ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(Choice Based Credit System)

R20

Artificial Intelligence & Machine Learning

For
B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for batches admitted from 2020-2021)

SWARNANDHRA

COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

SEETHARAMAPURAM, NARSAPUR-534 280, W.G.DT., A.P.

<div align="center">

ACADEMIC REGULATIONS

</div>

1. INTRODUCTION

Swarnandhra College of Engineering & Technology (**Subsequently referred to as SCET**) will be followed the norms of Jawaharlal Nehru Technological University Kakinada and Govt. of Andhra Pradesh.

All Academic Programme rules and regulations are approved by the Academic Council, which is the highest Academic body of the Institute. It is applicable for all Bachelor of Technology (B. Tech) degree programme from academic year 2020-21.

2. ADMISSIONS

2.1 Regular Admission

(Join in first year B. Tech Programme)

Admissions in the Institution are classified into **CATEGORY – A,** through convener, EAMCET and **CATEGORY- B** filled by the college management.

2.2 Lateral Entry Admission
(Join in the Second year/third semester of B. Tech Programme)
Eligibility: Diploma in Engineering / B.Sc Degree with Mathematics as one course .
Based on the rank secured by the candidate at Engineering Common Entrance Test (ECET) conducted by APSCHE, Government of Andhra Pradesh.

2.3 Advance standing Admission
(Transfer from other Colleges/ Re-admission due to dis-continuation)
These may arise in the following cases:

a) When a student seeks transfer from other colleges to SCET and desirous to pursue the study at SCET in an eligible branch of study.
b) When students of SCET get transferred from one regulation to another regulation.

In all such cases, approval is mandatory from the statutory bodies

3. UNDER GRADUATE (UG) PROGRAMMES OFFERED

The College is offering   the following programmes:

- Computer Science and Engineering (CSE)
- Electronics and communication Engineering (ECE)
- Electrical and Electronics Engineering (EEE)
- Information Technology (IT)
- Mechanical Engineering (ME)
- Civil Engineering (CE)
- Artificial Intelligence and Machine Learning (AI&ML)
- Robotics (ROBO)

3.1 Structure of the Programme:

i) **Preamble:**

It is emphasized in UGC Guidelines on Choice Based Credit System (CBCS), that the important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides

governance and other matters. It is adopted grading system in place of conventional system of marks and percentages.

CBCS provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The students can register any course of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach through open electives.

Key words CBCS, such as Course, credit, credit point, CGPA, SGPA, Grade Point, Letter Grades as given in the UGC guidelines are used the same definitions.

Each Programme consists of:

i). Foundation courses in Basic Sciences, Engineering Sciences, Humanities and social science including management courses.
ii). Professional core Courses to impart broad knowledge.
iii). Professional Elective Courses from the discipline or interdisciplinary areas / industry related opted by the student based on their interest in specialization.
iv). Open Elective Courses from the interdisciplinary areas opted by the students based on their interest in specialization.
v). Mandatory Courses, Internship, Seminar, Project work.
vi). Skill Oriented Courses to upskilling the graduates on the skills relevant to the need and demands of the industry.

Each Programme designed to have 35-40 theory courses, 20-25 laboratory courses and 05 Skill Oriented Courses. The categories of courses are indicated in the following table.

A three-week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

TABLE-1 CATEGORY OF COURSES

S.No	Category	Code
1	Humanities and social science including Management courses	HSMC
2	Basic Science courses	BSC
3	Engineering courses science	ESC
4	Professional core Courses	PCC
5	Open Elective Courses	OEC
6	Professional Elective Courses	PEC
7	Internship, seminar, project work	PROJ
8	Skill Oriented Courses	SC
9	Laboratory Courses	LC
10	Mandatory courses	MC

Note: All components prescribed in the curriculum will be conducted and evaluated.

