine Independent Code Optimization and Instruction Scheduling.

COURSE OUTCOMES:

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

CO 1: Summarize different phases and passes of a compiler. [K2]
CO 2: Compare and Contrast various Top-Down and Bottom-Up Parsing techniques. [K2]
CO 3: Interpret different types of Intermediate Code representations. [K2]
CO 4: Illustrate the effective usage of register allocation and various Code-generation techniques. [K2]
CO 5: Apply different code-optimization techniques to optimize the target code. .[K3]

SYLLABUS

UNIT–I

Overview of Language Processing: Pre-processor, compiler, assembler, interpreter, linker & loader and phasesof a compiler.
Lexical Analysis: Role of the lexical analysis, lexical analysis vs. parsing, token, patterns and lexemes, lexical errors. Regular expressions: Regular definitions for the language constructs, strings, sequences, transition diagram for recognition of tokens, reserved words and identifiers with examples.

UNIT–II

Syntax Analysis: Discussion on CFG, LMD, RMD, ambiguity, parse tree, role of the parser, Classification of Parsing Techniques: Brute Force approach, left recursion, left factoring. Top-down parsing: FIRST and FOLLOW, LL (1) grammars, non-recursive predictive parsing and error recovery in predictive parsing.

UNIT–III

Types of Bottom-Up Approaches: Introduction to bottom-up parser, Why LR Parsers?, model of an LR parsers, operator precedence parser, shift- reduce parser, difference between LR and LL Parsers, Construction of SLR Table. More Powerful LR parsers: Construction of CLR (1), LALR parsing table, dangling ELSE ambiguity, and error recovery in LR parsing and comparison of all bottom-up approaches with all top-down approaches.

UNIT–IV

Semantic analysis: SDT schemes, evaluation of semantic rules, intermediate codes, three address codes - quadruples, triples, abstract syntax trees, types and declarations, type checking.

Symbol Table: Use and need of symbol tables, runtime environment storage organization, stack allocation, access to non-local data, heap management.

UNIT–V

Code Generation: Issues, target machine, basic blocks and flow graphs, simple code generator, peep-hole optimization

Machine Independent Code Optimization: Semantic preserving transformations, global common sub expression elimination, copy propagation, dead code elimination, constant folding, strength reduction, loop optimization, instruction scheduling and inter procedural optimization.

TEXT BOOKS:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers – Principles, Techniques & Tools”, Pearson, Second edition, 2007.
2. K. Muneeswaran, “Compiler Design”, Oxford University Press, 2013.

REFERENCE BOOKS:

1. Keith D. Cooper, & Linda Torczon, “Engineering a Compiler”, Morgan Kaufman publications, Second edition, 2011.
2. V. Raghavan, “Principles of Compiler Design”, TMH, Second edition, 2011.
3. Kenneth C. Louden, “Compiler Construction - Principles and Practice”, Cengage Learning publications, First edition,1997.
4. Yunlin Su, Song Y. Yan, “Implementations of Compiler - A new approach to Compilers including the Algebraic Methods”, Springer publications, 2011.

WEB REFERENCES:

1. http://www.diku.dk/hjemmesider/ansatte/torbenm/Basics/
2. http://nptel.ac.in/courses/106108052/1
3. https://www.geeksforgeeks.org/compiler-design-tutorials/
4. https://link.springer.com/article/10.1007/s10766-005-3590-6

III B.TECH I SEMESTER (P.E.- I)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3109	**DEVOPS**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1 : Demonstrate the phases of software development life cycle. [K2]
CO2 : Outline the basic Fundamentals of DevOps. [K2]
CO3 : Adopt the DevOps technology into the project. [K6]
CO4 : Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5]
CO5 : Summarize the importance of DevOps maturity models. [K2]

SYLLABUS:

UNIT- I

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

UNIT- II

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

UNIT- III

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

UNIT- IV

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

UNIT- V

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

TEXT BOOKS:

1. Gene Kim , John Willis , Patrick Debois, “The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations” Jez Humb,O’Reilly Publications
2. Mike Loukides, “What is Devops? Infrastructure as code” O’Reilly publications.
3. Jez Humble and David Farley, “Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation”,

4. Dave Harrison, Knox Lively, "Achieving DevOps: A Novel about Delivering the Best of Agile, DevOps, and Micro services.
5. Joakim Verona , Packt, "Practical Devops"

REFERENCE BOOKS:

1. Mandi Walls, "Building a DevOps Culture", O'Reilly publications
2. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Micro services"

WEB REFERENCES:

1. https://www.youtube.com/watch?v=hQcFE0RD0cQ
2. https://www.youtube.com/watch?v=YSkDtQ2RA_c
3. https://www.svrtechnologies.video/courses/devops-training-free/lectures/10955807
4. https://www.youtube.com/watch?v=MOZMw5_fBFA

III B.TECH I SEMESTER (P.E.- I)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE:R20AM3101	**COMPUTER VISION**						

COURSE OBJECTIVES

- To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems; and To provide the student with programming experience from implementing computer vision and object recognition applications.

COURSE OUTCOMES:

After completing the course you will be able to:

CO1 : Identify basic concepts, terminology, theories, models and methods in the field of computer vision [K2]

CO2 : Analyze known principles of human visual system [K4]

CO3 : Analyze basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition [K4]

CO4 : Analyze and Suggest a design of a computer vision system for a specific problem [K4]

SYLLABUS

UNIT I

Introduction what is computer vision? , A brief history Image Formation Models: Monocular imaging system, Orthographic& Perspective Projection, Camera model and Camera calibration, Binocular imaging systems.

UNIT II

Image Processing and Feature Extraction: Image representations (continuous and discrete), Edge detection

UNIT III

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion

UNIT IV

Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis

UNIT V

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition.

TEXT BOOKS:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

REFERENCE BOOKS:

1. Computer Vision: Algorithms and Applications by Richard Szeliski. Available for free online.
2. Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman. Available for free online (Warning: Direct PDF link).
3. Multiple View Geometry in Computer Vision (Second Edition) by Richard Hartley and Andrew Zisserman. Available for free online through the UM Library (Login required).
4. Emanuele Trucco and AllessandroVerri "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998.

III B.TECH I SEMESTER (P.E.- I)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3103	**HIGH PERFORMANCE COMPUTING**						

COURSE OBJECTIVES:

- To learn about approaches used in high performance computing.
- To learn about techniques and methods to scale up scientific applications.
- To design advanced modern computing systems.

COURSE OUTCOMES:

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

CO1 : Interpret the terminology of high performance computing [K2].
CO2 : Make use of MPI based parallel programs in distributed Memory architectures [K2].
CO3 : Analyze parallel programs using Pthreads and Open MP [K3].
CO4 : Apply OpenMP parallel programming concepts, including reduction clauses. [K3]
CO5 : Summarize the concept of GP-GPU [K2].

SYLLABUS:

UNIT - I

Introduction to Parallel hardware and software, need for high performance systems and Parallel Programming, SISD, SIMD, MISD, MIMD models, Performance issues.

UNIT - II

PThreads, Thread Creation, Passing arguments to Thread function, Simple matrix multiplication using Pthreads.

UNIT - III

Pthreads: Critical sections, mutexes, semaphores, barriers and conditional variables, locks, thread safety, simple programming assignments.

UNIT - IV

Open MP Programming: Introduction, reduction clause, parallel for-loop scheduling, atomic directive, critical sections and locks, private directive, Programming assignments, n body solvers using open MP.

UNIT - V

Introduction to MPI programming: MPI primitives such as MPI_Send, MPI-Recv, MPI_Init, MPI-Finalize, etc., Application of MPI to Trapezoidal rule, Parallel Quick sorting algorithm

TEXT BOOKS:

1. An Introduction to Parallel Programming, Peter S Pacheco, Elsevier, 2011
2. Programming Massively Parallel Processors, Kirk & Hwu, Elsevier, 2012

REFERENCE BOOKS:

1. CUDA by example: An introduction to General Purpose GPU Programming, Jason, Sanders, Edward Kandrit, Perason, 2011
2. CUDA Programming, Shame Cook, Elsevier
3. High Performance Heterogeneous Computing, Jack Dongarra, Alexey & Lastovetsky , Wiley
4. Parallel computing theory and practice, Michel J.Quinn, TMH

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20CC31L4	**MACHINE LEARNING LAB**						

COURSE OBJECTIVES:

- This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

COURSE OUTCOMES (COS):

At the end of the course, student will be able to
CO1: Implement procedures for the machine learning algorithms [K3]
CO2: Design and Develop Python programs for various Learning algorithms [K6]
CO3: Apply appropriate data sets to the Machine Learning algorithms [K3]
CO4: Develop Machine Learning algorithms to solve real world problems [K6]
CO5: Design and Develop Python programs using predefined libraries [K6]

REQUIREMENTS:
Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.

EXPERIMENT-1:
Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

EXPERIMENT-2:
For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

EXPERIMENT-3:
Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

EXPERIMENT-4:
Exercises to solve the real-world problems using the following machine learning methods:
a) Linear Regression b) Logistic Regression c) Binary Classifier

EXPERIMENT-5:
Develop a program for Bias, Variance, Remove duplicates , Cross Validation

EXPERIMENT-6:
Write a program to implement Categorical Encoding, One-hot Encoding

EXPERIMENT-7:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

EXPERIMENT-8:
Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

EXPERIMENT-9:
Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

EXPERIMENT-10:
Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

EXPERIMENT-11:
Exploratory Data Analysis for Classification using Pandas or Matplotlib.

EXPERIMENT-12:
Write a Python program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

EXPERIMENT-13:
Write a program to Implement Support Vector Machines and Principle Component Analysis.

EXPERIMENT-14:
Write a program to Implement Principle Component Analysis.

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20CC31L1	**DATA WAREHOUSING AND DATA MINING LAB**						

COURSE OBJECTIVES:

- Exposure to real life data sets for analysis and prediction.
- Practical exposure on implementation of well-known data mining tasks.
- Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.
- Handling a small data mining project for a given practical domain.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:
CO 1: Apply data preprocessing techniques on the given data. [K3]
CO 2: Construct classification model for the given data. [K6]
CO 3: Identify Association Rules for the given data. [K3]
CO 4: Apply the clustering techniques on the given data. [K3]

LIST OF EXPERIMENTS

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

ONLINE REFERENCES:

1. https://weka.waikato.ac.nz/dataminingwithweka/preview
2. https://www.class-central.com/tag/weka

III B.TECH I SEMESTER (SOC)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4	0	50	50	2
SUBCODE: R20AM31SC1	**MEAN STACK TECHNOLOGIES LAB**						

COURSE OBJECTIVES:

- To develop the skills and practical experience with the MEAN Stack.

COURSE OUTCOMES:

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

CO1 : Build a component-based application using Angular components and enhance their functionality using directives.[K3]

CO2 : Utilize data binding for developing Angular forms and bind them with model data.[K3]

CO3 : Apply Angular built-in or custom pipes to format the rendered data. [K3]

CO4 : Develop a single page application by using synchronous or asynchronous Angular routing. [K6]

CO5 : Make use of MongoDB queries to perform CRUD operations on document database. [K3]

LIST OF EXERCISES:

1(a) Course Name: Angular JS
Module Name: Angular Application Setup
Observe the link http://localhost:4200/welcome on which the mCart application is running. Perform the below activities to understand the features of the application.
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_01311968696962252870 9_shared?collectionType=Course&collectionId=lex_20858515543254600000_shared&pathId=lex_1097288406575931 8000_shared

1(b) Course Name: Angular JS
Module Name: Components and Modules
Create a new component called hello and render Hello Angular on the page
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_20054046883477630000_shared?collectionType=Course&pathId=lex_16242264358499643000_shared&collectionId=lex_20858515543254600000_shared

1(c) Course Name: Angular JS
Module Name: Elements of Template
Add an event to the hello component template and when it is clicked, it should change the course Name.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19226434057992030000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

1(d) Course Name: Angular JS
Module Name: Change Detection
Progressively building the PoolCarz application

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2560981637120771000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

2(a) Course Name: Angular JS
Module Name: Structural Directives - ngIf
Create a login form with username and password fields. If the user enters the correct credentials, it should render a "Welcome <<username>>" message otherwise it should render "Invalid Login!!! Please try again..." message
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012763740226043904259 5_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

2(b) Course Name: Angular JS
Module Name: ngFor
Create a courses array and rendering it in the template using ngFor directive in a list format.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32795774277593590000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

2(c) Course Name: Angular JS
Module Name: ngSwitch
Display the correct option based on the value passed to ngSwitch directive.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_23388127475984175000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

2(d) Course Name: Angular JS
Module Name: Custom Structural Directive
Create a custom structural directive called 'repeat' which should repeat the element given a number of times.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24073319904331424000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

3(a) Course Name: Angular JS
Module Name: Attribute Directives - ngStyle
Apply multiple CSS properties to a paragraph in a component using ngStyle.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24037156998765367000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

3(b) Course Name: Angular JS
Module Name: ngClass
Apply multiple CSS classes to the text using ngClass directive.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_3459610297074182000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

3(c) Course Name: Angular JS
Module Name: Custom Attribute Directive
Create an attribute directive called 'showMessage' which should display the given message in a paragraph when a user clicks on it and should change the text color to red.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_14783742359773809000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

4(a) Course Name: Angular JS
Module Name: Property Binding
Binding image with class property using property binding.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_8951964709153619000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course
Components - Viewer Page | Infosys Springboard (onwingspan.com)

4(b) Course Name: Angular JS
Module Name: Attribute Binding
Binding colspan attribute of a table element to the class property.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_7154252883180625000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

4(c) Course Name: Angular JS
Module Name: Style and Event Binding
Binding an element using inline style and user actions like entering text in input fields.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_7417401021103822000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

5(a) Course Name: Angular JS
Module Name: Built in Pipes
Display the product code in lowercase and product name in uppercase using built-in Pipes.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_11810543990912035000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

5(b) Course Name: Angular JS
Module Name: Passing Parameters to Pipes
Apply built-in pipes with parameters to display product details.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_21187073707540988000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

5(c) Course Name: Angular JS
Module Name: Nested Components Basics
Load Courses list Component in the root component when a user clicks on the View courses list button.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24231999287700136000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

6(a) Course Name: Angular JS
Module Name: Passing data from Container Component to Child Component
Create an App Component that displays a dropdown with a list of courses as values in it. Create another component called the Courses List component and load it in App Component which should display the course details. When the user selects a course from the
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_15758356947336235000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

6(b) Course Name: Angular JS

Module Name: Passing data from Child Component to Container Component
Create an App Component that loads another component called the Courses List component. Create another component called Courses List Component which should display the courses list in a table along with a register .button in each row.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2494980689916818400_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

6(c) Course Name: Angular JS
Module Name: Shadow DOM
Apply Shadow DOM and None encapsulation modes to components.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10312243404892470000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

6(d) Course Name: Angular JS
Module Name: Component Life Cycle
Override component life-cycle hooks and logging the corresponding messages to understand the flow.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10818939635948007000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

7(a) Course Name: Angular JS
Module Name: Template Driven Forms
Create a course registration form as a template-driven form.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2810668513603024400_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

7(b) Course Name: Angular JS
Module Name: Model Driven Forms or Reactive Forms
Create an employee registration form as a reactive form.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33704702617536004000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

7(c) Course Name: Angular JS
Module Name: Custom Validators in Reactive Forms
Create a custom validator for an email field in the employee registration form (reactive form)
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33728128192769250000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

8(a) Course Name: Angular JS
Module Name: Custom Validators in Template Driven forms
Create a custom validator for the email field in the course registration form.
https://infyspringboard.onwingspan.com/web/en/viewer/webmodule/lex_27688491925133280000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

8(b) Course Name: Angular JS
Module Name: Services Basics
Create a Book Component which fetches book details like id, name and displays them on the page in a list format. Store the book details in an array and fetch the data using a custom service.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32584403823635940000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

8(c) Course Name: Angular JS
Module Name: RxJS Observables
Create and use an observable in Angular.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_6209609363905256000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

9(a) Course Name: Angular JS
Module Name: Server Communication using HttpClient
Create an application for Server Communication using HttpClient
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012763739531706368261 5_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

9(b) Course Name: Angular JS
Module Name: Communicating with different backend services using Angular
R-20 Syllabus for CSE, JNTUK w. e. f. 2020 – 21, JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA, KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
HttpClient Create a custom service called Product Service in which Http class is used to fetch data stored in the JSON files.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_4266333361795059700_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

10(a) Course Name: Angular JS
Module Name: Routing Basics, Router Links
Create multiple components and add routing to provide navigation between them.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_3782024852517635000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

10(b) Course Name: Angular JS
Module Name: Route Guards
Considering the same example used for routing, add route guard to Books Component. Only after logging in, the user should be able to access Books Component. If the user tries to give the URL of Books component in another tab or window, or if the user tries
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_30303325731876470000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

10(c) Course Name: Angular JS
Module Name: Asynchronous Routing
Apply lazy loading to BookComponent. If lazy loading is not added to the demo, it has loaded in 1.14 s. Observe the load time at the bottom of the browser console. Press F12 in the browser and click the Network tab and check the Load time
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9878739890118246000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

10(d) Course Name: Angular JS
Module Name: Nested Routes
Implement Child Routes to a submodule.
https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_01276804390044467214 0_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course

11(a) Course Name: MongoDB Essentials - A Complete MongoDB Guide
Module Name: Installing MongoDB on the local computer, Create MongoDB Atlas Cluster
Install MongoDB and configure ATLAS
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818214373130240300 83_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course

11(b) Course Name: MongoDB Essentials - A Complete MongoDB Guide
Module Name: Introduction to the CRUD Operations
Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818218741661696301 18_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course

12(a) Course Name: MongoDB Essentials - A Complete MongoDB Guide
Module Name: Create and Delete Databases and Collections
Write MongoDB queries to Create and drop databases and collections.
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818216541192192301 21_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course

12(b) Course Name: MongoDB Essentials - A Complete MongoDB Guide
Module Name: Introduction to MongoDB Queries
Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().
https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_013289081626451968250 5_shared?collectionId=lex_auth_01317716929471283211 3_shared&collectionType=Course

TEXT BOOKS:

1. Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson.
2. Pro Mean Stack Development, 1st Edition, ELadElrom, Apress O'Reilly.
3. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
4. MongoDB – The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly

SOFTWARE CONFIGURATION AND INSTALLATION:

1. **Angular:** Setup details: Angular Application Setup - Internal - Viewer Page | Infosys Springboard (onwingspan.com)
2. **MongoDB:** TOC - MongoDB Essentials - A Complete MongoDB Guide | Infosys Springboard (onwingspan.com)

WEB LINKS:

1. https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS)
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01317716929471283211 3_shared/overview (Mongo DB)

III B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4	0	50	50	2
SUBCODE: R20CC31MC01	**PROFESSIONAL ETHICS AND HUMAN VALUES**						

COURSE OBJECTIVES:

- To equip the student with the basic knowledge relating to the ethical behaviour in engineering discipline and to make the students understand the rules and regulation relating to intellectual property rights (Patents, copyrights, trademarks etc.,)

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1 : Learn necessary behavioural skills relating to the Ethics at industrial sector and to gain fundamental knowledge [K2].
CO2 : Acquaint with basic human values, responsibilities and rights of engineers which are very much necessary today [K2].
CO3 : Equip with knowledge on basics of intellectual property rights and cyber law [K2].
CO4 : Gain knowledge on the patents, trademark and copy rights [K2].

SYLLABUS

UNIT - I

Human Values: Ethics, Morals, Values, Integrity, Work Ethics, Service Learning, Civic Virtue, Respect for Others, Living Peacefully, Caring, Sharing, Honesty, Courage, Value of Time, Cooperation, Commitment, Empathy, Self-Confidence, Spirituality, Character.

UNIT - II

Engineering Ethics: Professional Roles to Be Played by Engineer - Engineers Role as Managers, Consultants and Leaders; Ethical Theories and its uses.

UNIT - III

Engineers Responsibilities and Rights: Professional Rights and Responsibilities, Whistle Blowing, Cross Cultural Issues and Occupational Crimes, Industrial Espionage.

UNIT - IV

Introduction to Intellectual Property Law: The Evolutionary Past, The IPR Tool Kit, Legal Tasks in Intellectual Property Law, Ethical obligations in Intellectual Property Law, Introduction to Cyber Law, Cybercrimes, Innovations and Inventions Trade related Intellectual Property Right.

UNIT - V

Intellectual property Rights : Basics, Types of Intellectual Property, Copy Rights – Principles-Subject Matter of Copy Rights; Copy Right Formalities and Registration, Patent Law - Rights and Limitations, Patent Requirements, Patent Registration Process.

UNIT - VI

Trademark: Trademark Registration Process - Post Registration Process, Transfer of Rights, Trade Secrets – Maintaining Trade Secrets; Physical Security, Employee Confidentiality Agreement

TEXT BOOK:

1. Professional Ethics and Morals, Prof. A.R.Aryasri, Dharanikota Suyodhana, 1/e, Maruthi Publications.
2. Intellectual property , Deborah e. Bouchoux, 1/e, Cengage learning, New Delhi.

REFERENCES:

1. Kompal Bansal & Parishit Bansal" Fundamentals of IPR for Engineers BS Publications.
2. Cyber Law. Texts & Cases, South- western's special topics collections.
3. M. Ashok Kumar and mohd. Iqbal Ali: "Intellectual property right" serials pub.
4. "Engineering Ethics and Human Values" by M. Govindarajan, S. Natarajan and V.S. Senthil Kumar- PHI Learning PVT. Ltd-2009

ADDITIONAL RESOURCES:

1. nptel.ac.in/courses/106102064/1
2. nptel.ac.in/courses/106103069

III B.TECH. – II SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20AM3203	Deep Learning techniques	PC	30	70	100	3	0	0	3
2	R20CC3208	Design and Analysis of Algorithms	PC	30	70	100	3	0	0	3
3	R20AM3204	Soft Computing	PC	30	70	100	3	0	0	3
4	R20AM3205 R20CC3209 R20CC3201 R20AM3207	Professional Elective - II • Software Project Management • Artificial Neural Networks • Cryptography and Network Security • Distributed Systems	PE	30	70	100	3	0	0	3
5	**Open Elective – II**		OE	30	70	100	3	0	0	3
6	R20AM32L1	Deep Learning Lab	PC	15	35	50	0	0	3	1.5
7	R20AM32L2	Soft Computing Lab	PC	15	35	50	0	0	3	1.5
8	R20AM32L3	Artificial Intelligence and Neural Networks Lab	ES	15	35	50	0	0	3	1.5
9	R20CC32SC1	English Employability Skills	SC	-	-	50	0	0	4	2
10	R20CC32MC1	Essence of Indian Traditional Knowledge	MC			-	2	0	0	0
TOTAL										**21.5**
11		**Honors/Minor Course**		30	70	100	4	0	0	4

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM3203	**DEEP LEARNING TECHNIQUES**						

COURSE OBJECTIVES:

The main objective of the course is to make students:

- Learn deep learning methods for working with sequential data,
- Learn deep recurrent and memory networks,
- Learn deep Turing machines,
- Apply such deep learning mechanisms to various learning problems.
- Know the open issues in deep learning, and have a grasp of the current research directions.

COURSE OUTCOMES:

After the completion of the course, student will be able to

CO1 : Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning. [K2]
CO2 : Analyze the Neural Network training, various random models.[K4]
CO3 : Apply the Techniques of Keras, Tensor Flow, Theano and CNTK [K3]
CO4 : Classify the Concepts of CNN and RNN [K2]
CO5 : Analyze Interactive Applications of Deep Learning [K4]

SYLLABUS

UNIT I:

Fundamentals of Deep Learning: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines,

Fundamentals of Machine Learning: Four Branches of Machine Learning, Evaluating Machine learning Models, over fitting and under fitting. **[Text Book 2]**

UNIT II: Introducing Deep Learning: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. **[Text Book3]**

UNIT III: Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, Tensor Flow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews: Binary Classification, Classifying newswires: Multiclass Classification. **[Text Book 2]**

UNIT IV:

Convolutional Neural Networks: Neural Network and Representation Learning, Convolutional Layers, Multichannel Convolution Operation,

Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. **[Text Book 3]**

UNIT V:

Interactive Applications of Deep Learning: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. **[Text Book 1]**

Deep Learning Research: Auto encoders**,** Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. **[Text Book 1]**

TEXT BOOKS:

1. Deep Learning- Ian Good fellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016
2. Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s): Manning Publications, ISBN: 9781617294433
3. Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Algae Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821
4. Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412

REFERENCE BOOKS:

1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009.
2. Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013.
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.

WEB LINK:

1. Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3208	**DESIGN AND ANALYSIS OF ALGORITHMS**						

COURSE OBJECTIVES:

- To analyze the asymptotic performance of algorithms.
- To write rigorous correctness proofs for algorithms.
- To demonstrate a familiarity with major algorithms and data structures.
- To apply important algorithmic design paradigms and methods of analysis.
- To synthesize efficient algorithms in common engineering design situations.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:
After successful completion of this course, the students will be able to:
CO 1: Apply asymptotic notations to measure the performance of algorithms [K3]
CO 2: Apply divide-and-conquer paradigm when an algorithmic design situation calls for it [K3].
CO 3: Identify all feasible solutions to get optimal solutions using greedy method [K3].
CO 4: Apply dynamic-programming approach, to solve real world problems [K3].
CO 5: Analyze fundamental graph traversal techniques to solve various applications using Backtracking, Branch and bound paradigms [K4].

SYLLABUS:

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

UNIT-II
Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication.

UNIT-III
Greedy method: General method, Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest paths.

UNIT-IV
Dynamic Programming: The General method, All pairs shortest path problem, Optimal binary search trees, 0/1 knapsack, Reliability design, The Travelling sales person problem, Matrix-chain multiplication.

UNIT-V
Backtracking: The General method, N-Queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles.
Branch and Bound: The method, 0/1 knapsack problem, Travelling sales person problem.

TEXT BOOK:

1. Fundamentals of Computer Algorithms, Second Edition – Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Universities Press.

REFERENCE BOOKS:

1. S. Sridhar, Oxford, Design and Analysis of Algorithms, First Edition –.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, Introduction to Algorithms, second edition, PHI Pvt.Ltd.
3. Parag Himanshu Dave, Himanshu Bhalchandra Dave, Design and Analysis of Algorithms, Second Edition –, Pearson Education.
4. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, Design and Analysis of Computer Algorithms –, Pearson Education.
5. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition –, Pearson Education.

WEB REFERENCES:

1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. https://www.coursera.org/learn/algorithms-divide-conquer
3. http://nptel.ac.in/courses/106101060/
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/index.html

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3204	**SOFT COMPUTING**						

COURSE OBJECTIVES:

In the course the student will Learn soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world problems.

COURSE OUTCOMES:

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

- **CO1 :** Understand the concepts of uncertainty and evidence in decision-making. [K2]
- **CO2 :** Differentiate between supervised and unsupervised learning and apply them to real-world problems. [K4]
- **CO3 :** Apply the structure and functioning of adaptive neural networks. [K3]
- **CO4 :** Analyze the concept of neuro-fuzzy systems and their advantages. [K4]
- **CO5 :** Apply the encoding, fitness functions, and reproduction mechanisms in genetic algorithms. [K3]

SYLLABUS

UNIT I: Introduction:
Uncertainty and Evidence, Shafer Dumpster belief and possibility Theory, Random sets and mass assignments, Dumpsters Rule, Fuzzy Measures and aggregation operators, Bayesian Networks. Graphical methods.

UNIT II: **Automated Learning-1 and 2**
Automated Learning-1: Supervise vs. unsupervised learning, Decision Tree induction, rule induction algorithms.
Automated Learning-2: Bayesian network learning algorithms, Evolutionary algorithms.

UNIT III: **Neural Networks and Fuzzy Methods:**
Neural Networks: Adaptive Networks, Supervised Learning NN, Reinforcement Learning, Unsupervised Learning. Fuzzy set theory, fuzzy control (including model based control), and Fuzzy Decision trees.

UNIT IV: **Hybrid systems:**
Neuro Fuzzy Systems, Back propagation Network supported by Fuzzy, GA based weight determination applications.

UNIT V: **Genetic Algorithms and Applications**
Encoding, Fitness functions, reproduction, Fuzzy Genetic Algorithms.
Applications: Practical Examples from areas such as Medical, Management, and control, GA in fuzzy logic controller design.

REFERENCE BOOKS

1. Neuro Fuzzy and Soft Computing, A Computational approach to learning and Machine, Jyh-Shing Roger Jang, Cuen Tsai Sun, Eiji Mizurani, PEA.
2. Machine Learning, Tom Mitchell, MGH, 1997.
3. Soft Computing Techniques and Applications, Robert John, R. Birkenhead, Ralph Birkenhead.
4. Neural Networks, Fuzzy logic and genetic algorithms, S Rakasekharan, GA Vijayalakshmi, PHI.
5. Principles of Soft Computing, Sivanandam, Deepa, Wiley India, 2008.
6. Soft Computing and Intelligent Systems Design, Karry, De Silva, PEA, 2004.

III B.TECH II SEMESTER (P.E.- II)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM3205	**SOFTWARE PROJECT MANAGEMENT**						

COURSE OBJECTIVES:

- To study about the concepts of object-oriented software engineering.

COURSE OUTCOMES:

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

CO1 : Illustrate the conventional software Management and economics [K2].
CO2 : Outline the software life cycle phases and artifacts [K2].
CO3 : Illustrate the various workflows, check points and iterative process planning [K2].
CO4 : Analyze the project organizations, responsibilities and control [K4].
CO5 : Apply project control and process instrumentation methodologies. [K3]

SYLLABUS

UNIT – I:

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 – II:

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.
Model based software architectures: A Management perspective and technical perspective.

UNIT – III:

Work Flows of the process: Software process workflows, Iteration workflows.
Checkpoints of the process: Major mile stones, Minor Milestones, Periodic status assessments.
Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT – IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.
Process Automation: Automation Building blocks, The Project Environment.

UNIT – V:

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.
Tailoring the Process: Process discriminants.

TEXT BOOK:

1. Software Project Management, Walker Royce: Pearson Education, 2005.

REFERENCES:

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson

WEB REFERENCES:

1. URL: https://www.youtube.com/watch?v=eOTcPOvT-H4
2. URL: https://www.youtube.com/watch?v=IdBSLvoP6uY
3. URL: https://www.youtube.com/watch?v=SkQzQCAWf8M

E-BOOKS:

1. http://www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
2. http://www.mbaexamnotes.com/software-project-management.html

III B.TECH II SEMESTER (P.E.- II)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3209	**ARTIFICIAL NEURAL NETWORKS**						

COURSE OBJECTIVES:

- To Understand the basics of Artificial Neural Networks, including their structure and activation functions.
- Learn to design, train, and analyze neural networks, enabling practical problem-solving using these techniques.

COURSE OUTCOMES:

By completing the course the students will be able to:

- **CO1 :** Understand comprehension of Artificial Neural Network (ANN) fundamentals, including the structure of ANNs, biological and artificial neurons, and common activation functions used in ANNs. [K2]
- **CO2 :** Apply their knowledge to understand single-layer perceptrons, their role as pattern classifiers, and the limitations of perceptrons in solving complex problems. [K3]
- **CO3 :** Apply their knowledge to grasp the concepts of multilayer perceptrons, batch and online learning, and the derivation of the back propagation algorithm, including its application in solving problems like the XOR problem. [K3]
- **CO4 :** Analyze the structures of multi-layer feed-forward networks, the back propagation algorithm for training, and the practical and design considerations in implementing feed-forward ANNs. [K4]
- **CO5 :** Apply their understanding to perform function approximation, explore techniques like cross-validation and network pruning, and comprehend advanced concepts such as convolutional networks and non-linear filtering in ANN applications. [K3]

SYLLABUS

UNIT-1

Introduction and ANN Structure. Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.

UNIT-2

Single layer perceptrons. Structure and learning of perceptrons. Pattern classifier – introduction and Bayes' classifiers. Perceptron as a pattern classifier. Perceptron convergence. Limitations of a perceptrons.

UNIT-3

Multilayer perceptron, Batch and online learning, derivation of the back propagation algorithm, XOR problem, Role of Hessian in online learning, annealing and optimal control of learning rat

UNIT-4

Feed forward ANN. Structures of Multi-layer feed forward networks. Back propagation algorithm. Back propagation – training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning.

UNIT-5

Approximations of functions, Cross-validation, Network pruning and complexity regularization, convolution networks, non-linear filtering.

TEXT BOOKS:

1. Simon Haykin, "Neural Networks: A comprehensive foundation", Second Edition, Pearson Education Asia.
2. Satish Kumar, "Neural Networks: A classroom approach", Tata McGraw Hill, 2004.

REFERENCE BOOKS:

1. Robert J. Schalkoff, "Artificial Neural Networks", McGraw-Hill International Editions, 1997.

WEB REFERENCES

1. https://nptel.ac.in/courses/108108148

III B.TECH II SEMESTER (P.E.- II)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3201	**CRYPTOGRAPHY AND NETWORK SECURITY**						

COURSE OBJECTIVES:

- The main objective of this course is to teach students to understand and how to address various software security problems in a secure and controlled environment.
- During this course the students will gain knowledge in various kinds of software security problems, and techniques that could be used to protect the software from security threats.

COURSE OUTCOMES:

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

CO1 : Summarize the fundamentals of Cryptography. [K2]
CO2 : Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4]
CO3 : Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3]
CO4 : Interpret the role of hash functions and Digital Signatures in Information Security.[K2]
CO5 : Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]

SYLLABUS:

UNIT-I

Introduction: Security Attacks-Passive Attacks, Active Attacks, Security Services-Authentication, Access control, Confidentiality, Integrity, Availability service, Nonrepudiation, Security Mechanisms- Specific Security Mechanisms, Pervasive Security Mechanisms, model for Network Security, Basics of Cryptography - Symmetric Cipher Model, Substitution Techniques- Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, polyalphabetic Ciphers, One-Time pad. Transposition Techniques-rail fence, Block and Stream Ciphers.

UNIT-II

Symmetric Key Cryptography: Fiestel Cipher Structure, Block Cipher Design Principles- Design Criteria, Number of Rounds, Design of Function F, Data Encryption Standard (DES), Strength of DES, Triple DES, International Data Encryption algorithm(IDEA), AES- Structure, Transformation functions, Key Expansion, Block Cipher Modes of Operation- ECB, CBC, OFB,CFB,CTR Modes.

UNIT-III

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems-Proof and Examples, Euler's Totient Function, Primitive root and Discrete Logarithms.
Public Key Cryptography: Principles of Public key Cryptosystems-Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptography, Public-Key Cryptanalysis, RSA Algorithm: Description of the Algorithm, The Security of RSA, Diffie-Hellman Key Exchange Algorithm, Elgamal encryption & decryption

UNIT-IV

Cryptographic Hash Functions: Message Authentication Requirements and Functions-Message Encryption, Message Authentication Code, Hash Function, Message Authentication Codes (MAC)-Requirements, Hash Functions-Requirements, Applications of MAC and hash functions, Secure Hash Algorithm (SHA-512), HMAC.