MOOCS: A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

ii) **Contact hours:** Depending on the complexity and volume of the course, the number of contact hours per week will be determined.

iii) **Credits:**

TABLE-2 CREDITS BASED ON CONTACT HOURS

Course type	No. of Contact Hours	No. of Credits
Theory	1	1
Practical	2	1

TABLE-3 CREDITS FOR DIFFERENT COURSES

Course type	Lecture method			Credits
	L	T	P	C
Theory/Elective	2	1	0	3
	3	0	0	3
	2	0	2	3
	2	0	0	2
Laboratory	0	0	2	1
	0	0	3	1.5
	0	0	4	2
Skill Oriented Courses	1	0	2	2

3.2 Curriculum for each Programme:
- All Four year B. Tech Programme of study is formulated based on the guidelines mentioned in 3.1 and recommended by the concerned Board of Studies (BoS) and approved by the Academic Council (AC).
- The same curriculum will be applicable for lateral entry students from 3rd semester onwards.
- For advance standing admission, the equivalent curriculum will be prepared by BoS and approved by AC.

4   DURATION OF THE PROGRAMME:

The duration of the B. Tech. Programme is four academic years consisting of eight semesters. Students, who fail to fulfill all the academic requirements for the award of the degree within the prescribed duration as per article 4.1, will forfeit their admission in B. Tech**.**

4.1 Maximum duration of study.
Maximum duration permitted for completion of the B. Tech. Programme of study will be:

Regular Admission: Eight academic years in sequence from the year of admission for a student admitted into first year of any Programme.

Lateral Entry Admission: Six academic years in sequence from the year of admission for a student admitted into second year of any Programme.

Advanced standing Admission: The maximum time for completion of Programme of study, will be twice the period in terms of academic years in sequence, with prescribed curriculum.

TABLE- 4 MAXIMUM DURATION OF STUDY

Admitted year of study	Maximum duration
First year	8 Academic years in sequence
Second year (Lateral entry)	6 Academic years in sequence
Advanced standing	Twice the period in terms of academic years in sequence

4.2 Cancellation of Admission :
In case candidate fails the above conditions for the award of degree, admission stands cancelled.

5 MEDIUM OF INSTRUCTION :
The medium of instruction and examinations are in English.

6 MINIMUM INSTRUCTION DAYS: Each semester will consist of 22 weeks duration with minimum of 110 working days which includes instruction days, internal tests and End examinations.

7 TRANSITORY REGULATIONS (Admitted under advance standing)**:**

The following regulations will be followed the operandi. At the time of such admission, based on the Programme pursued (case by case)
 ➢ Discontinued or detained candidates are eligible for re-admission in subsequent years in the same semester.
 ➢ The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

In case of transferred students from other colleges, credits shall be transferred to SCET as per the academic regulations and course structure of SCET.

8 DISTRIBUTION AND WEIGHTAGE OF MARKS:

Each semester consists of 4/5/6 theory courses and 4/3/2 Laboratory courses. However, in the 8th semester there will be only project work / internship in industry.

(a). **Theory Courses:**
 ▪ Each course consists of five units.
 ▪ All courses will be evaluated with a maximum of 100 marks.
 ▪ Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
 ▪ The internal evaluation of 30 marks consists of Two Mids for 20 marks and Five class tests for 10 marks.
 ▪ Mid Examination: Each mid examination will be conducted for 20 marks with the duration of 75 Minutes. Internal test paper consists of three questions (8M+8M+4M) from two and half units and all are to be answered.
 ▪ **Weighted average of two Mids** performance will be considered, weightage of 80% for the best Mid marks and 20% for the second.
 ▪ **Class tests for 10 marks calculation**: There will be one class test conducted in each unit. Average of **Best three** will be considered.
 ▪ The **end semester** examination will be conducted for 70 marks which covers full syllabus. In end examination pattern, **Part – A** consists of five short questions from all units (Brainstorming/Thought provoking/Case study) for 10 marks.   **Part – B** has **5 questions** with internal choice from each unit and valued for 60 marks.
 ▪ Internal Marks will be considered for three academic years only if the candidates will not completed the concern course because of less than 12 internal marks. Thereafter   the

candidate writes external examination for 70 which will be converted to 100 but the candidate must get minimum 40 %.