Digital Signatures: Digital Signature Schemes, Authentication Protocols- Mutual Authentication, One-Way Authentication, Digital Signature Standards-The DSS Approach, The digital Signature Algorithm.

UNIT-V

Authentication Applications: Kerberos: Motivation, Version 4, X.509 Directory Authentication service, E-Mail, PGP, S/MIME.

Web Security: Web Security Considerations, Secure Sockets Layer- SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, Transport Layer Security, Secure Electronic Transactions (SET), Firewalls.

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 6th Edition, 2011.
2. Chwan Hwa Wu, J.David Irwin, "Introduction to Computer Networks & Cyber Security", CRC Press, 2013.

REFERENCE BOOKS:

1. Eric Maiwald, "Fundamentals of Network Security", Dreamtech press.
2. Withman , Thomson, "Principles of Information Security".
3. Buchmann, Springer, "Introduction to Cryptography".
4. Bruce Schneier, John Wiley & Sons, "Applied Cryptography", 2nd Edition.
5. Benard Menezes, "Network Security Essentials and Cryptography", Cengage Learning,2011.
6. Behrouz A.Fourouzan and Debdeep Mukhopadhyay, "Cryptography and Network, 2nd Edition", McGraw-Hill, 2010.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs07/preview
2. https://www.coursera.org/learn/cryptography
3. https://www.coursera.org/specializations/computer-network-security
4. https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7

III B.TECH II SEMESTER (P.E.- II)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM3207	**DISTRIBUTED SYSTEMS**						

COURSE OBJECTIVES:

- The aim of this subject is to study, learn, and understand the main concepts of distributed systems
- To learn Hardware and software features that supports these systems.

COURSE OUTCOMES:

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

- **CO1 :** Outline the benefits of distributed systems. [K2]
- **CO2 :** Interpret synchronization techniques in distributed systems. [K2]
- **CO3 :** Summarize process scheduling techniques, threads and fault tolerance in distributed environments. Analyze various distributed deadlock detection and prevention techniques. [K4]
- **CO4 :** Interpret distributed file system implementations and shared memory**.** [K2]
- **CO5 :** Relationship of distributed system functions in MACH. [K4]

SYLLABUS:

UNIT–I

Introduction to Distributed systems: Goals of distributed system, hardware and software concepts, design issues. Communication in Distributed systems: Layered protocols, ATM networks, the Client - Server model, remote procedure call and group communication.

UNIT–II

Synchronization in Distributed systems: Clock synchronization, Mutual exclusion, E-tech algorithms, the Bully algorithm, a ring algorithm, atomic transactions.

UNIT-III

Processes: Processes and Processors in distributed systems: Threads, system models, Processor allocation, Scheduling in distributed system, Fault tolerance and real time distributed systems.

Deadlocks: deadlock in distributed systems, Distributed deadlock prevention, and distributed dead lock detection.

UNIT-IV

Distributed file systems: Distributed file systems design, distributed file system implementation, trends in distributed file systems. Distributed shared memory : What is shared memory, consistency models, page based distributed shared memory, shared variable distributed shared memory, object based DSM.

UNIT-V

Case study MACH: Introduction to MACH, process management in MACH, memory management in MACH, communication in MACH, UNIX emulation in MACH.

TEXT BOOKS:

1. Andrew. S. Tanenbaum, "Distributed Operating System", PHI
2. Stallings, "Operating Systems Internal and Design Principles", Pearson Education / PHI, Fifth Edition–2005.

REFERENCE BOOKS:

1. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System Principles", - 7th Edition, John Wiley.
2. Andrew S Tanenbaum, "Modern Operating Systems", 2nd edition Pearson/PHI.

WEB REFERENCES:

1. http://www.cs.colostate.edu/~cs551dl/externalLinks.php
2. http://www.personal.kent.edu/~rmuhamma/OpSystems/os.html
3. https://www.sanfoundry.com/operating-system-questions-answers-distributed-operating-system/
4. https://link.springer.com/journal/446
5. https://www.ukessays.com/.../the-distributed-operating-system-info..
6. https://www.youtube.com/watch?v=sK9MC5GREXg

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20AM32L1	**DEEP LEARNING LAB**						

COURSE OBJECTIVES:

To provide hands-on practical experience and application of deep learning techniques and models in various domains, including image and speech processing, text-to-speech conversion, object detection, character recognition, and more, using popular deep learning frameworks and tools.

COURSE OUTCOMES:

At the end of the Course the student shall be able to

- **CO1 :** Make use of deep learning APIs like Keras [K3]
- **CO2 :** Implement multiple conversions for Analysis [K3]
- **CO3 :** Apply deep learning techniques for object identification and segmentation [K3]
- **CO4 :** Implement RNN and CNN for multiple problems [K3]
- **CO5 :** Implement Autoencoders and GAN. [K3]

LIST OF EXPERIMENTS:

(Any 12 Experiments from the following to be performed)

1. Build a deep neural network model start with linear regression using a single variable.
2. Build a deep neural network model start with linear regression using multiple variables.
3. Write a program to convert speech into text.
4. Write a program to convert text into speech.
5. Write a program to convert video into frames.
6. Write a program for Time-Series Forecasting with the LSTM Model.
7. Build a feed forward neural network for prediction of logic gates.
8. Write a program to implement deep learning Techniques for image segmentation.
9. Write a program for object detection using image labeling tools.
10. Write a program to predict a caption for a sample image using LSTM.
11. Write a program for character recognition using CNN.
12. Write a program to predict a caption for a sample image using CNN.
13. Write a program for character recognition using RNN and compare it with CNN.
14. Write a program to detect Dog image using YOLO Algorithm.
15. Write a program to develop Autoencoders using MNIST Handwritten Digits.
16. Write a program to develop a GAN for Generating MNIST Handwritten Digits.

REFERENCE BOOKS:

1. Navin Kumar Manaswi ,***Deep Learning with Applications Using Python Chatbots and Face, Object, and Speech Recognition With TensorFlow and Keras*** ,Apress,2018.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press,2016.
3. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach, O'Reilly Media, First Edition, 2017.

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE:R20AM32L2	**SOFT COMPUTING LAB**						

COURSE OBJECTIVES:

To familiarize students with fundamental concepts and practical implementations of neural networks, fuzzy logic, and set operations, enabling them to apply these techniques to solve various computational and pattern recognition problems.

COURSE OUTCOMES:

At the end of the Course the student shall be able to

- **CO1 :** Perform set operations, including Union, Intersection, and Complement. [K2]
- **CO2 :** Implement De-Morgan's Law with an application level of understanding. [K5]
- **CO3 :** Capable of plotting various membership functions. [K5]
- **CO4 :** Implement a Fuzzy Inference System (FIS) using a FIS Editor to model and predict tip values based on quality and service parameters. [K5]
- **CO5**: Implement and fine-tuning fuzzy inference systems. [K5]

NOTE: All program can complete using MAT LAB ONLY

LIST OF EXPERIMENTS

1. To perform Union, Intersection and Complement operations.
2. To implement De-Morgan’s Law.
3. To plot various membership functions.
4. To implement FIS Editor. Use Fuzzy toolbox to model tip value that is given after a dinner based on quality and service.
5. To implement FIS Editor.
6. Generate ANDNOT function using McCulloch-Pitts neural net.
7. Generate XOR function using McCulloch-Pitts neural net.
8. Hebb Net to classify two dimensional input patterns in bipolar with given targets
9. Perceptron net for an AND function with bipolar inputs and targets.
10. To calculate the weights for given patterns using hetero associative neural net.
11. To store vector in an auto-associative net. Find weight matrix & test the net with input
12. To store the vector ,find the weight matrix with no self-connection. Test this using a discrete Hopfield net

REFRENCES

1. https://drive.google.com/file/d/1Hu0IbAFdwvjX8lz3pOdkNE8o52ZngfZ8/view?usp=sharing

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	15	35	50	1.5
SUBCODE: R20AM32L3	**ARTIFICIAL NEURAL NETWORKS LAB**						

COURSE OBJECTIVES:

- To enable students to understand, implement, and apply various artificial neural network models and machine learning algorithms, such as back-propagation, naïve Bayesian classifier, single-layer perceptron, multi-layer perceptron, feed forward ANN, CNN, and L1 and L2 regularization, using appropriate datasets to solve diverse computational and pattern recognition problems.

COURSE OUTCOMES:

At the end of the Course the student shall be able to

- **CO1 :** Implement an Artificial Neural Network using the Back-propagation algorithm. [K5]
- **CO2 :** Analysing a naïve Bayesian classifier for a training dataset stored as a .CSV file and computing the classifier's accuracy on test datasets.[K4]
- **CO3 :** Building a single-layer perceptron.[K5]
- **CO4 :** Construct a multi-layer perceptron to solve the XOR problem, building a network with multiple hidden layers.[K6]
- **CO5 :** Implementing non-linearly separable problems using neural networks [K5].

1. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
2. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a CSV file. Compute the accuracy of the classifier, considering few test data sets
3. Build a single layer perceptron
4. Build a Multi-layer perceptron
5. Build a Multi-layer perceptron for XOR problem
6. Build a Feed forward ANN
7. Build a CNN
8. Build L1 and L2 regularization

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1	-	2		50	50	2
SUBCODE:R20CC32SC1	**ENGLISH EMPLOYABILITY SKILLS (Common to All Branches)**						

COURSE OBJECTIVES:

- To train the students to use language effectively in professional situations like group discussions, public speaking, presentations and interviews.
- To make the students understand the importance of body language.
- To expose the students to SWOT Analysis.

COURSE OUTCOMES:

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

CO1 : Write effective Resume for employment.
CO2 : Make formal presentations using relevant technical style of communication and appropriate strategies for both academic and professional purpose.
CO3 : Participate in Group Discussions using analytical and problem solving skills.
CO4 : Face job interviews confidently and enhance employability.

SYLLABUS

UNIT– I

Personal Introduction & JAM
SWOT Analysis

UNIT–II

Resume and Video Portfolio
Non Verbal Communication
Professional Etiquette

UNIT–III

Presentation Skills
Emotional Intelligence (How to face ambiguity, uncertainty and cobntingencies)

UNIT-IV

Group Discussion

UNIT-V

Interview skills- Mock Interviews

REFERENCE BOOKS:

1. Rajendra Pal, J S KorlahaHi, *Essentials of Business Communication,* Sultan Chand & Sons
2. Andrea J. Rutherford, *Basic Communication Skills for Technology,* Pearson Education Asia
3. V. Prasad, *Advanced Communication Skills,* Atma Ram Publications
4. Sanjay Kumar, Pushp Lata, *Communication Skills,* Oxford University Press
5. Meenakshi Raman, Sangeeta Sharma, *Fundamentals of Technical Communication,* Oxford University Press.

III B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	-	-	-	-	-	0
SUBCODE: R20CC32MC1	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**						

COURSE OBJECTIVES:

The objectives of this course will help the students

- To get necessary knowledge on Indian culture
- To know the Indian languages and Literature in India
- To explore the Indian arts and architecture in India
- To know the education system, science and scientists in India

COURSE OUTCOMES:

After successful completion of the course students will be able to

CO1 : Interpret the philosophy of Indian Culture [K2].Interpret the Indian languages, Epics
CO2 : Ramayana and Mahabharata [K2].
CO3 : Analyze the information about Indian arts and architecture [K4].
CO4 : Analyze the spread of cultural exchange in abroad [K4].
CO5 : Analyze the contributions of scientists in different eras [K4].

SYLLABUS

UNIT-I: Indian Culture: An Introduction

Characteristics of Indian culture, Significance of Indian culture, Geography of Indian Culture. Society in India through ages- Ancient period- varna and jati, family and marriage in India, position of women in ancient India, Contemporary period; caste system and communalism

UNIT-II: Indian Languages and Literature

Evolution of script and languages in India: Harappan Script and Brahmi Script. Short History of the Sanskrit literature: The Vedas, The Brahmanas and Upanishads & Sutras, Epics: Ramayana and Mahabharata.

UNIT-III: Indian Arts and Architecture

Indian Art & Architecture: Hindu Temple Architecture, Buddhist Architecture, Medieval Architecture. Rise of modern theatre and Indian cinema.

UNIT-IV: Spread of Indian Culture Abroad

Causes, Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies. Indian Culture in South East Asia. India, Central Asia and Western World through ages

UNIT-V: Education System in India:

Education in ancient, medieval and modern India, aims of education, Science and scientists of ancient India, Science and Scientists of Modern India.

SUGGESTED READINGS:

1. Kapil Kapoor, "Text and Interpretation: The Indian tradition" ISBN: 81246033375, 2005
2. " Science in Samskrit", Samskrita Bharti Publisher , ISBN 13 : 978- 8187276333,2007
3. NCERT , "Position Paper On Arts ,Music, Dance Theatre", ISBN 81-7450 494-X,200

IV YEAR - I SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC4106 R20AM4103 R20CC4119 R20CCOE310 / R20IT4107	Professional Elective – III • Natural Language Processing • ETL Principles • Information Retrieval Systems • Blockchain Technologies	PE	30	70	100	3	0	0	3
2	R20CC4102 R20AM4104 R20AM4105 R20AM4105	Professional Elective – IV • Human Computer Interaction • Big Data Analytics • Recommender Systems • Feature Engineering	PE	30	70	100	3	0	0	3
3	R20CC4121 R20CC4118 R20AM4108 R20CC4120	Professional Elective - V • Reinforcement Learning • NoSQL Databases • Data Analytics & Visualization • AI Chatbots	PE	30	70	100	3	0	0	3
4	**Open Elective – III**		OE	30	70	100	3	0	0	3
5	**Open Elective – IV**		OE	30	70	100	3	0	0	3
6	R20CC4101 R20CC4117	1. Business Management Concepts for Engineers 2. Entrepreneurship and Innovation	HS	30	70	100	3	0	0	3
7	R20AM41SC1	Data Analytics & Visualization Lab	SC	-	50	50	0	0	4	2
8	R20INTERN	Summer Internship/Community Service Project	PR	-	50	50	0	0	0	1.5
9	R20CC41MC	MOOCS								1.5
TOTAL										**23**
10		**Honors/Minor Course**		30	70	100	4	0	0	4

IV B.TECH I SEMESTER (P.E.III)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4106	**NATURAL LANGUAGE PROCESSING**						

COURSE OBJECTIVES

This course enables the students:

- To understand the algorithms available for the processing of linguistic Information and computational properties of natural languages.
- To conceive basic knowledge on various morphological, syntactic and Semantic NLP tasks.
- To familiarize various NLP software libraries and data sets publicly available.
- To develop systems for various NLP problems with moderate complexity.
- To learn various strategies for NLP system evaluation and error analysis.

COURSE OUTCOMES

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

CO1 : Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language [K2].

CO2 : Demonstrate understanding of the relationship between NLP and statistics &machine learning. [K4].

CO3 : Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. [K4].

CO4 : Develop systems for various NLP problems with moderate complexity [K4].

CO5 : Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings [K4].

SYLLABUS

UNIT-I

Introduction to NLP: NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

UNIT-II

Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, smoothing (basic techniques), Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.

UNIT-III

Parts-of-speech Tagging Parts-of-speech Tagging: Basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

UNIT-IV

Parsing Basic concepts: Top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

UNIT-V

Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.

TEXT BOOKS:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing", 3rd Edition, 2018.

REFERENCE BOOKS:

1. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing".

IV B.TECH I SEMESTER (P.E.III)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM4103	**ETL PRINCIPLES**						

COURSE OBJECTIVES:

- To learn to handle ETL operations effectively, making sure data is secure, risks are minimized, and processes are efficient.
- To acquire the skills to enhance ETL processes by following best practices, maintaining data quality, and improving performance.

COURSE OUTCOMES:

By completing the course the students will be able to:

CO1 : Understand the different data structures used in ETL systems, such as flat files, XML data sets, and relational tables, and understand the principles of staging data. [K2]

CO2 : Apply tools and techniques to build logical data maps, extract data from diverse sources, and integrate heterogeneous data, ensuring data quality and adherence to business rules. [K3]

CO3 : Apply data quality standards and cleansing techniques to handle data anomalies, design conformed dimensions, and deliver dimension tables for data integrity. [K3]

CO4 : Analyze different fact table structures, manage indexes, and efficiently load and maintain fact data, optimizing ETL performance.[K4]

CO5 : Apply ETL operations, including scheduling, migration, and performance optimization, while minimizing risks and enhancing data security, ensuring efficient ETL processes. [K3]

SYLLABUS

UNIT I:

ETL Data Structures: To Stage or Not to Stage, Designing the Staging Area, Data Structures in the ETL System: Flat files, XML Data Sets, Relational Tables, Independent DBMS Working Tables, Third Normal Form Entity/Relation Models, No relational Data Sources, Dimensional Data Models, Fact Tables, Dimension Tables, Atomic and Aggregate Fact Tables, Surrogate Key Mapping Tables

UNIT II:

Extracting: Logical Data Map, Components of the Logical Data Map, Using Tools for the Logical Data Map, Building the Logical Data Map- Data Discovery Phase, Data Content Analysis, Collecting Business rules in the ETL Processes, Integrating Heterogeneous Data Sources, Challenge of Extracting from Disparate Platforms, Flat files, XML Sources, Web Log Sources, ERP System Sources

UNIT III:

Cleaning and Conforming: Defining Data Quality, Cleaning Deliverables, Known Table Row Counts, Column Nullity, Column Numeric and Date Ranges, Column Length Restriction, Column Explicit Valid Values, Column Explicit Invalid Values, Conformed Dimensions, Designing the Conformed Dimensions, Conformed Facts

Delivering Dimension Tables: The Basic Structure of a Dimension, the Grain of a Dimension, Flat Dimensions and Snowflaked Dimensions, Date and Time Dimensions, Big Dimensions, Small Dimensions, Dimensional Roles, Degenerate Dimensions, Slowly Changing Dimensions, Multivalued Dimensions and Bridge Tables

UNIT IV:

Delivering Fact Tables: Basic Structure of a Fact Table, Surrogate Key Pipeline, Fundamental Grains: Transaction Grain Fact Tables, Periodic Snapshot Fact Table, Accumulating Snapshot Fact Tables, Managing Indexes, Managing Partitions, Outwitting the Rollback Log, Loading the Data, Incremental Loading, Inserting Facts, Updating and Correcting Facts, Negating Facts, updating Facts, Deleting Facts, Factless Fact Tables

UNIT V:

Operations: Scheduling and Support, Migrating to Production, Achieving optimal ETL performance: Estimating Load Time, Vulnerabilities of Long-Running ETL processes, Minimizing Risk of Load Failures, Purging Historic Data, Monitoring ETL System: Measuring ETL Specific Performance Indicators, Measuring Infrastructure Performance Indicators, Tuning ETL Processes, ETL System Security.

TEXT BOOKS:

1. Ralph Kimball, Joe Caserta, "The Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data," Wiley, 2004.

REFERENCES:

1. Silvers, Fon, "Building and Maintaining a Data Warehouse," Ukraine: CRC Press, 2008.

WEB REFERENCES:

1. https://www.coursera.org/learn/extract-transform-and-load-data

IV B.TECH I SEMESTER (P.E.III)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4119	**INFORMATION RETRIEVAL SYSTEMS**						

COURSE OBJECTIVES:

- To provide the foundation knowledge in information retrieval.
- To equip students with sound skills to solve computational search problems.
- To appreciate how to evaluate search engines.
- To appreciate the different applications of information retrieval techniques in the Internet or Web environment.
- To provide hands-on experience in building search engines and/or hands-on experience in evaluating search engines.

COURSE OUTCOMES:

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

CO1 : Understand basic theories in information retrieval systems [K2]
CO2 : Classify the analysis tools as they apply to information retrieval systems. [K2]
CO3 : Illustrate the problems solved in current IR systems.[K3]
CO4 : Discuss the advantages of current IR systems [K4]
CO5 : Summarize the difficulty of representing and retrieving documents.[K2]

SYLLABUS

UNIT-I:

Introduction to Information Storage and Retrieval System: Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms

UNIT-II:

Inverted Files: Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

UNIT-III:

Signature Files: Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

UNIT-IV:

New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

UNIT-V:

Stemming Algorithms: Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files

Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri

TEXT BOOKS:

1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
2. Modern Information Retrieval by Yates Pearson Education.
3. Information Storage & Retrieval by Robert Korfhage – John Wiley & Sons.

REFERENCE BOOKS:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2ed, Springer

IV B.TECH I SEMESTER (P.E.III)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CCOE10 / R20IT4107	**BLOCK CHAIN TECHNOLOGIES**						

COURSE OBJECTIVES:

- Introduces the fundamental concepts and functionalities of Blockchain.
- Provide conceptual understanding of methods in securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

COURSE OUTCOMES:

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

CO1 : Summarize the fundamentals of Blockchain.[K2]
CO2 : Analyze the working of Blockchain.[K4]
CO3 : Interpret how business can be easily made with Blockchain.[K4]
CO4 : Summarize how Block Chain can be integrated with various current technologies.[K2]
CO5 : Get familiarity about the Blockchain strength in providing solutions.[K3]

SYLLABUS:

UNIT-I:

Grasping Blockchain Fundamentals: Tracing Blockchain's Origin, The shortcomings of current transaction systems, the emergence of bitcoin, the birth of blockchain, revolutionizing the Traditional Business Network, Exploring a blockchain application, recognizing the jey business benefits, Building trust with blockchain.

UNIT-II:

Taking a Look at How Blockchain Works: Why It's Called "Blockchain", what makes a Blockchain Suitable for Business? Shared ledger, Permissions, Consensus, Smart Contracts, Identifying Participants and their Roles.

UNIT-III:

Propelling Business with Blockchains: Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business Networks, Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility.

UNIT-IV:

Block chain in Action: Use Cases: Financial Services, Commercial financing, Trade finance, Cross-border transactions, Insurance, Government, Supply Chain Management, Healthcare, Electronic medical records Healthcare payments preauthorization.

UNIT-V:

Hyper ledger, a Linux Foundation Project: Hyper ledger Vision, Hyper ledger Fabric, How Can IBM Help Developers Innovate with Blockchain? Offering an easily accessible cloud and development platform, Individualized attention and industry Expertise, Problems with Blockchain: Security and Safeguards, Protection from attackers, Hacks on exchanges, what is stopping adoption? Scalability problems, Network attacks to destroy bitcoin, Case Study: Failed currencies & Blockchain.

TEXTBOOKS:

1. Blockchain for Dummies®, IBM Limited Edition, Manav Gupta, John Wiley & Sons, Inc. 111 River St, Hoboken, NJ 07030-5774

REFFERENCE BOOKS:

1. Swan, Melanie. Blockchain: Blueprint for a new economy. “O’Reilly Media, Inc.”, 2015.
2. Gupta, M. “Blockchain for Dummies.”(2017).

IV B.TECH I SEMESTER (P.E.IV)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4102	**HUMAN COMPUTER INTERACTION**						

COURSE OBJECTIVES:

- The main objective is to get student to think constructively and analytically about how to design and evaluate interactive technologies.

COURSE OUTCOMES:

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

CO1 : Outline knowledge about user interface design. [K2]
CO2 : Summarize the importance of Graphical User Interface. [K2]
CO3 : Apply the strategies used in design process. [K3]
CO4 : Summarize the importance of screen designing. [K2]
CO5 : Apply the various operations of Windows. [K3]

SYLLABUS

UNIT – I

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.

UNIT – II

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT – III

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds.

UNIT – IV

Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics.

UNIT – V

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls.

Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Goryd, Abowd, Russell Beal, "Human Computer Interaction", PEA, 3/e, 2004.
2. Wilbert O Galitz, "The Essential guide to user interface design", Wiley Dream tech, 2/e.

REFERENCE BOOKS:

1. Dan R.Olsan, “Human Computer”, Interaction Cengage 2010.
2. Ben Shneidermann , “Designing the user interface”, 4/e, PEA.
3. Soren Lauesen, “User Interface Design”, PEA.
4. Prece, Rogers, Sharps, “Interaction Design”, Wiley.

WEB REFERENCES:

1. https://scholar.google.co.in/scholar?q=human+computer+interaction&hl=en&as_sdt=0&as_vis=1&oi=scho lar
2. https://www.interaction-design.org/literature/topics/human-computer-interaction
3. https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction
4. https://www.tutorialspoint.com/human_computer_interface/human_computer_interface introduction.htm

IV B.TECH I SEMESTER (P.E.IV)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM4104	**BIG DATA ANALYTICS**						

COURSE OBJECTIVES:

- Introducing Java concepts required for developing map reduce programs.
- Optimize business decisions and create competitive advantage with Big Data analytics.
- Derive business benefit from unstructured data.
- Imparting the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

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

CO1 : Interpret the architectural elements of big data and Hadoop framework. [K2]
CO2 : Analyse various big data applications using map reduce programming module [K4]
CO3 : Analyse Spark capabilities such as distributed datasets, in-memory caching, and the interactive shell. [K4]
CO4 : Summarize Spark's powerful built-in libraries, including Spark SQL, Spark Streaming. [K2]
CO5 : Analyze Hadoop data with PIG and Hive. Interpret the applications and architecture of Mobile Computing and multiplexing techniques. [K4]

SYLLABUS:

UNIT– I

Starting Hadoop: Google File System, -The building blocks of Hadoop: Namenode, Data node, Secondary Namenode, Job Tracker, Task Tracker. -Setting up SSH for a Hadoop cluster: Define a common account, Verify SSH installation, Generate SSH key pair, Distribute public key and validate logins. - Running Hadoop: Local (standalone) mode, Pseudo-distributed mode, fully distributed mode.

UNIT–II

Map Reduce: A Weather Dataset: Data Format, -Analyzing the Data with Hadoop: Map and Reduce, Java Map Reduce: A test run, the old and the new Java Map Reduce APIs.
Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner.

UNIT–III

Programming with RDDs: What Is Apache Spark, RDD Basics, Creating RDDs, RDD Operations, Passing Functions to Spark, Common Transformations and Actions, Persistence (Caching).

UNIT-IV

Pig: Hadoop Programming Made Easier: Admiring the Pig Architecture, -Going with the Pig Latin Application Flow, -Working through the ABCs of Pig Latin: Uncovering Pig Latin structures, looking

at Pig data types and syntax. -Evaluating Local and Distributed Modes of Running Pig Scripts, -Checking out the Pig Script Interfaces, -Scripting with Pig Latin.

UNIT-V

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: The Hive CLI client, The web browser as Hive client, Squirrel as Hive client with the JDBC Driver. -Working with Hive Data Types, -Creating and Managing Databases and Tables: Managing Hive databases, Creating and managing tables with Hive. -Seeing How the Hive Data Manipulation Language Works: LOAD DATA examples, INSERT examples, Create Table as Select (CTAS) examples. Querying and Analyzing Data: Joining tables with Hive, Improving your Hive queries with indexes, Windowing in HiveQL, Other key HiveQL features.

TEXT BOOKS:

1. Tom White, "Hadoop: The Definitive Guide" 3rd Edition, O'Reilly Media.
2. Matei Zaharia, Holden Karau, Andi Konwinski, Patric Wendell, Learning Spark, O'Reilly Media,2015.
3. by Chuck Lam, "Hadoop in Action" MANNING Publ.
4. Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss, "Hadoop for Dummies"

REFERENCE BOOKS:

1. Alex Holmes, "Hadoop in Practice", MANNING Publ.
2. Srinath Perera, "Hadoop Map Reduce Cookbook", Thilina Gunarathne

WEB REFERENCES:

1. https://www.edx.org/learn/big-data
2. https://www.edureka.co/big-data-and-hadoop

IV B.TECH I SEMESTER (P.E.IV)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM4105	**RECOMMENDER SYSTEMS**						

COURSE OBJECTIVES:

- To equip students with a comprehensive understanding of recommender systems, spanning collaborative filtering, content-based recommendation, knowledge-based recommendation, hybrid approaches, and evaluation methods, enabling them to design, implement, and critically evaluate recommendation systems for diverse applications.
- To cultivate students' analytical and problem-solving skills, allowing them to address the challenges associated with recommendation systems, ranging from data analysis and algorithm implementation to model selection, user-centered design, and the assessment of system performance, while also considering security and ethical considerations in recommendation system design.

COURSE OUTCOMES:

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

CO1 : To understand basic techniques and problems in the field of recommender systems [K2]
CO2 : Evaluate Types of recommender systems: non-personalized, content based, collaborative filtering [K3]
CO3 : Apply algorithms and techniques to develop Recommender Systems that are widely used in the Internet industry [K3]
CO4 : Apply knowledge based and hybrid recommender systems for designing models. [K3]
CO5 : To develop state-of-the-art recommender systems [K3]

SYLLABUS

UNIT-I

Introduction: Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

UNIT-II

Collaborative Filtering: User-based nearest neighbour recommendation, Item-based nearest neighbour recommendation, Model based and pre-processing based approaches, Attacks on collaborative recommender systems.

UNIT-III

Content-based recommendation: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

UNIT-IV

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies.

UNIT-V

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs, Evaluation on historical datasets, Error metrics, Decision-Support metrics, User-Centred metrics.

TEXT BOOKS

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.

REFERENCES

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed

IV B.TECH I SEMESTER (P.E.IV)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM4106	**FEATURE ENGINEERING**						

COURSE OBJECTIVES:

- To equip students with a solid understanding of the machine learning pipeline, feature engineering techniques, and data pre-processing, enabling them to transform and optimize raw data effectively.
- To develop proficiency in handling and extracting meaningful information from various data types, including text data and categorical variables, and to apply dimensionality reduction and nonlinear featurization methods for improved machine learning outcomes.

COURSE OUTCOMES:

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

CO1 : Analyze various techniques for transforming and pre-processing data, such as scalars, vectors, and feature scaling. [K4]

CO2 : Apply techniques for cleaning and pre-processing text data, including stop words removal, stemming, and phrase detection [K3]

CO3 : Explain various encoding methods for categorical variables, such as one-hot encoding, dummy coding, and feature hashing. [K2]

CO4 : Apply the concept of nonlinear featurization through K-Means clustering. [K3]

CO5 : Apply item-based collaborative filtering for recommendation systems. [K3]

SYLLABUS

UNIT – I :

The Machine Learning Pipeline : Data, Tasks, Models, Features, Model Evaluation Fancy Tricks with Simple Numbers: Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Log Transform in Action, Power Transforms: Generalization of the Log Transform, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling), ℓ2 Normalization, Interaction Features, Feature Selection

UNIT – II :

Text Data: Flattening, Filtering, and Chunking: Bag-of-X: Turning Natural Text into Flat Vectors, Bagof-Words, Bag-of-n-Grams, Filtering for Cleaner Features: Stop words, Frequency-Based Filtering, Stemming; Atoms of Meaning: From Words to n-Grams to Phrases: Parsing and Tokenization, Collocation Extraction for Phrase Detection The Effects of Feature Scaling: From Bag-of-Words to Tf-Idf :Tf-Idf : A Simple Twist on Bag-of Words, Putting It to the Test : Creating a Classification Dataset, Scaling Bag-of-Words with Tf-Idf Transformation, Classification with Logistic Regression, Tuning Logistic Regression with Regularization

UNIT – III :

Categorical Variables: Counting Eggs in the Age of Robotic Chickens: Encoding Categorical Variables: One-Hot Encoding, Dummy Coding, Effect Coding, Pros and Cons of Categorical Variable Encodings; Dealing with Large Categorical Variables: Feature Hashing, Bin Counting Dimensionality Reduction: Squashing the Data Pancake with PCA: Intuition, Derivation: Linear Projection, Variance and Empirical Variance, Principal Components: First Formulation, Principal Components: Matrix-Vector Formulation, General Solution of the Principal Components; Transforming Features, Implementing PCA: PCA in Action, Whitening and ZCA, Considerations and Limitations of PCA

UNIT – IV:

Nonlinear Featurization via K-Means Model Stacking: k-Means Clustering, Clustering as Surface Tiling, k-Means Featurization for Classification: Alternative Dense Featurization, Pros, Cons, and Gotchas

UNIT – V :

Item-Based Collaborative Filtering, First Pass: Data Import, Cleaning, and Feature Parsing, Academic Paper Recommender: Naive Approach, Second Pass: More Engineering and a Smarter Model, Academic Paper Recommender: Take 2, Third Pass: More Features is More Information, Academic Paper Recommender: Take 3

TEXT BOOKS:

1. "Feature Engineering for Machine Learning Principles and Techniques for Data Scientists", Alice Zheng& Amanda Casari, O'REILLY, 2018
2. "Feature Engineering and Selection: A Practical Approach for Predictive Models", Max Kuhn, Kjell Johnson, CRC Press, 2019.

REFERENCE BOOKS:

1. "The art of feature engineering essentials for machine Learning" Pablo, Duboue, Cambridge University Press, 2020.
2. Feature Engineering Made Easy: Identify Unique Features from Your Dataset in Order to Build Powerful Machine Learning Systems, DivyaSusarla and SinanOzdemir, Packt Publishing, 2018.

IV B.TECH I SEMESTER (P.E.- V)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4121	**REINFORCEMENT LEARNING**						

COURSE OBJECTIVES:

- Good understanding of various types of algorithms for Reinforcement Learning
- Be able to design an RL system

COURSE OUTCOMES:

Upon completion of this course, the students should be able to:

- **CO1 :** Summarize the relevance of Reinforcement Learning and how does it complement other ML Techniques. [K2]
- **CO2 :** Analyze various RL algorithms. [K4]
- **CO3 :** Formulate a problem as a Reinforcement Learning problem and solve it [K3]
- **CO4 :** Implement RL algorithms using Python [K3]
- **CO5 :** Apply convergence analysis to assess the efficiency and stability of value iteration in various reinforcement learning scenarios. [K3]

SYLLABUS:

UNIT – I

Introduction: Notation, what is Reinforcement Learning (RL)?, 687-Gridworld: A Simple Environment, Describing the Agent and Environment Mathematically, Creating MDPs, Planning and RL, Additional Terminology, Notation, and Assumptions.

UNIT – II

Black-box optimization for rl: Hello Environment! , Black-Box Optimization (BBO) for Policy Search, Evaluating RL Algorithms.

Value functions: State-Value Function, Action-Value Function, The Bellman Equation for v, the Bellman Equation for q π, Optimal Value Functions, Bellman Optimality Equation for v *

UNIT – III

Policy iteration and value iteration: Policy Evaluation, Policy Improvement, Value Iteration, the Bellman Operator and Convergence of Value Iteration.

Monte Carlo methods: Monte Carlo Policy Evaluation, Gradient-Based Monte Carlo Algorithm.

UNIT-IV

Temporal difference (td) learning: Function Approximation, Maximum Likelihood Model of an MDP versus Temporal Difference Learning, Sarsa: Using TD for control, Q-Learning: Off-Policy TD-Control.

UNIT – V

High-confidence policy improvement: Off-Policy Policy Evaluation, High-Confidence Off-Policy Evaluation (HCOPE), High-Confidence Policy Improvement, λ-Return Algorithm.

Backwards view of td (Λ): True Online Temporal Difference Learning, Sarsa (λ) and Q (λ), Policy Gradient Algorithms, Policy Gradient Theorem, Proof of the Policy Gradient Theorem.