(b). **Practical Courses:**

- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- End practical examination will be conducted by the internal and external examiner appointed by COE.
- Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

(c). **Design or Engineering Drawing Marks Distribution:** For the courses of design or drawing such as Engineering Graphics, etc., the distribution will be 30 marks for internal evaluation with 10 marks for day-to-day work, and 20 marks from two internal test (80% of first best + 20% of second best). End examination will be conducted for 70 marks.

(d) **Summer Internship:** It can be carried out with a minimum of Six weeks and maximum Eight weeks duration at end of 4th semester and 6th semester. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. It will be evaluated internally by an internal evaluation committee comprising of Head of the Department and two faculty of the department. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits

(e) **Full Internship and Project Work:** The 8th Semester Project Work with full internship will be evaluated for 200 Marks. The project work is evaluated for internal assessment of 60 and external Examination for 140. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

i) Internal Assessment: Internal Assessment will be monitored by Project Review Committee consists of Head of the Department , Supervisor and Senior faculty member on the basis of two seminars and the internal marks will be awarded by Project Supervisor with recommendation of PRC.

ii) External Examination: External Examination will be conducted by Project external examination committee consists of Head of the Department, Supervisor and External examiner appointed by CoE , through presentation / viva - voce by the student.

9. Community Service Project (Experiential Learning through Community Engagement):

Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development. Community Service Project is meant to link the community with the college for mutual benefit. Community Service Project is an integral part of the curriculum with 4 Credits and evaluated internally for 100 marks.

Objectives:

❖ To sensitize the students to the living conditions of the people who are around them,
❖ 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:

1. Every student should put in a minimum of 180 hours for the Community Service Project during the summer/ Semester vacation.
2. Each class/section should be assigned with a mentor
3. Specific Departments could concentrate on their major areas of concern.
4. A log book has to be maintained by each of the student, where the activities undertaken / involved to be recorded.
5. The log book has to be countersigned by the concerned mentor/faculty incharge.
6. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
7. The final evaluation to be reflected in the grade memo of the student.

8. The Community Service Project should be different from the regular programmes of NSS / NCC / Green Corps / Red Ribbon Club, etc.
9. 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.
10. The Project Log-, Project Implementation, Project report and Presentation shall carry 20%, 30%, 25% and 25% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

TABLE- 5 MARKS ALLOCATION

Course type	Marks Allocation			
	Internal		End Semester	Total
	Internal test	Class Test/ Day to day work		
Theory course	20	10	70	100
Laboratory course	15	15	70	100
Design or Drawing course	20	10	70	100
Skill Oriented Courses	15	15	70	100
Summer Internship	50		-	50
Community Service Project	100		-	100
Project Work	60		140	200

(f) **Mandatory Courses**:
These courses are compulsory with zero credits. Only internal examination will be conducted and student has to secure minimum 40% of the marks in the evaluation for passing the course. The minimum attendance requirement is 75 %.

(g) **Open Electives:** Students are to choose Open Elective – I during 5th Semester, Open Elective–II during 6th Semester and Open Elective – III and IV during 7th Semester from the list of Open Electives given in the Course Structure. However, students cannot opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the courses offered by the parent Department in any Semester.

(h) **Skill Oriented Courses:**

   i) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering.

   ii) For these courses, one theory and two practical hours may be allotted as approved by the concerned BOS.

   iii) 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 concerned BoS.

   iv) Every year the concerned BoS review the skill oriented courses based on industrial demand which are offered by the eligible external agencies and college.

   v) Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination. End examination will be conducted by the internal and external examiner appointed by COE. Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

vi) If a student chooses 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 depends on the Course Completion Certificate.

vii) College academic committee evaluates the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

viii) There are five (05) skill-oriented courses shall be offered during III to VII semesters.

ix) 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.

10. ATTENDANCE REQUIREMENTS

(i) A student will be eligible to appear for end semester examinations, if he/she acquired a minimum of 75% of attendance in aggregate of all the courses.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (Above 65% and below 75%) in any semester may be granted by the College Academic Committee.

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

(iv) Students with less than 65% of attendance in any semester are not eligible to take up their end examination of that particular semester and their registration for previous semesters examinations shall be allowed.