TEXT BOOKS:

1. Sutton and Barto, Reinforcement Learning: An Introduction, the MIT Press Cambridge, Massachusetts London, England, 2015.
2. Csaba Szepesvari, Algorithms for Reinforcement Learning, Morgan & Claypool, United States, 2010.

REFERENCES:

1. Anand Raja Raman, Jure Leskovec and J.D.Ullman, "Mining of Massive Data Sets"' ebook, Publisher, 2014.
2. Kevin P. Murphey, "Machine Learning, a Probabilistic Perspective", the MIT Press Cambridge, Massachusetts, 2012.
3. Tomasz Drabas, Denny Lee,"Learning Pyspark", Packt, February 2017.
4. Jeff M. Philips, "Coresets", arXiv:1601.00617,20

WEB REFERENCES:

1. https://elearning.dl.unipi.it/course/view.php?id=227
2. https://mrcet.com/downloads/digital_notes/IT/R17A1201%20

IV B.TECH I SEMESTER (P.E.- V)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4118	**NO SQL DATABASES**						

COURSE OBJECTIVES

- To grasp the challenges and benefits of handling persistent data, concurrency, and integration.
- Gain practical knowledge in key database models like key-value stores, document databases, and graph databases.

COURSE OUTCOMES

Upon completion of the course the student will be able to

CO1 : Analyze, evaluate, and design database systems using various data models and technologies [K4]

CO2 : Analyze, compare, and implement advanced distribution models and consistency strategies in distributed database systems. [K4]

CO3 : Design, implement, and manage Key-Value Store systems. [K5]

CO4 : Design, implementation, and management of Document Databases. [K5]

CO5 : Design, implement, and manage Graph Databases. [K5]

SYLLABUS

UNIT-I:

Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access,

UNIT-II:

Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

UNIT-III:

What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

UNIT-IV:

Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications,

When Not to Use, Complex.
Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT-V:
Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use.

TEXT BOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

REFERENCE BOOKS:

1. Dan Sullivan, "NoSQLFor Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

IV B.TECH I SEMESTER (P.E.- V)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20AM4108	**DATA ANALYTICS & VISUALIZATION**						

COURSE OBJECTIVES

- To understand the importance of analytics in a wide variety of industries
- To understand the various types of data, apply and evaluate the principles of data visualization.
- Acquire skills to apply visualization techniques to a problem and its associated dataset.
- To apply structured approach to create effective visualizations from the massive dataset using various visualization tools.

COURSE OUTCOMES

Upon completion of the course the student will be able to

CO1 : Interpreting the Importance of Data and its importance [K2]
CO2 : Illustrating various ANOVA methods and Regression methods [K2]
CO3 : Analyze various data types and visualization types to extract meaningful insights. [K4]
CO4 : Apply visualization techniques to address specific problems using datasets and derive valuable insights, especially for large datasets.[K3]
CO5 : Make use of powerbi tool for applying various functions. [K3]

SYLLABUS:

UNIT-I

Introduction to Data Analytics: Data and its importance, data analytic and its types, importance of data analytics

Python Fundamentals: Python Language Basics, Jupiter Notebook, Introduction to pandas, Data Structures, Essential Functionality

Central Tendency and Dispersion: Visual Representation of the Data, Measures of Central Tendency, Dispersion

UNIT-II

Analysis of Variance (ANOVA): Introduction to ANOVA, one way ANOVA, two way ANOVA, Post – Hoc test

Regression: Simple Linear Regression, Multiple Linear Regression, Maximum Likelihood Estimation (MLE), Logistic Regression, step-wise methods and algorithms.

UNIT-III Introduction to Data Visualization

Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis: Four Levels for Validation. Statistical charts (Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart - Frequency Polygon - Box plot - Scatter plot - Regression curves.)

UNIT-IV Visualization Techniques

Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques -multidimensional techniques - visualizing cluster analysis K-means and Hierarchical Cluster techniques.

UNIT-V Data Visualization Tools:

Power BI – DAX Logical Functions - Date and Time Functions, Time Intelligence Functions, Information Functions, Logical Functions, Mathematical and Trigonometric Functions, Statistical Functions, Text Functions, Parent-Child functions.

TEXT BOOKS

1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. “O’Reilly Media, Inc.".
2. David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). “Wiley-Interscience Publication”.
3. Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.
4. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021

REFERENCE BOOKS

1. Dr. Chun-hauh Chen, W. K. Hardle, A. Unwin, Handbook of Data Visualization, 1st edition, Springer publication, Germany, 2008.
2. Ben Fry, Visualizing Data, 1st edition, O'Reilly Media, United States, 2008.
3. Avril Coghlan, A little book of R for multivariate analysis, 1st edition, Welcome Trust Sanger Institute, United Kingdom, 2013.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21 cs45/preview
2. https://onlinecourses.nptel.ac.in/noc21 ma74/preview
3. https://onlinecourses.nptel.ac.in/noc23 cs18/preview

IV B.TECH I SEMESTER (P.E.- V)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4120	**AI CHATBOTS**						

COURSE OBJECTIVES:

- Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
- Identify best practices for defining a chatbot use case, and use a rapid prototyping framework to develop a use case for a personalized chatbot.

COURSE OUTCOMES:

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

CO1 : Understand the significance of chatbot in various industries. [K2]
CO2 : Apply the concepts of chatbot to real world applications. [K3]
CO3 : Design a generic solution architecture for private chatbots. [K5]
CO4 : Understand the concept of chatbot architecture, be familiar with popular open-source NLP and NLU tools. [K2]
CO5 : Proficient in integrating chatbots with third part APIs and databases effectively.[K5]

UNIT-I:

Introduction: Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR)

UNIT-II:

Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

UNIT-III:

Building a Chatbot Solution: Business Considerations, Chatbots vs. Apps, Growth of Messenger Applications, Direct Contact vs. Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots

UNIT IV:

Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

UNIT V:

Introduction to Microsoft Bot, RASA, and Google Dialog flow: Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module

TEXT BOOKS:

1. Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks", ISBN 978-1-4842-5034-1, Apress,2019

REFERENCE BOOKS:

1. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
2. Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
3. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564.
4. Abhishek Singh, Karthik Ramasubramanian and Shrey Shivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334.

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4101	**BUSINESS MANAGEMENT CONCEPTS FOR ENGINEERS**						

COURSE OUTCOMES:

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

- **CO1 :** Summarize fundamentals of Managerial economics for decision making. [K2]
- **CO2 :** Apply concepts of Financial Accounting and BEP for business decisions. [K3]
- **CO3 :** Evaluate fundamental concepts and principles of management. [K5]
- **CO4 :** Discuss functional areas of management like HR, marketing and finance. [K6]
- **CO5 :** Apply project management techniques for project planning and evaluation. [K3]

SYLLABUS

UNIT-I:

Introduction to managerial economics: Definitions, - Nature And Scope- Relation With Other Subjects- Demand Definition- Determinants- Law of Demand and Its Exceptions- Concept of Elasticity of Demand- Cost Concepts- CVP Analysis (With Simple Problems), Significance-Limitations.

UNIT-II:

Market structures and financial accounting: Introduction to Markets – Features of various markets-Perfect competition, Monopoly and Oligopoly. Definition – Importance, limitations and basic books of financial accounting, Preparation of basic books of accounting: journal, ledger and trail balance.

UNIT-III:

Introduction to management: Concept, Nature, Importance- Functions of Management- Henry Fayols Principles of Management- F.W.Taylors Scientific Management- Douglas Mc Gregors Theory X and Y.

UNIT-IV:

Functional areas of management: Concept of HRM, Functions of HR Manager- Marketing Management- Functions of Marketing Manager- Production Management-Functions of Production Management – Financial Management and functions of Financial Management.

UNIT-V:

Project management: (PERT/CPM): Development of Network – Difference between PERT and CPM- Problems on Critical Path- Problems on PERT Analysis.

TEXT BOOKS

1. Dr. N. APPARAO Dr. P. Vijay Kumar: "Managerial economics and financial analysis" Cengage publication's, New Delhi-2011.
2. Dr. A. R. Aryasri- Managerial Economics and Financial Analysis, TMH2011.
3. V. Maheswari: Managerial Economies, Sultan Chand.
4. Suma Damodaran: Managerial Economics, Oxford 2011.
5. Koontz & Weihrich: Essentials of Management" TMH 2011.

REFERENCES:

1. Managerial economics theory & applications, DM Mithani, Himalaya Publishing House, 2013. **Unit-1, 2**
2. Accounting For Managers, G. Prasad, Jaibharath Publishers, 2016. - **Unit-3**
3. Dr. P. Vijaya Kumar & Dr. N. Appa Rao," Management Science" cengage. Delhi, 2012. **Unit-4, 5**
4. Project Planning & Control with PERT & CPM, BC Punmia & KK Khandelwal, Lakshmi Publications, New Delhi, 4th Edition – 2016. - **Unit-6**

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	30	70	100	3
SUBCODE: R20CC4117	**ENTREPRENEURSHIP & INNOVATION**						

COURSE OBJECTIVES:

- Creating awareness among the students about the significance of entrepreneurship and its social relevance.
- Imparting knowledge to the students on institutional support available to start a business venture
- To understand the significance of entrepreneurial training in the development of new and existing entrepreneurs

COURSE OUTCOME:

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

CO1 : Outline the concepts of Entrepreneurship.[K2]
CO2 : Create the awareness on creativity and innovation.[K6]
CO3 : Adopt the Entrepreneurship Development programs[K6]
CO4 : Evaluate the project planning and feasibility studies.[K5]
CO5 : Analyze the concept of small and micro enterprises.[K4]

SYLLABUS:

UNIT –I

Entrepreneur and entrepreneurship: Entrepreneur – Definitions, concept of entrepreneur, characteristics of entrepreneur, types of entrepreneurs, concept of entrepreneurship, characteristics of entrepreneurship, role of entrepreneurship in economic development, ethics and social responsibilities of an entrepreneur, Financial institutional support to entrepreneurs (IDBI,SISI,DIC,NIESBUD, Commercial banks etc.,

UNIT-II

Creativity and innovation in entrepreneurship: Meaning and concept of creativity - Nature and characteristics of creativity -Creativity Process- Factors affecting creativity - Meaning and Importance Innovation - Process -Distinguish the Creativity and Innovation.

UNIT –III

Entrepreneurship development programmes: Designing Appropriate Training Programme to inculcate Entrepreneurial Spirit -Training for Entrepreneurs, Entrepreneurship Development Programme (EDP) – Need and objectives of EDP's -Phases and evolution on EDP's existing and new Entrepreneurs.

UNIT –IV

Project planning and feasibility studies: Meaning of a project, Project identification – Sources of new Ideas, Methods of generating ideas, Project selection, - Project Feasibility Study -Project evaluation and Techniques (PBP, ARR, NPV, IRR & PI).

UNIT –V

Small and micro enterprises: Importance, definitions, MSME's Development Act 2006 – policies

and their support to MSMEs - Growth of Firm and growth strategies, Factors inducing growth – sickness in small business and remedies.

TEXT BOOKS:

1. Arya Kumar , "Entrepreneurship", Pearson, Publishing House, New Delhi, 2012.
2. VSP Rao, Kuratko, "Entrepreneurship', Cengage Learning, New Delhi,2012
3. Shoimo Maital, DVR Seshadri, "Innovation Management", Response Books 2007

REFERENCE BOOKS:

1. B.Janakiram, M Rizwana , "Entrepreneurship Development", Excel Books, ND, 2011
2. P.C.Shejwalkar , "Entrepreneurship Development", Everest Publishing House, ND, 2011
3. Vinnie Jauhari& Sudhanshu Bhushan, "Innovation Management". Oxford University Press, 2014.

WEB REFERENCES:

1. https://www.sciencedirect.com/science/article/abs/pii/S0362331900000604
2. https://www.emerald.com/insight/content/doi/10.1108/ET-02-2013-0018/full/html
3. https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-9-innovation-and-entrepreneurship/

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	4	0	50	50	2
SUBCODE: R20AM41SC1	**DATA ANALYTICS & VISUALIZATION LAB**						

COURSE OBJECTIVES:

- To introduce Tableau and enable to connect different data sources and prepare data for analysis.
- To introduce students to Power BI, enabling them to understand its products, install Power BI Desktop, connect to data sources, and become familiar with the user interface for data analysis and visualization.
- To equip students with the skills to transform and preprocess data effectively using Power BI, including tasks like data summarization, joining data tables.

COURSE OUTCOMES:

By completing the course the students will be able to:

CO1 : Understand the features and architecture of Tableau.[K2]

CO2 : Analyze different data sources, distinguish between live and extract connections. [K4]

CO3 : Demonstrate comprehension of different products within the Power BI Suite and will be able to install Power BI Desktop. [K3]

CO4 : Apply data transformation techniques, create calculated columns, measures, and perform data summarization, joining data tables, and data hierarchy to prepare data for analysis. [K3]

CO5 : Apply their knowledge to visualize data using various chart types, tables, and filtering methods in Power BI, allowing them to present data effectively. [K3]

Data Analytics

EXPERIMENT-I: Introduction to Tableau

- **a.** Installation of Tableau Desktop/Public
- **b.** Understanding the Architecture and Features of Tableau, Interface of Tableau (Layout, Toolbars, Data pane, Analytics pane etc.)
- **c.** Introducing various file type
- **d.** How to create data visualization using Tableau feature “show me”
- **e.** Reorder and Remove Visualization Fields
- **f.** How to create calculated field
- **g.** How to perform operation using cross tab
- **h.** Working with workbook data and Worksheet

EXPERIMENT-II: Data Preparation

- Connecting to different Data Source
  - i. Excel
  - ii. CSV

iii. SQL Server

- Live vs. Extract Connection
  - **i.** Creating Extract
  - **ii.** Refreshing Extract
  - **iii.** Increment Extract
  - **iv.** Refreshing Live
  - **v.** Data Source Editor
- Pivoting and splitting
- Data Interpreter: Clean Dirty Data

Data Visualization

EXPERIMENT-I: Introduction to Power BI

a) Understanding different types of products in the Power BI Suite
b) Installation of Power BI Desktop
c) Connecting to various common Data Sources
d) Getting familiar with the user interface of Power BI Desktop

EXPERIMENT-II: Data Transformation & Pre-Processing

a) Data Transformation
b) Data summarization using Grouping
c) Joining Data Tables
d) Creating Calculated Columns
e) Creating Measures
f) Grouping Data Categories
g) Applying Data Hierarchy

EXPERIMENT-III: Data Visualization using Charts Part-I

a) Stacked column and Bar Charts
b) Clustered column and Bar Charts
c) Line Chart
d) Area & Stacked Area Charts
e) Pie & Donut Charts
f) Stacked & Column Combined Charts

EXPERIMENT-III: Data Visualization using Charts Part-II

a) Funnel Chart
b) Waterfall chart
c) Tree Map Chart
d) Scatter Plot Chart

EXPERIMENT-IV: Presenting Data in Tables

a) Data Table
b) Data Presentation using Matrix Crosstab
c) Cards & Multi Row Cards

TEXT BOOKS

1. Pro Tableau: A Step-by-Step Guide By Seema Acharya, Subhashini Chellappan

2. Communicating Data with Tableau: Designing, Developing, and Delivering Data By Ben Jone
3. **Pro Power BI Desktop:** Self-Service Analytics and Data Visualization for the Power User 3rd Edition by Adam Aspin

WEB RESOURCES

1. https://www.tableau.com/
2. https://www.youtube.com/watch?v=SPB7JvU3CPY&list=PLNLDEHOJTZSiTiYy-WHFNvOhr8gPgBYeh
3. https://www.tutorialspoint.com/tableau/index.htmhttps://www.udemy.com/course/power-bi-for-data-visualization/
4. https://www.tutorialspoint.com/power_bi/power_bi_supported_data_sources.htm
5. https://learn.microsoft.com/en-us/power-bi/fundamentals/service-get-started

IV B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	0	0	0	0	1.5
SUBCODE: R20CC41MC	**MASSIVE OPEN ONLINE COURSES (MOOCs)**						

COURSE OBJECTIVES:

- The majority of MOOCs require that the learner be self-directed and proactive in the learning process. In addition to engaging in the course material, they provide learners with an opportunity to develop or expand their personal learning networks (PLN). Learner success is enhanced by learner actions before, during, and after the MOOC.

COURSE OUTCOMES:

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

CO1 : Identify suitable course required for their carrier. [K3]
CO2 : Adapt effectively for changing conditions. [K5]
CO3 : Develop and refine oral communication skills. [K3]
CO4 : Take part in lifelong learning. [K3]

EVALUATION OF MOOC's COURSE

Student has to complete an on-line course to fulfil the academic requirement of B.Tech course. The on-line Course should be offered by any reputed organization like NPTEL, COURSERA, edX, Udacity, SWAYAM etc., approved by Departmental Committee constituted by HOD. Student has to submit the progress of the MOOC's course (such as assignment submission etc.,) to the departmental committee. The B.Tech degree shall be awarded only upon submission of MOOC's certificate. If a student fails to submit in that semester, he/she has to submit the certificate in the subsequent semesters for getting the degree awarded.

IV B.TECH – II SEMESTER

S.No.	Subject Code	Subject	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20DD42PW	Major Project & Internship	PR	60	140	200	-	-	-	12
TOTAL										**12**

IV B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	60	140	200	12
SUBCODE: R20CC42PW	**MAJOR PROJECT & INTERNSHIP**						

COURSE OBJECTIVES:

- To offer students a glimpse into real world problems and challenges that need IT based solutions.
- To enable students to create very precise specifications of the IT solution to be designed.
- To enable students to use concepts of IT in creating a solution for a problem
- To improve the team building, communication and management skills of the students.

COURSE OUTCOMES:

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

CO1 : Acquire practical knowledge within the chosen area of technology for project development. [K3]

CO2 : Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach. [K4]

CO3 : Contribute as an individual or in a team in development of technical projects. [K3]

CO4 : Develop effective communication skills for presentation of project related activities. [K3]

1. **BATCH FORMATION:**
   The same batch of Mini Project – II will continue for the Main Project also. If any student wants to change the batch he/she can request project review committee (PRC). If possible project review committee can take required action.

2. **GUIDE ALLOTMENT:**
   If any guide who was allotted for Mini Project-II is not available, the batch can select a new guide with the consent of HOD.

3. **I MID SEMINAR**:
   Generally I Mid seminar is conducted after completing the literature survey. For this I Mid seminar the evaluation committee consists of guide, coordinator and HOD .This seminar is conducted for 40 marks. Out of 40 marks ,20 marks are awarded by guide based on the performance ,work and attendance of the student and 20 marks are awarded by the coordinator based on presentation ,work quality, analysis etc. during this seminar the students are supposed to deliver the proposed work and work completed so far.

4. **II MID SEMINAR:**
   Like I Mid seminar, for II Mid seminar the evaluation committee consists of guide, coordinator & HOD. This seminar is conducted for 40 marks. Out of 40 marks, 20 marks are awarded by guide based on the performance, work and attendance of the student. The remaining 20 marks are awarded by the coordinator based on presentation, work quality and result discussions. In this seminar the students are supposed to deliver the complete project work with final results.

5. **EXTERNAL SEMINAR & VIVA VOCE:**
   For external viva the evaluation committee consists of university nominated external examiner, guide & HOD. This viva is conducted for 120 marks.

LIST OF HONORS

1. The subjects opted for Honors should be advanced type which are not covered in regular curriculum.
2. Students has to acquire 16 credits with minimum one subject from each pool.
3. Concerned BoS can add or delete the subjects as per the decision of the board.
6. Pre requisites to be defined by the board for each course.
7. Compulsory MOOC / NPTEL Courses for 04 credits (02 courses@ 2 credits each)

Pool 1: ARTIFICIAL MODELLING

S.No.	HONOR Subject Title	Sub Code	No.of periods per week			No.of Credits
			L	T	P	C
1	Applications of AIML	R20AMHN01	4	0	0	4
2	Intelligence Information Retrieval	R20AMHN02	4	0	0	4
3	Cognitive Science	R20AMHN03	4	0	0	4
4	Pattern Recognition	R20AMHN04	4	0	0	4
5	Knowledge Representation and Reasoning	R20AMHN05	4	0	0	4
6	Expert Systems	R20AMHN06	4	0	0	4

Pool 2: Cloud Computing and Virtualization Technology

S.No.	HONOR Subject Title	Sub Code	No.of periods per week.			No.of Credits
			L	T	P	C
1	Introduction to IT Infrastructure Landscape	R20CSHN13	4	0	0	4
2	Cloud Computing Virtualization	R20CSHN14	4	0	0	4
3	Cloud Computing Architecture	R20CSHN15	4	0	0	4
4	Cloud Computing Security & Management	R20CSHN16	4	0	0	4

Minors:

S.No.	Minor Title	Dept. Offering Subject	Sub Code	No. of Periods per week			No. of credits
				L	T	P	C
1	Software Engineering	CSE (AIML)	R20CCMN34	4	0	0	4
2	Database Management Systems	CSE (AIML)	R20CCMN43	4	0	0	4
3	Artificial Intelligence	CSE (AIML)	R20CCMN44	4	0	0	4
4	Principles of Machine Learning	CSE (AIML)	R20CCMN45	4	0	0	4
5	Deep Learning	CSE (AIML)	R20CCMN46	4	0	0	4
6	Reinforcement Learning	CSE (AIML)	R20CCMN47	4	0	0	4
In addition to any of the four subjects, MOOC/NPTEL courses for 04 credits (2 8-weeks courses @ 2 credits each) are compulsorily in the domain of AIML							

Pool 1

ARTIFICIAL MODELLING

S.No.	HONOR Subject Title	Sub Code	No.of periods per week			No.of Credits
			L	T	P	C
1	Applications of AIML	R20AMHN01	4	0	0	4
2	Intelligence Information Retrieval	R20AMHN02	4	0	0	4
3	Cognitive Science	R20AMHN03	4	0	0	4
4	Pattern Recognition	R20AMHN04	4	0	0	4
5	Knowledge Representation and Reasoning	R20AMHN05	4	0	0	4
6	Expert Systems	R20AMHN06	4	0	0	4

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN01	**APPLICATIONS OF AIML**						

Course Objectives:
Students will be able to critically analyze and apply machine learning methodologies across diverse industries, including healthcare, retail, and finance.

Course Outcomes:
CO1: Apply the principles of machine learning in healthcare, retail and finance. [K3]
CO2: Apply key technological advancements to healthcare sector. [K3]
CO3: Apply key technological advancements to retail sector. [K3]
CO4: Implement machine learning solutions in financial contexts. [K5]
CO5: Analyze machine learning concepts across various industries. [K4]

UNIT 1:
Overview of Machine Learning in Healthcare, Overview of Machine Learning in Retail, Overview of Machine Learning in Finance

UNIT 2:
Key Technological advancements in Healthcare, How to Implement Machine Learning in Healthcare, Pitfalls to Avoid with Machine Learning in Healthcare

UNIT 3:
Key Technological Advancements in Retail, How to Implement Machine Learning in Retail, Pitfalls to Avoid With Machine Learning in Retail,

UNIT4:
Key Technological Advancements in Finance, How to Implement Machine Learning in Finance, Pitfalls to Avoid with Machine Learning in Finance

UNIT5:
Case Studies in Healthcare AI, Case Studies in Retail AI, Case Studies in Finance AI

TEXTBOOK:

1. Puneet Mathur, “Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance”, Apress, 2018 References:
2. S. Kanimozhi Suguna, M. Dhivya, Sara Paiva, “Artificial Intelligence (AI) Recent Trends and Applications”, CRC Press, 2021

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN02	**INTELLIGENCE INFORMATION RETRIEVAL**						

Course Objectives:

To provide students with a comprehensive understanding of Information Retrieval (IR) systems and models, equipping them with the knowledge and skills for applying techniques and analyzing models.

Course Outcomes:

CO1: Understand the fundamentals of Information Retrieval (IR) systems [K2]

CO2: Apply statistical characteristics of text, regular expressions, text normalization, edit distance, and N-gram language models. [K3]

CO3: Analyze and compare similarity measures, ranking methods, Boolean matching, vector space models, probabilistic models, XML retrieval, and language models for information retrieval. [K4]

CO4: Analyze web search basics, characteristics, web crawling, distribution of indexes, connectivity servers, link analysis, and algorithms like PageRank [K4]

CO5: Apply web mining techniques and understand their applications, including mining on social media platforms. [K3]

UNIT-1:

Fundamentals of IR Systems, Models and Indexing: Overview of IR Systems, Information retrieval using the Boolean model, the dictionary and postings lists, Tolerant retrieval, Automatic Indexing, Index construction and compression, Scoring, Vector space model and term weighting

UNIT-2:

Document Representation and Analysis: Statistical Characteristics of Text, Regular Expressions, Text Normalization, Edit Distance, N- Gram Language Models, Naive Bayes and Sentiment Classification-Logistic Regression for Document Analysis

Query Processing and Evaluation: Basic Query Processing, Data Structure and File Organization for IR, Evaluation in information retrieval-Relevance feedback, User Profiles, Collaborative Filtering and query expansion

UNIT-3:

Retrieval Models: Similarity Measures and Ranking, Boolean Matching, Vector Space Models, Probabilistic Models, XML Retrieval, Language models for information retrieval.

Text Classification and Clustering: Text classification-vector space classification-support vector machines and machine learning on documents-Clustering-flat clustering- hierarchical clustering-Matrix decompositions and latent semantic indexing

UNIT-4:

Web Search Analysis: Web search basics. Web characteristics-index size and estimation- near duplicates and shingling-web crawling-distributing indexes- connectivity servers-link analysis-web as a graph-PageRank- Hubs and authoritative pages- summarization-question answering

UNIT-5:

Web Mining and Online IR Systems: Web mining and its applications-Mining Twitter, Facebook, Instagram, Linkedin, Mailboxes and GitHub.Online IR systems- online public access catalogs-digital libraries-architectural issues- document models -representations and access protocols

TEXT BOOK(S):

1. C. D. Manning, P. Raghavan, and H. Schutze, Introduction to Information Retrieval, Cambridge University Press (2008)
2. Ricardo Baezce Yates, Berthier Ribeiro-Neto, Modern Information Retrieval: The Concepts and Technology behind Search (2ndEd, 2010)
3. Mikhail Klassen, Matthew A. Russell, Mining the Social Web,O'Reilly Media, Inc., 3rd Edition (2019)

REFERENCE BOOKS:

1. Ceri, S., Bozzon, A., Brambilla, M., Della Valle, E., Fraternali, P. And Quarteroni, S., 2013. Web information retrieval. Springer Science & Business Media.
2. D. Jurafsky, and J. Martin, Speech and language processing : an introduction to natural language processing, computational linguistics, and speech recognition, Pearson Prentice Hall, Second Edition (2013)
3. Giles, Mark Smith, John Yen, Advances in Social Network Mining and Analysis ,Springer, 2010
4. Bruce Croft, Donald Metzler and Trevor Strohma, Search Engines: Information Retrieval in Practice (1st Ed 2009)

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN03	**COGNITIVE SCIENCE**						

Course Objectives:

To provide students with a comprehensive understanding of Cognitive Science.

Course Outcomes:

CO1: Understand the fundamental concepts of cognitive science, appreciate its interdisciplinary nature [K2]

CO2: Apply planning and learning methods in cognitive systems, including situation logic, rote learning, inductive learning, and various classification techniques [K3]

CO3: Analyze reasoning methods, such as reasoning by analogy, explanation-based reasoning, case-based reasoning, and ethical considerations in AI. [K4]

CO4: Understand various cognitive modeling approaches, including declarative/logic-based computational models, connectionist models, Bayesian models, and computational models of memory and language [K2]

CO5: Synthesize modeling paradigms, integrating classical models of rationality, symbolic reasoning, decision making under uncertainty, inductive generalization, causality, and categorization. [K5]

UNIT-1:

Introduction to Cognitive Science: Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology- Understanding, Common Sense Reasoning.

UNIT-2:

Planning and Learning Methods: Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning - Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees.

UNIT-3:

Reasoning methods: Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks- Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakes- AI ethics

UNIT-4:

Cognitive Modeling: Declarative/ logic-based computational cognitive modelling - connectionist models of cognition – Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning.

UNIT-5:

Modeling Paradigm: Modelling Select Aspects of Cognition Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis.

Cognitive Development: Child concept acquisition - Child language learning - Acquisition of arithmetic skills – Distributed Cognition and Learning- Simple and Complex Decision Making – Reasoning Under Uncertainty – Natural Language Understanding – Natural Language Processing – Automated

TEXT BOOK(S):

1. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2014.
2. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019.
3. Elaine Rich,Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, TMS, third edition.

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN04	**PATTERN RECOGNITION**						

Course Objectives:

To equip students with a comprehensive understanding of pattern recognition principles and methodologies.

Course Outcomes:

CO1: Understand fundamental concepts of pattern recognition, including different paradigms, data structures for representation, proximity measures, feature selection, and evaluation metrics. [K2].
CO2: Apply efficient algorithms, data reduction, and prototype selection. [K3]
CO3: Understand the construction of decision trees, the splitting process at nodes, and recognize issues such as overfitting and pruning. [K2]
CO4: Apply Support Vector Machines for classification, covering both the linearly separable and non-linearly separable cases. [K3]
CO5: Apply techniques to handwritten digit recognition, involving the description of digit data, pre-processing, and classification algorithms. [K3]

UNIT - I:

Introduction to Pattern Recognition: Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,
Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection, Evaluation of Classifiers, Evaluation of Clustering

UNIT – II:

Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection,
Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network.

UNIT – III:

Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns.
Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Over fitting and Pruning, Example of Decision Tree Induction.

UNIT – IV:

Support Vector Machines: Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non-linearly Separable Case.
Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering

UNIT – V:

Clustering: Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of

the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

TEXT BOOKS:

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier

REFERENCE BOOKS:

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN04	**PATTERN RECOGNITION**						

Course Objectives:

To equip students with a comprehensive understanding of pattern recognition principles and methodologies.

Course Outcomes:

CO1: Understand fundamental concepts of pattern recognition, including different paradigms, data structures for representation, proximity measures, feature selection, and evaluation metrics. [K2].
CO2: Apply efficient algorithms, data reduction, and prototype selection. [K3]
CO3: Understand the construction of decision trees, the splitting process at nodes, and recognize issues such as overfitting and pruning. [K2]
CO4: Apply Support Vector Machines for classification, covering both the linearly separable and non-linearly separable cases. [K3]
CO5: Apply techniques to handwritten digit recognition, involving the description of digit data, pre-processing, and classification algorithms. [K3]

UNIT - I:

Introduction to Pattern Recognition: Data Sets for Pattern Recognition, Different Paradigms for Pattern Recognition,
Pattern Representation: Data Structures for Pattern Representation, Representation of Clusters, Proximity Measures, Size of Patterns, Abstractions of the Data Set, Feature, Feature Selection, Evaluation of Classifiers, Evaluation of Clustering

UNIT – II:

Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection,
Bayes Classifier: Bayes Theorem, Minimum error rate classifier, Estimation of Probabilities, Comparison with the NNC, Naive Bayes Classifier, Bayesian Belief Network.

UNIT – III:

Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, Classification Using HMMs, Classification of Test Patterns.
Decision Trees: Introduction, Decision Trees for Pattern Classification, Construction of Decision Trees, Splitting at the Nodes, Over fitting and Pruning, Example of Decision Tree Induction.

UNIT – IV:

Support Vector Machines: Introduction, Linear Discriminant Functions, Learning the Linear Discriminant Function, Neural Networks, SVM for Classification, Linearly Separable Case, Non-linearly Separable Case.
Combination of Classifiers: Introduction, Methods for Constructing Ensembles of Classifiers, Methods for Combining Classifiers, Evaluation of Classifiers, Evaluation of Clustering

UNIT – V:

Clustering: Clustering and its Importance, Hierarchical Algorithms, Partitional Clustering, Clustering Large Data Sets, An Application to Handwritten Digit Recognition: Description of

the Digit Data, Pre-processing of Data, Classification Algorithms, Selection of Representative Patterns.

TEXT BOOKS:

1. Pattern Recognition an Introduction, V. Susheela Devi M. Narasimha Murty, University Press.
2. Pattern Recognition, Segrios Theodoridis,Konstantinos Koutroumbas, Fourth Edition, Elsevier

REFERENCE BOOKS:

1. Pattern Recognition and Image Analysis, Earl Gose, Richard John Baugh, Steve Jost, PHI 2004.
2. C. M. Bishop, 'Neural Networks for Pattern Recognition', Oxford University Press, Indian Edition, 2003.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, Johy Wiley, 2002

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN05	**KNOWLEDGE REPRESENTATION AND REASONING**						

Course Objectives:

To acquire practical skills in applying diverse knowledge representation and reasoning techniques across various domains.

Course Outcomes:

CO1: Understand the foundational concepts related to knowledge representation, reasoning, and the significance of logic in AI. [K2]
CO2: Apply principles to describe physical entities, define abstractions, and represent knowledge. [K3]
CO3: Apply knowledge engineering, frame-based representation, and natural language semantics. [K3]
CO4: Apply knowledge related to processes, change contexts. [K3]
CO5: Apply alternative approaches like fuzzy logic and nonmonotonic logic. [K3]

UNIT I:

The Key Concepts: Knowledge, Representation, Reasoning, Why knowledge representation and reasoning, Role of logic

Logic: Historical background, representing knowledge in logic, Varieties of logic, Name, Type, Measures, Unity Amidst diversity

UNIT II:

Ontology: Ontological categories, Philosophical background, Top-level categories, Describing physical entities, Defining abstractions, Sets, Collections, Types and Categories, Space and Time

UNIT III:

Knowledge Representations: Knowledge Engineering, Representing structure in frames, Rules and data, Object-oriented systems, Natural language Semantics, Levels of representation

UNIT IV:

Processes: Times, Events and Situations, Classification of processes, Procedures, Processes and Histories, Concurrent processes, Computation, Constraint satisfaction, Change **Contexts:** Syntax of contexts, Semantics of contexts, First-order reasoning in contexts, Modal reasoning in contexts, Encapsulating objects in contexts.

UNIT V:

Knowledge Soup: Vagueness, Uncertainty, Randomness and Ignorance, Limitations of logic, Fuzzy logic, Nonmonotonic Logic, Theories, Models and the world, Semiotics

Knowledge Acquisition and Sharing: Sharing Ontologies, Conceptual schema, Accommodating multiple paradigms, Relating different knowledge representations, Language patterns, Tools for knowledge acquisition

TEXT BOOKS:

1. Knowledge Representation *logical, Philosophical, and Computational Foundations* by John F. Sowa, Thomson Learning.
2. Knowledge Representation and Reasoning by Ronald J. Brachman, Hector J. Levesque, Elsevier.

Pool 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	30	70	100	4
SUBCODE: R20AMHN06	**EXPERT SYSTEMS**						

Course Objectives:

Students will be able to comprehend, apply, and evaluate the fundamental concepts of artificial intelligence and knowledge representation.