(v) Attendance may also be condoned for those who participate in Inter Collegiate/university sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose (>65%) and recommended by the concerned authority. He/ She shall pay the prescribed Condonation fee.

(vi) Prescribed Condonation fee shall be payable by the student to appear for the end examination.

(vii) A Student will not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered consecutively.

(viii) A student will be condoned only four times for regular student and three times for lateral entry students during entire course of study.

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

TABLE-6 ATTENDANCE REQUIREMENT

Attendance Percentage	Condonation fee	Appear End Exams
Above 75 %	Nil	Eligible
65 % -75%	Yes (on medical grounds)	Eligible
Below 65 %	Nil	Not Eligible (Seek re-admission to that semester when offered)

11. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in S.No.10.

(i) A student will be deemed to have satisfied the minimum academic requirements and earned

the credits allotted to each theory or practical or design or drawing subject or project if he/she secures not less than a minimum of 35% of marks exclusively in the end semester examinations in each of the courses, for which the candidate had appeared. However, the candidate should have secured a minimum of 40% marks in both external and internal components put together to declare eligible for pass..

(ii)   A student will be promoted from first semester to second semester, second semester to third and third to fourth semester, if he/she satisfies the minimum attendance requirement.

(iii)   A student will be promoted from 4th to 5th Semester (2nd year to 3rd year), if he/she fulfills the academic requirements of 40% of the credits up to either 3rd or 4th Semester from all the examinations (Regular and supplementary) whether or not the candidate takes the examinations.

(iv)   A student will be promoted from 6th to 7th Semester (3rd year to 4th year), only if he/she fulfills the academic requirements of 40% of the credits up to either 5th or 6th Semester from, all the examinations (regular and supply) whether or not the candidate takes the examinations.

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

TABLE-7 PROMOTION IN TO NEXT HIGHER CLASS

Promotion		Promotion Criteria
From	To	
1ST Semester	2nd Semester	Minimum Attendance requirement
2nd Semester	3rd Semester	
3rd Semester	4th Semester	
4th Semester	5th Semester	Minimum Attendance requirement & 40% of credits up to either 3rd or 4th semester from all exams
5th Semester	6th Semester	Minimum Attendance requirement
6th Semester	7th Semester	Minimum Attendance requirement & 40% of credits up to either 5th or 6th semester from all exams
7th Semester	8th Semester	Minimum Attendance requirement

12. GAP YEAR CONCEPT

Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year study, after the 4th Semester with the due recommendations of the GAP committee and approved by the principal. This may be extended to two years at the most which period is not counted for the maximum time for graduation.

13. AWARD OF B.TECH DEGREE:

A student shall be eligible for award of the B.Tech. Degree if he/she fulfills all the following conditions:

(i) Pursue the programme of study for a stipulated period of four years and not more than eight years.
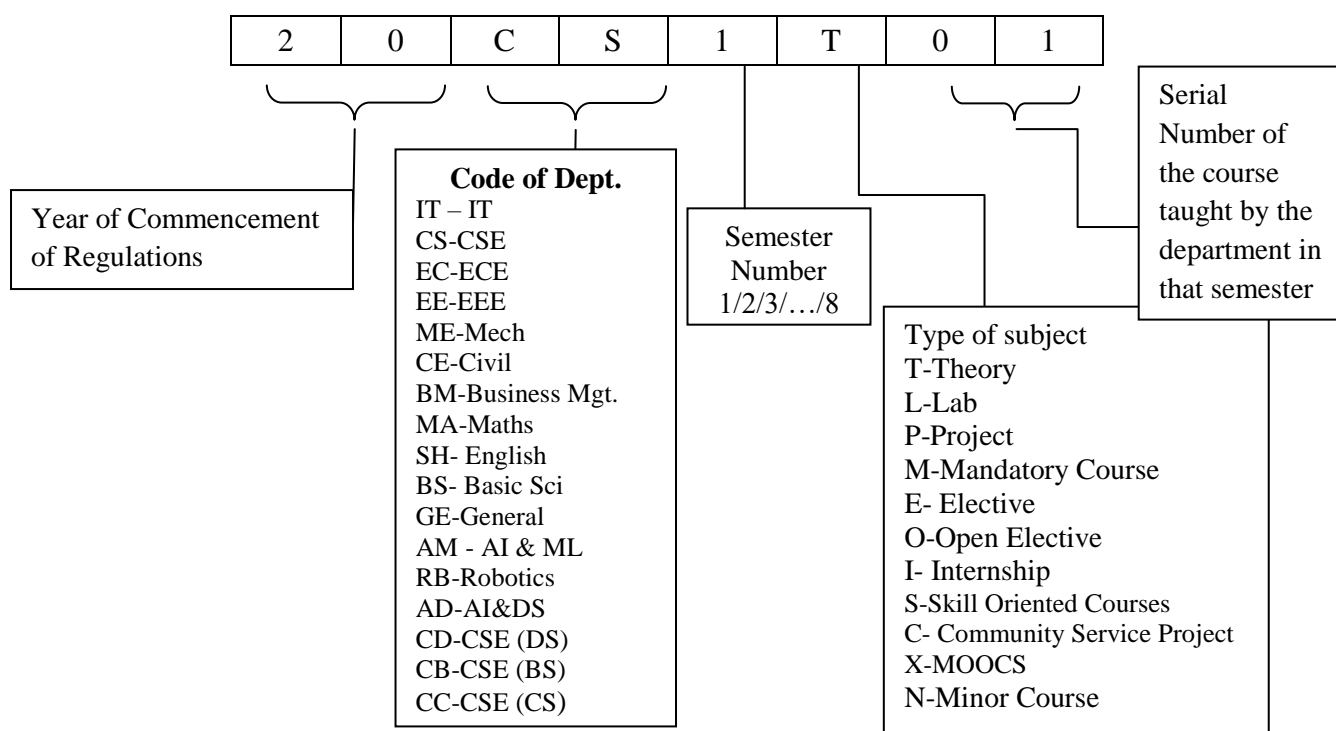
(ii) Register for 160 credits and secure the same.

(iii) Registered and successfully completed all the components prescribed in the programme of study in which he/she is admitted.

(iv) All mandatory courses must be completed with satisfactory.

(vi) Obtained CGPA greater than or equal to 5.0 (minimum requirements for pass).

(vii) A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

(viii) All students shall register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during first two years. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

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

14. **AWARD OF B. TECH. (HONOR)/B. TECH. (MINOR):**

B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. Registering for Honors/Minor is optional. (Refer Sl.No 24 & 25)

15. **COURSE CODE & COURSE NUMBERING SCHEME:**

The subject codes will be given by the department teaching the subject. Each subject code contains 8 characters. The 8 characters for each subject will be filled as per the following guidelines.

2	0	C	S	1	T	0	1

Year of Commencement of Regulations

Code of Dept.
IT – IT
CS-CSE
EC-ECE
EE-EEE
ME-Mech
CE-Civil
BM-Business Mgt.
MA-Maths
SH- English
BS- Basic Sci
GE-General
AM - AI & ML
RB-Robotics
AD-AI&DS
CD-CSE (DS)
CB-CSE (BS)
CC-CSE (CS)

Semester Number
1/2/3/…/8

Type of subject
T-Theory
L-Lab
P-Project
M-Mandatory Course
E- Elective
O-Open Elective
I- Internship
S-Skill Oriented Courses
C- Community Service Project
X-MOOCS
N-Minor Course

Serial Number of the course taught by the department in that semester

16. GRADING SYSTEM:

16.1 Award of Grade:
(i) Semester Grade Point Average (SGPA):

a) The Semester Grade Point Average (SGPA) will be calculated according to the formula

$$SGPA\ (Si) = \frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the subject i
G_i = grade points obtained by the student in the subject.

b) To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time.

$$CGPA = \frac{\sum C_i S_i}{\sum C_i}$$

where 'Si' is the SGPA of the ith semester and Ci is the total number of credits in that semester

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

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

iii. 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.

iv. Equivalent Percentage = (CGPA – 0.75) x 10

(ii) After a student satisfy the requirements prescribed for the award of B.Tech Programme he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point scale of 10 and given in Table 8.