Course Outcomes:

CO1: Analyze and articulate the foundations of AI, demonstrating a synthesis of introductory and knowledge-related concepts at an applied level. [K4]

CO2: Analyze the syntax and semantics of these logics, convert to clausal form, and apply inference rules, showcasing an application of logical reasoning in representing knowledge. [K4]

CO3: Apply knowledge representation concepts to real-world scenarios at an applied level. [K3]

CO4: Apply structured knowledge representation techniques, including graphs, frames, and object-oriented representations. [K3]

CO5: Analyze and design expert systems architectures. [K4]

UNIT I:

Overview of Artificial Intelligence: Definition & Importance of AI.

Knowledge: General Concepts: Introduction, Definition and Importance of Knowledge, Knowledge-Based Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.

UNIT II:

Knowledge Representation: Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of Wffs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, No deductive Inference Methods, Representations Using Rules.

UNIT III:

Dealing with Inconsistencies and Uncertainties: Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.

UNIT IV:

Structured Knowledge: Graphs, Frames and Related Structures: Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.

Object-Oriented Representations: Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.

UNIT V

Knowledge Organization and Management: Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

Expert Systems Architectures: Introduction, Rule Based System Architecture, Non-Production System Architecture, Dealing with uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.

TEXT BOOK:

1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

REFERENCE BOOKS:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston,- Principles of AI & Expert System Development, TMH, New Delhi

POOL – 2
CLOUD COMPUTING AND VIRTUALIZATION TECHNOLOGY

S.No.	HONOR Subject Title	Sub Code	No.of periods per week.			No.of Credits
			L	T	P	C
1	Introduction to IT Infrastructure Landscape	R20CSHN13	4	0	0	4
2	Cloud Computing Virtualization	R20CSHN14	4	0	0	4
3	Cloud Computing Architecture	R20CSHN15	4	0	0	4
4	Cloud Computing Security & Management	R20CSHN16	4	0	0	4

POOL-2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CSHN13	**INTRODUCTION TO IT INFRASTRUCTURE LANDSCAPE**						

COURSE OBJECTIVES:

Student will learn Infrastructure requirement for cloud application like Servers, storage, databases, middleware and security aspects.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1: Analyze the various Server Technologies used in Cloud Architecture [K4].
CO2: Analyze the Storage structure used in Cloud [K4].
CO3: Analyze Network and Security issues in the Cloud [K4].
CO4: Analyze various types of databases and its usage in the Cloud [K4].
CO5: Analyze various Middle ware technologies used in the Cloud [K4].

SYLLABUS:

UNIT - I:

Systems Overview Server Technology, Blade Server, Rack Servers, Enterprise Server, High Performance Server, Operating System, Operating System Features, Tasks of Operating System, Virtualization, Benefits of Virtualization, Types of virtualization, Hypervisor, Types of Hypervisor, Features of Hypervisors, I/O Virtualization, Virtual Machine Types, Partitioning, Server Deployment, Types of Deployment, Virtual Server Deployment, Server Management Console, Server Availability Concepts, Server Availability Concepts and Techniques, Server Workloads, Directory Server Concepts, Directory, LDAP Protocol, LDAP Overview, LDAP Architecture, LDAP Models, Information Model, Naming Model, Functional Model, Security Model, LDAP Replication Topologies, Simple Master-Replica, Master Forward-Replica, Gateway Replication, Peer Replication, LDAP Interchange Format, LDIF File Format, Data Encoding, Creating Directory Entries Using LDIF, Organization Unit Entries, Organization Person Entries.

UNIT - II:

Storage Overview Storage Overview, what is Storage Networking Technology? Types of Storage Systems, Storage Devices and Technologies, RAID Functions, RAID Types, Archiving Data and data policy, Data storage Techniques, Optical Storage, Solid State Drives, Solid State Drives, Big data and its key technologies, Data Retrieval challenges, Network and Online Storage, FC-AL (Fibre Channel Arbitrated Loop), FABRIC, Switched FABRIC, Introduction to Storage Area Networks, Storage Area Network, Storage area network components, Zoning, Zoning is of 2 Types, Storage Virtualization, Types of Storage Virtualization, Advantages of Storage Virtualization, Disadvantages of Storage Virtualization, Types of Virtualization.

UNIT - III:

Network and Security Overview Network Topology, Topologies are either physical or logical, Common Topologies, Bus and Tree topology, Star Topology, Ring Topology, Mesh Topology – Fully Connected, what is a firewall? Firewall, Think Time, IP Addressing, Security zones,

switching concepts, Layer 2 Switching, Function at Layer 2, What is Routing? IP Routing, Types of Routing, Virtual LAN, Benefits of VLAN, Dynamic vs. Static VLANs, VLAN Standardization, Security Basics, Basic Components, Cryptography, Key Encryption, Private Key Encryption, Public Key Encryption, Public Key Encryption (Example), Secure Messaging, Data Security, Network Security.

UNIT - IV:

Database Overview Information System, Traditional Approach, Database Approach, Database Terminology, Fields, Records, Database File, Database and Database Management System, Key, Characteristics of Databases, Introduction to DBMS, Advantages of DBMS, Disadvantages of DBMS, Data Models, Types of DBMS, Hierarchical Database, Network Database, Relational Databases, Object oriented database, Data Security Concepts, Data Mining, Data Warehousing and Data Marts, Relational DBMS, Terminology.

UNIT - V:

Application and Middleware Overview Applications and Middleware Overview, Middleware, Message Oriented Middleware, IBM WebSphere MQ, WebSphere MQ Objects, Web Tier Deployment, Applications Servers, Cluster Deployment, Lotus Notes – A Messaging Technology, Lotus Notes design principles, Lotus Domino Server Types, Organization in Lotus Notes, Organization Certifier, Documents in Lotus, Services in Lotus Domino, Lotus Notes Client, Certificates and Server Files, Access Control List, Lotus Notes (Domino) - Integration, Warehouse Modeling Approaches, Global data Warehouse Architecture, Independent data mart architecture, Basic Concepts of Dimensional modeling, Basic OLAP Operations.

TEXT BOOKS

1. Pierre Belanger, Landscape as Infrastructure: A Base Primer
2. IT Infrastructure A Complete Guide - 2020 Edition by Gerardus Blokdyk
3. Home Server Components: A quick overview (For the Tech Hobbyist Series Book 2) by Ronn Hanley

POOL-2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CSHN14	**CLOUD COMPUTING VIRTUALIZATION**						

COURSE OBJECTIVES:

Student will learn storage virtualization, Network virtualization,, application virtualization and their USECASES.

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: Outline Virtualization [K2].
CO2: Analyze Server and Storage Virtualization [K4].
CO3: Analyze Network and Application Virtualization [K4].
CO4: Analyze cloud development and delivery models [K4].
CO5: Analyze the Cloud workloads [K4].

SYLLABUS

UNIT - I

Introduction to Virtualization

Traditional IT Infrastructures, Shortcomings of physical infrastructures, Benefits of Virtualization, Comparison of traditional IT infrastructures with virtualized infrastructures, Implementing Virtualization, A typical hardware/software server stack, Logical Equivalence, Pre and Post Virtualization Server Stacks, Types of Virtualization, Area and technology based classification, History of Virtualization, Time-sharing systems, IBM Mainframe Virtualization, IBM PowerVM Virtualization, Extending Virtualization to x86, Hardware support for x86 Virtualization, Impact of Virtualization, Cost Impact, Manageability Impact.

UNIT - II

Server and Storage Virtualization

Types of Server Virtualization, Para Virtualization, Simulation, Hardware Assisted Virtualization, Hypervisors, Ring levels on x86 processors, Types of Hypervisors, IBM PowerVM Hypervisors, Common considerations in server virtualization, Desktop Virtualization, how desktop virtualization works? Benefits of Desktop Virtualization, Constraints in Desktop Virtualization, Types of Desktop Virtualization, Anatomy of server virtualization, Three major layers in Xen Server, Storage Virtualization Overview, Benefits of storage virtualization, Features in the logical layer, Types of Storage Virtualization, Host level storage virtualization, Host based mirroring, Storage level virtualization, Network based storage virtualization.

UNIT - III

Network and Application Virtualization

Network virtualization overview, Virtual Private Network (VPN), How VPN works, Virtual LAN (VLAN), Advantages of VLAN, Application virtualization overview, Challenges in using applications in traditional install, use and update model, Solution for challenges, Architecture, Benefits of application virtualization.

UNIT - IV

Cloud implementation, deployment and delivery models

Cloud deployment models, Private cloud, Public cloud, Hybrid cloud, Pros and cons of each architecture, Cloud deployment decision factors, Business IT control, Business critical applications, Data and transaction security, Compliance and audit, Balance of CAPEX and OPEX, Workload characteristics, Workload lifespan preferences, Industry segment – SME and Large enterprises, Data freedom, Software characteristics, Time to deploy, Public cloud, Public cloud - Example, Important points about public cloud, Factor Matrix, Public cloud advantages, Public cloud disadvantages, Private cloud, Private cloud – Scenario, Key observations from scenario, Factor matrix, Private cloud advantages, Private cloud disadvantages, Hybrid Cloud, Hybrid cloud scenario, Observations from Hybrid scenario, Factor Matrix, Hybrid cloud advantages, Hybrid cloud disadvantages, Overview of cloud delivery models, Types of cloud delivery models, Cloud delivery infrastructure, IT Layers, IaaS overview, IaaS features, Cloudbursting, Cloudbursting definition, Multi Tenancy, Resource pooling, IaaS examples, PaaS Overview, PaaS example, Platform services infrastructure, PaaS features, PaaS components, Things to consider before choosing PaaS, PaaS examples, Common technologies and solution provided by a web hosting PaaS stack, SaaS, SaaS advantages, SaaS examples.

UNIT - V

Case study on virtualization and cloud workloads

Case study overview, Customer IT landscape, Functions of the data centre, Triggers for virtualization, Preparation for virtualization, Server selection, Server sizing, Server criticality, Provisioning, Proximity and Locality, Transition tools for virtualization, Cost Savings, Cloud Workloads Overview, What is workload? Workload characterization, Factors that influence cloud workload, Workloads most suitable for cloud, Private cloud solution, Types of workload, Temporary non-production workloads, Mission critical production workloads, Advantages, Mission critical workloads, Mixed workloads, Production only workload most suitable for a hybrid cloud, Industry specific cloud workloads, Workloads not suitable for public cloud,
Workloads not suitable for private cloud, Workloads made possible by cloud.

TEXT BOOKS:

1. Cloud Computing and Virtualizationby Dac-Nhuong Le , Raghvendra Kumar, et al.
2. Cloud Computing & Virtualization by R Rajeswara Rao and V Subba Ramaiah

POOL-2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CSHN15	**CLOUD COMPUTING ARCHITECTURE**						

COURSE OBJECTIVES:
Student will learn different types of Cloud Computing Architectures and its usages.

COURSE OUTCOMES:
On completion of this course, the students will be able to
CO1: Analyze evolution of Cloud [K4].
CO2: Analyze various Cloud Architectures [K4].
CO3: Analyze NIST Cloud computing reference Architecture K4].
CO4: Analyze IBM Cloud Computing reference Architecture [K4].
CO5: Analyze AWS Cloud Computing reference Architecture [K4].

SYLLABUS:
UNIT – I:
Industry Trends and the Future of Cloud Computing Analysis of industry trends, Evolution from IaaS to PaaS applications, Convergence of IaaS and SaaS providers, Trends leading from private to hybrid clouds, The future of cloud computing: — Hybrid clouds and cloud brokering, — Application transformation: fully multithreaded, multi provider, dynamically scalable applications, — Self-service administration: consolidated application control panels, -Software-defined networking, — Software-defined datacentre, — Big Data and analytics, — The Internet of Things.

UNIT – II:
Cloud computing architecture Workload distribution architecture, NIST reference architecture mapping, Resource pooling architecture, Dynamic scalability architecture, Elastic resource capacity architecture, Service load balancing architecture, Cloud bursting architecture, Elastic disk provisioning architecture, Redundant storage architecture, Cloud computing patterns, Mechanism audit monitor, Mechanism resource replication, Mechanism of various concept.

UNIT – III:
Cloud Computing Reference Architecture (CCRA) – NIST: NIST Cloud Computing Reference Architecture (CCRA), Objectives of NIST, The conceptual reference model, Example: Usage scenarios, Cloud consumer, Cloud provider, Cloud auditor, Cloud broker, Cloud carrier, Scope of control between provider and consumer, CCRA: Architectural components, Service orchestration, Cloud service management, Business support, Provisioning and configuration Portability and interoperability, Security, Privacy, Cloud taxonomy.

UNIT – IV:

Cloud Computing Reference Architecture (CCRA) – IBM : IBM's CCRA, IBM CCRA roles, Cloud service consumer, Cloud service provider, Cloud services, Infrastructure, Common Cloud Management Platform (CCMP), CCMP supports any level of virtualization, Business Support Services (BSS), Operational Support Services (OSS), Security, resilience, performance and consumption, Cloud service creator: Service development tools, IBM CCRA versions or CCRA evolution, Adoption patterns, Adoption pattern in CCRA 3.0, Examples of cloud services.

UNIT – V:

Cloud Computing Reference Architecture – AWS : What is amazon web services, Features of AWS, Web application hosting, Content and media serving, Large scale computing and huge data sets, Disaster recovery for local applications, Media sharing, Financial service grids, Time series data processing, Backup and restore to VMware cloud on AWS, Pilot light on VMware cloud on AWS, Microsoft share point on VMware cloud on AWS, Hybrid active directory trusted domain, Hybrid active directory stretched domain, Oracle RAC on VMware cloud on AWS, Batch processing, Advertisement serving, Asynchronous online gaming, Ecommerce website: Web frontend, Ecommerce website: Checkout service, Marketing and recommendations, Fault tolerance and high availability, File synchronization service, Amazon services, Amazon Simple Storage Service (S3), Amazon services developer tools, Amazon services developer tools, Amazon services security, identity and compliance, Amazon service applications.

TEXT BOOKS

1. Cloud Computing: Concepts, Technology & Architecture, 1e by Erl
2. Service-Oriented Architecture: Concepts, Technology, and Design by Thomas Erl

POOL-2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	-	-	30	70	100	3
SUBCODE: R20CSHN16	**CLOUD COMPUTING SECURITY & MANAGEMENT**						

COURSE OBJECTIVES:

Student will study clod computing security risks, management issues and different encryption decryption techniques.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1: Analyze Service Management & System Administration in Cloud [K4].
CO2: Analyze Cloud growth planning [K4].
CO3: Analyze various Security risks in Cloud [K4].
CO4: Analyze Identity management issues in Cloud [K4].
CO5: Analyze various Encryption & Decryption techniques used in the Cloud [K4].

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SYLLABUS:

UNIT 1.

Service Management & System Administration in Cloud : Concept of service management, Characteristics of Cloud Service Management, Cloud Architecture, Aneka Cloud Architecture, Characteristics of Cloud, Workflows in Cloud, Algorithm Description, Calculating Score of Machine, Deadline Distribution, General Architecture of Cloud Workflow Systems, Cloud Provisioning, Integrate and Automate, Enable elastic applications, Maximize Efficiency, Four dimensions of cloud provisioning, How cloud provisioning works, Cloud provisioning security, Specific provisioning actions, Self service provisioning for cloud computing services, Cloud-based Infrastructure Services Provisioning, Cloud Usage Monitor, Monitoring Agent, Resource Agent, Polling Agent, Key Benefits and Features, Cloud Monitoring Features, Metering and Billing, IaaS Billing and Metering Services, PaaS Billing and Metering Service, SaaS Billing and Metering Service, Up and Coming Service Models

UNIT – II :

Cloud Growth Planning & Managing Security and Resiliency : Forecasting requirements for cloud managed resources, Table January 2011- Estimation Capacity, The cloud service provider business, Competitive Landscape, Entering the cloud computing marketplace, General cloud service provider business models, Application Hosting on Cloud, The IBM Cloud Computing Reference Architecture (CCRA), Support Systems Capabilities, Shared System Capabilities, High Availability and Interoperability, Implementing cloud computing using IBM SmartCloud for Service Providers offerings, Operational Environment, Operational view for cloud management, Operational view for cloud service usage, Solution Integration, Common Integration Points, Service Development and Onboarding,

UNIT – III:

Security Overview and Understanding Security Risks : Security Overview, User Responsibility, The IT security management challenge, Improved requisite for controlling agreement, Improved mixture and gaining activity, Progressively growing user populations, Evolving skills modify the IT security setting, Operating System - Security, Security Imperatives, Authentication, One Time Passwords, Program Threats, System Threats, Computer Security Classifications, Application Security, Application Penetration Testing, Application Code Review, Secure Developer Training, Data Center Security, Data Center - Concept, Data Center – Design Imperatives, Security – Cloud Computing, Security Issues during Cloud Adoption, Solutions for Cloud Security Concerns, Security Framework,

UNIT –IV :

Addressing security risks in cloud & Identity Management

Introduction, Security Risks, Cloud Security Guidance, Effective governance, risk and compliance process, Audit Business and Operational Processes, Manage People, Roles and Identities, Ensure Proper Protection of Data and Information, Enforce Privacy Policies, Assess the security provisions of cloud applications, Ensuring Cloud networks and connections are secure, Evaluate security controls on physical infrastructure and facilities, Manage security terms in the cloud SLA, Understand the security requirements of the exit process, Cloud Security Assessment, Identity Management, Identity Management Models, Authentication and Authorization, Challenges of Identity Management, Evolution of IAM — Moving Beyond Compliance, Identity Access Management Life-cycle Phases, IAM and IT Trends, Case study (Bank) — IAM in practice, Transforming IAM, Key considerations when transforming IAM, IAM Tools, Transforming IAM, Transformation Plan, Detention, Field Acquisition & Analysis.