Table -8

CGPA	Award of Division
≥ 7.75	First Class with Distinction (Without any supplementary appearance)
$\geq 6.75 < 7.75$	First Class
$\geq 5.75 < 6.75$	Second Class
$\geq 5.00 < 5.75$	Pass Class

16.2 Award of Grade in Each Semester:
(i) Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each subject. The letter grades and the corresponding grade points are as given in the Table 10.

Table -9

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

(ii) A student earns a minimum of 5 grade points in a subject is declared to have successfully completed the subject, and is deemed to have earned the credits assigned to that subject. However, it should be noted that a pass in any subject/Internship/project/ shall be governed by the rules mentioned in **S.No. 13**.

(iii) Grade Sheet: A grade sheet (memorandum) will be issued to each student indicating his/her performance in all courses taken in that semester and also indicating the grades.

(iv) Transcripts: After successful completion of the programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued up to any point of study to the student on request and by paying stipulated fee in force.

(v) Candidates shall be permitted to apply for revaluation within the stipulated period with payment of prescribed fee.

(vi) The Academic Council has to approve and recommend to the JNTUK, Kakinada for the award of a degree to any student.

17. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i.   The students have to acquire 121 credits from 3rd Semester to 8th Semester of Program (regular) for the award of the degree.

ii.   Students, who fail to fulfill the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

iii. The same attendance regulations are to be adopted as per the rules mentioned in item No.9.

iv.   **Rules for Promotion in to Next Higher Class:** (6th Semester to 7th Semester): A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to either 5th or 6th Semester.

18. SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Final Examinations held at the end of each semester, a Supplementary Examination will be conducted. A student can appear for any number courses of supplementary examinations till he/she clears the courses. However the maximum stipulated period of programme cannot be relaxed under any circumstance.

19. ADVANCED SUPPLEMENTARY EXAMINATIONS:

Candidate who fails the courses in 7th and 8th Semester can appear for Advanced Supplementary Examinations.

20. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 121 credits from 3rd Semester to 8th Semester of B. Tech Programme for the award of the degree.
ii. All mandatory courses must be completed with satisfactory for award of degree.
iii. Obtained CGPA greater than or equal to 4.5 (minimum requirements for pass).
iv. The same attendance regulations are to be adopted as per the rules mentioned in item No.09.
v. **Rules for Promotion from 6th Semester to 7th Semester**: A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to 6th Semester.
vi. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.

21. CONDUCT AND DISCIPLINE:

Students admitted in SCET are to be followed the conduct and discipline of the college and which will be updated from time to time.

22. MALPRACTICES:

If any malpractices held in internal assessment tests or Semester-End Examinations, Principal constitute a Malpractice Enquiry Committee to enquire the case. The principal shall take necessary action based on the recommendations of the committee as per stipulated norms.

23. WITHHOLDING OF RESULTS

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

24. HONORS PROGRAMME:

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

b) A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 7.75 CGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 CGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

c) 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.

d) 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).

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

f) 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.

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

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

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

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

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

25. MINOR PROGRAMME:

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

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

b) 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, VLSI etc.

c) 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.

d) 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 7.75 CGPA (Cumulative 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 7.75 CGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An CGPA of 7.75 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

e) 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).

f) 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.

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

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

i) College Academic committee evaluates the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

j) 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.

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

l) 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.

26. GENERAL:

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final and which is to be ratified by the Chairman of the Governing Body.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

SEMESTER-I

S. No.	Course Type	Course Title	L	T	P	C	IM	EM	TM
1	20MA1T01	Linear Algebra	3	-	-	3.0	30	70	100
2	20BS1T02	Engineering Chemistry	3	-	-	3.0	30	70	100
3	20HS1T01	English	3	-	-	3.0	30	70	100
4	20CS1T01	Problem Solving Using C Programming	3	-	-	3.0	30	70	100
5	20BS1L02	Engineering Chemistry Lab	-	-	3	1.5	30	70	100
6	20HS1L01	English Proficiency Lab	-	-	3	1.5	30	70	100
7	20CS1L01	C Programming Lab	-	-	3	1.5	30	70	100
8	20IT1L01	IT Work shop	-	-	3	1.5	30	70	100
		Total	**12**	**0**	**12**	**18**	**240**	**560**	**800**