UNIT – V:

Encryption and Decryption

Introduction, what is Cryptography? Strong Cryptography, how does cryptography work? Conventional Cryptography, Public Key Cryptography, How PGP works, Keys, Digital Signatures, Hash Functions,

Digital Certificates, Certificate Distribution and Management, Certificate Formats, PGP Certificate Format, X.509 Certificate Format, Public Key Value, Trust, Trust Models, Levels of trust in PGP, Certificate Revocation and Communication,

TEXT BOOKS:

1. Vulnerability Management for Cloud Computing - 2014: A Cloud Computing Security Essential (Disruptive Cloud Computing & IT) by Rajakumar Sampathkumar and Swarnalakshmi Balasubramani
2. Cloud Computing and Security: 4th International Conference, ICCCS 2018, Haikou, China, June 8-10, 2018, Revised Selected Papers, Part II (Lecture Notes in Computer Science Book 11064) by Xingming Sun, Zhaoqing Pan, et al.
3. Cloud Management and Security, Imad M. Abbadi, IBM.

List of Open Electives offered by Department

S.No.	Open Elective -1 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC10E17	Mean Stack Technologies	30	70	100	3	0	0	3
2	R20CC10E18	Artificial Intelligence	30	70	100	3	0	0	3

S.No.	Open Elective -2 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC20E16	Cloud Computing	30	70	100	3	0	0	3
2	R20CC20E17	Principles Of Machine Learning	30	70	100	3	0	0	3

S.No.	Open Elective -3 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC30E17	Cryptography and Network Security	30	70	100	3	0	0	3
2	R20CC30E18 /R20CC4118	NOSQL Databases	30	70	100	3	0	0	3

S.No.	Open Elective -4 Subject Code	Subject Title	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	R20CC40E16/ R20CC4104	e-Commerce	30	70	100	3	0	0	3
2	R20CC40E17/ R20CC4106	Natural Language Processing	30	70	100	3	0	0	3

III B.TECH I SEMESTER Open Elective - 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC1OE217	**MEAN STACK TECHNOLOGIES**						

COURSE OBJECTIVES:

- This course is designed to introduce students to learn how to design both the front and back end of web applications. The course will introduce web-based media-rich programming tools for creating interactive web pages.

COURSE OUTCOMES:

After completion of this course, the students would be able to:

CO1 : Apply Angular8 to develop web applications. [K3]
CO2 : Make use of Forms and Services. [K3]
CO3 : Utilize Node.js to create Server Side Applications. [K3]
CO4 : Make use of Express to deploy web applications. [K3]
CO5 : Experiment with NoSQL using MongoDB. [K3]

SYLLABUS:

UNIT-I: Angular8:

Introduction, Installation, Creating First Angular8 Application, Architecture, Angular Components and Templates, Data Binding, Directives, Pipes, Services and Dependency Injection.

UNIT-II: Angular8:

Reactive Programming, Http Client Programming, Angular Material, Routing and Navigation, Forms, Form Validation, CLI Commands.

UNIT-III: Node.js:

Introduction, Git Basic commands, Node.js Process Model, Node.js Console, Node.js Basics, Node.js Modules, Local Modules, Export Module, Node Package Manager, Node.js Web Server.

UNIT-IV: Node.js contd. & Express.js:

Node.js File System, Debugging Node.js, Node Inspector, Node.js EventEmitter, Frameworks for Node.js. **Express.js:** Express.js Web App, Serving Static Resources.

UNIT-V: MongoDB:

Access MongoDB in Node.js, Connecting MongoDB, Insert Documents, Update/Delete Documents, Query Database, Mangoose.

TEXT BOOKS:

1. Node.js, MongoDB and Angular Web Development by Brad Dayley, Brendan Dayley-2nd Edition-Addison-Wesley
2. Getting MEAN with Mango, Express, Angular and Node by Simon Holmes, Clive Harber-2nd Edition-Manning Publications.
3. MEAN Cookbook by Nicholas McClay-Packt

REFERENCES BOOKS:

1. Node.js: Web Development for Beginners by Joseph Conner
2. Mean Stack Developer by Camila Cooper

ADDITIONAL RESOURCES:

1. https://www.edx.org/course/introduction-to-mongodb-using-the-mean-stack
2. http://www.simplilearn.com/full-stack-web-developer-mean-stack-certification-training
3. https://www.tutorialsteacher.com/nodejs/expressjs-web-application.

III B.TECH I SEMESTER Open Elective - 1	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC1OE218	**ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents:Search, Knowledge representation, inference, logic and learning.
- The knowledge of artificial intelligence plays a considerable role in some applications students developfor courses in the program.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO 1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO 2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]
CO 3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO 4: Apply the basic knowledge on learning and reinforcement learning. [K3]
CO 5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

UNIT - I

Introduction to AI, Problems, Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the Design of Search Programs.

UNIT - II

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Knowledge Representation Using Predicate Logic: Representing Simple Facts in logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

Weak slot-and-filler structures: Semantic Nets, Frames,

Strong slot-and-filler structures: Conceptual dependency, Scripts

UNIT - IV

Learning: Rote learning, learning by taking advice, learning in problem solving,

Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm, temporaldifference Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and PragmaticProcessing, Statistical Natural language Processing, Spell Checking,

Parallel and Distributed AI: Parallelism in Reasoning Systems, Distributed Reasoning Systems.

TEXT BOOKS:

1. Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint2008.
2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003
3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES

1. https://www.coursera.org/learn/machine-learning
2. https://www.simplilearn.com/big-data-and-analytics/machine-learning
3. https://www.appliedaicourse.com/course/applied-ai-course-online
4. http://nptel.ac.in/courses/106105152

III B.TECH II SEMESTER Open Elective - 2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC2OE16	**CLOUD COMPUTING**						

COURSE OBJECTIVES:

- To gain knowledge about Virtualization and Virtual Machines
- To familiarize Cloud Computing and its services.

COURSE OUTCOMES:

After successful completion of this course, the students would be able to:

CO1 : Interpret various types of Virtualization. [K2]
CO2 : Outline the Cloud Computing Architectures and Models. [K2]
CO3 : Analyze the Cloud Infrastructure Management and Migration and Disaster Management in Cloud. [K4]
CO4 : Analyze AWS and MS Azure services. [K4]

SYLLABUS:

UNIT-I: Overview of Cloud Computing:

Essentials of Cloud Computing, History of Cloud Computing, Business and Information, Benefits of Cloud Computing, Limitations of Cloud Computing, Characteristics of Cloud Computing, How to Develop Cloud Infrastructure, Vendors of Cloud Computing.

UNIT-II: Introduction to virtualization and virtual machine:

Types of virtualization: Server virtualization, Application/ desktop virtualization, client virtualization, storage virtualization, Network virtualization service / application infrastructure virtualization, virtual machines & virtualization middleware.
Cloud Computing Architecture: Grid Framework Overview, Grid Architecture, Cloud Computing Architecture, Key Design Aspects of Cloud Architecture, Cloud Services, and Cloud Applications, Similarities and Differences Between Grid and Cloud Computing, Cloud and Dynamic Infrastructure.

UNIT-III: Models of Cloud Computing:

Cloud Service Models, Cloud Computing Sub Service Models, Cloud Deployment Models, Alternative Deployment Models, Cloud Stack, Cloud Storage.

UNIT-IV: Cloud Infrastructure Management and Migration:

Administrating Clouds, Cloud Management Products, Processes in Cloud Service Management, Cloud Providers and Traditional IT Service Providers, How to Access the Cloud, Migrating to Clouds.
Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management

UNIT-V:

What is Microsoft Azure? , Types of Azure Clouds, Azure key Concepts, Azure Domains (Components), Traditional vs. Azure Cloud Model, Applications of Azure, Advantages of Azure, Disadvantages of Azure. What is AWS? , History of AWS, Important AWS Services, Amazon Web Services Cloud Platform: Compute & Networking, Storage & Content Delivery Network, Database, Analytics, Application Services, Deployment and Management, Applications of AWS services,

Companies using AWS, Advantages of AWS, Disadvantages of AWS, Comparison between Azure and AWS.

TEXT BOOKS:

1. Cloud Computing – Shailendra Singh Oxford University Press.

REFERENCES BOOKS:

1. Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide David S. Linthicum Addison-Wesley Professional.
2. Distribured & Cloud Computing From Parallel Processing to the Internet of Things by Kai Hwang. Geoffrey C. Fox. Jack J. Dongarra

WEB REFERENCES:

1. https://nptel.ac.in/courses/106106129/21
2. http://freevideolectures.com/course/3649/cloud-computing
3. https://www.youtube.com/watch?v=Eg4AAGCE7X4&list=PL2UlrhJ_JwyA5IlOCdEWlNArFke4jgtlg.

III B.TECH II SEMESTER Open Elective - 2	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC2OE17	**PRINCIPLES OF MACHINE LEARNING**						

COURSE OBJECTIVES:

The course is introduced for students to

- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about Dimensionality reduction

COURSE OUTCOMES:

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

CO1 : Analyze practical issues in machine learning application. [K4]
CO2 : Apply decision tree algorithms for appropriate problem domains. [K3]
CO3 : Apply and interpret statistical techniques. [K4]
CO4 : Apply ML techniques to solve classification. [K3]
CO5 : Apply ML techniques to solve regression problems. [K3]

SYLLABUS:

UNIT-I

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

UNIT-II

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

UNIT-III

Evaluating Hypothesis: Motivation, Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypothesis, Comparing learning algorithms.

UNIT-IV

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

UNIT-V

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.

Instance Based Learning:
Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning,

TEXT BOOKS:

1. T.M. Mitchell, "Machine Learning", McGraw-Hill, 1997.
2. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

REFERENCE BOOKS:

1. Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

E-RESOURCES:

1. https://www.youtube.com/watch?v=FeGe35iYTXU&list=PL4gu8xQu0_5JBO1FKRO5p20wc8DprlOgn

IV B.TECH I SEMESTER Open Elective - 3	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC3OE17	**CRYPTOGRAPHY AND NETWORK SECURITY**						

COURSE OBJECTIVES:

- The main objective of this course is to teach students to understand and how to address various software security problems in a secure and controlled environment.
- During this course the students will gain knowledge in various kinds of software security problems, and techniques that could be used to protect the software from security threats.

COURSE OUTCOMES:

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

CO1: Summarize the fundamentals of Cryptography. [K2]

CO2: Analyze how security is achieved, and attacks can be countered by using symmetric/asymmetric algorithms. [K4]

CO3: Apply Number Theoretic concepts in developing cryptographic algorithms to counter attacks. [K3]

CO4: Interpret the role of hash functions and Digital Signatures in Information Security.[K2]

CO5: Illustrate the use of encryption techniques to secure data in transit across data networks. [K2]

SYLLABUS:

UNIT-I

Introduction: Security Attacks-Passive Attacks, Active Attacks, Security Services-Authentication, Access control, Confidentiality, Integrity, Availability service, Nonrepudiation, Security Mechanisms- Specific Security Mechanisms, Pervasive Security Mechanisms, model for Network Security, Basics of Cryptography - Symmetric Cipher Model, Substitution Techniques- Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, polyalphabetic Ciphers, One-Time pad. Transposition Techniques-rail fence, Block and Stream Ciphers.

UNIT-II

Symmetric Key Cryptography: Fiestel Cipher Structure, Block Cipher Design Principles- Design Criteria, Number of Rounds, Design of Function F, Data Encryption Standard (DES), Strength of DES, Triple DES, International Data Encryption algorithm(IDEA), AES- Structure, Transformation functions, Key Expansion, Block Cipher Modes of Operation- ECB, **CBC**, OFB,CFB,CTR Modes.

UNIT-III

Number Theory: Prime and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems-Proof and Examples, Euler's Totient Function, Primitive root and Discrete Logarithms.

Public Key Cryptography: Principles of Public key Cryptosystems-Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptography, Public-Key Cryptanalysis, RSA Algorithm: Description of the Algorithm, The Security of RSA, Diffie-Hellman Key Exchange Algorithm, Elgamal encryption & decryption

UNIT-IV

Cryptographic Hash Functions: Message Authentication Requirements and Functions-Message Encryption, Message Authentication Code, Hash Function, Message Authentication Codes (MAC)-

Requirements, Hash Functions-Requirements, Applications of MAC and hash functions, Secure Hash Algorithm (SHA-512), HMAC.

Digital Signatures: Digital Signature Schemes, Authentication Protocols- Mutual Authentication, One-Way Authentication, Digital Signature Standards-The DSS Approach, The digital Signature Algorithm.

UNIT-V

Authentication Applications: Kerberos: Motivation, Version 4, X.509 Directory Authentication service, E-Mail, PGP, S/MIME.

Web Security: Web Security Considerations, Secure Sockets Layer- SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol, Transport Layer Security, Secure Electronic Transactions (SET), Firewalls.

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 6th Edition, 2011.
2. Chwan Hwa Wu, J.David Irwin, "Introduction to Computer Networks & Cyber Security", CRC Press, 2013.

REFERENCE BOOKS:

1. Eric Maiwald, "Fundamentals of Network Security", Dreamtech press.
2. Withman , Thomson, "Principles of Information Security".
3. Buchmann, Springer, "Introduction to Cryptography".
4. Bruce Schneier, John Wiley & Sons, "Applied Cryptography", 2nd Edition.
5. Benard Menezes, "Network Security Essentials and Cryptography", Cengage Learning,2011.
6. Behrouz A.Fourouzan and Debdeep Mukhopadhyay, "Cryptography and Network, 2nd Edition", McGraw-Hill, 2010.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs07/preview
2. https://www.coursera.org/learn/cryptography
3. https://www.coursera.org/specializations/computer-network-security
4. https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7

IV B.TECH I SEMESTER Open Elective - 3	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC2OE18 / R20CC4118	**NOSQL DATABASES**						

COURSE OBJECTIVES

- To grasp the challenges and benefits of handling persistent data, concurrency, and integration.
- Gain practical knowledge in key database models like key-value stores, document databases, and graph databases.

COURSE OUTCOMES

Upon completion of the course the student will be able to

CO1 : Analyze, evaluate, and design database systems using various data models and technologies [K4]

CO2 : Analyze, compare, and implement advanced distribution models and consistency strategies in distributed database systems. [K4]

CO3 : Design, implement, and manage Key-Value Store systems. [K5]

CO4 : Design, implementation, and management of Document Databases. [K5]

CO5 : Design, implement, and manage Graph Databases. [K5]

SYLLABUS

UNIT-I:

Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access,

UNIT-II:

Distribution Models: Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

UNIT-III:

What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

UNIT-IV:

Document Databases, What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex
Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT-V:

Graph Databases, What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use

TEXT BOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

REFERENCE BOOKS:

1. Dan Sullivan, "NoSQLFor Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

IV B.TECH I SEMESTER (Open Elective – 4)	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4OE16/R20CC4104	**E-COMMERCE**						

COURSE OBJECTIVES:

- To introduce the fundamental principles of e-business, e-commerce, and the role of management.
- To introduce the application of tools and services to the development of small-scale e- commerce applications

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:
CO 1: Interpret the E-commerce applications and Process Model. [K2]
CO 2: Compare and contrast various electronic Payment Systems. [K3]
CO 3: Interpret the Intra Organizational Commerce. [K2]
CO 4: Outline the corporate digital library and marketing research. [K2]
CO 5: Analyze resource discovery and information filtering. [K4]

SYLLABUS:

UNIT – I

Electronic Commerce-Framework, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT – II

Consumer Oriented Electronic commerce - Mercantile Process models.
Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT – III

Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT – IV

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT – V

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering. Digital Video and electronic Commerce

TEXT BOOKS :

1. Kalakata, Whinston, “Frontiers of electronic commerce”, Pearson.

REFERENCE BOOKS :

1. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley, "E-Commerce fundamentals and applications"
2. S.Jaiswal – Galgotia, "E-Commerce".
3. Efrain Turbon, Jae Lee, David King, H.Michael Chang, "E-Commerce".
4. Gary P.Schneider, "Electronic Commerce", Thomson.
5. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.

WEB REFERENCES:

1. https://www.slideshare.net/kamalgulati7/full-notes-on-ecommerce-study-material-for-ecommerce
2. http://www.vssut.ac.in/lecture_notes/lecture1428551057.pdf
3. https://www.geektonight.com/e-commerce-notes/

IV B.TECH I SEMESTER Open Elective - 4	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
SUBCODE: R20CC4OE17 / R20CC4106	**NATURAL LANGUAGE PROCESSING**						

COURSE OBJECTIVES

This course enables the students:

- To understand the algorithms available for the processing of linguistic Information and computational properties of natural languages.
- To conceive basic knowledge on various morphological, syntactic and Semantic NLP tasks.
- To familiarize various NLP software libraries and data sets publicly available.
- To develop systems for various NLP problems with moderate complexity.
- To learn various strategies for NLP system evaluation and error analysis.

COURSE OUTCOMES

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

CO1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language [K2].
CO2: Demonstrate understanding of the relationship between NLP and statistics &machine learning. [K4].
CO3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. [K4].
CO4: Develop systems for various NLP problems with moderate complexity [K4].
CO5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings [K4].

SYLLABUS

UNIT-I

Introduction to NLP: NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity; Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

UNIT-II

Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques),Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development

UNIT-III

Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

UNIT-IV

Parsing Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

UNIT-V

Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to Word Net.

TEXT BOOKS:

1. Jurafsky Dan and Martin James H. "Speech and Language Processing", 3rd Edition, 2018.

REFERENCE BOOKS:

1. Jurafsky D. and Martin J. H., "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.
2. Goldberg Yoav "A Primer on Neural Network Models for Natural Language Processing".