SEMESTER-II

S. No.	Course Type	Course Title	L	T	P	C	IM	EM	TM
1	20MA2T02	Differential Equation and Numerical Methods	3	-	-	3.0	30	70	100
2	20BS2T01	Engineering Physics	3	-	-	3.0	30	70	100
3	20CS2T03	Object Oriented Programming with Python	3	-	-	3.0	30	70	100
4	20IT2T01	IT Essentials	3	-	-	3.0	30	70	100
5	20EE2T01	Basic Electrical and Electronics Engineering	3	-	-	3.0	30	70	100
6	20CS2L03	Object Oriented Programming Lab with Python	-	-	3	1.5	30	70	100
7	20EE2L01	Basic Electrical and Electronics Engineering Lab	-	-	3	1.5	30	70	100
8	20BS2L01	Engineering Physics Lab	-	-	3	1.5	30	70	100
9	20HS2L02	English Communications Lab	-	-	3	1.5	30	70	100
		Total	**15**	**0**	**12**	**21**	**270**	**630**	**900**

SEMESTER-III

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20IT3T01	Discrete Mathematics	3	-	-	3.0	30	70	100
2	20AM3T01	Data Structures & Algorithms	3	-	-	3.0	30	70	100
3	20CS3T02	Database Management Systems	3	-	-	3.0	30	70	100
4	20AM3T02	Artificial Intelligence	3	-	-	3.0	30	70	100
5	20AM3T03	Fundamentals of Java	3	-	-	3.0	30	70	100
6	20AM3L01	Data Structures & Algorithms Lab	-	-	3	1.5	30	70	100
7	20CS3L02	Database Management Systems Lab	-	-	3	1.5	30	70	100
8	20IT3L02	Java Programming Lab	-	-	3	1.5	30	70	100
9	20AM3S01	Exploratory Data Analytics using MS Excel	-	-	4	2.0	30	70	100
10	20CE3M01	Environmental Science	2	-	-	-	-	-	-
		Total	**18**	**-**	**13**	**21.5**	**270**	**630**	**900**

SEMESTER-IV

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA4T07	Probability and Statistics	3	-	-	3.0	30	70	100
2	20CS4T01	Operating Systems	3	-	-	3.0	30	70	100
3	20AM4T01	Data Science	3	-	-	3.0	30	70	100
4	20AM4T02	Fundamentals of Machine Learning	3	-	-	3.0	30	70	100
5	20BM4T01	Managerial Economics and Financial Analysis	3	-	-	3.0	30	70	100
6	20AM4L01	Data Science Lab	-	-	3	1.5	30	70	100
7	20CS4L02	Operating Systems using Linux Lab	-	-	3	1.5	30	70	100
8	20AM4L02	Machine Learning Applications Lab	-	-	3	1.5	30	70	100
9	20AM4S01	Mobile App Development	-	-	4	2.0	30	70	100
10	20BM4M01	Indian Constitution	2	-	-	-	-	-	-
		Total	**18**	**-**	**13**	**21.5**	**270**	**630**	**900**

SEMESTER-V

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CS5T01	Computer Networks	3	-	-	3.0	30	70	100
2	20AM5T01	Automata Theory	3	-	-	3.0	30	70	100
3	20AM5T02	Full Stack Web Development	3	-	-	3.0	30	70	100
4		**Professional Elective – I**	3	-	-	3.0	30	70	100
5		**Open Elective-I / Job Oriented Elective - I**	2	-	2	3.0	30	70	100
6	20CS5L01	Computer Networks Lab	-	-	3	1.5	30	70	100
7	20AM5L01	Full Stack Web Development Lab	-	-	3	1.5	30	70	100
8	20HS5S01	Advanced English Communications Skills Lab	-	-	4	2.0	30	70	100
9	20BM5M01	Essence of Indian Traditional Knowledge	2	-	-	-	-	-	-
10	20AM5I01	Internship - I	-	-	-	1.5	50	-	50
		Total	**17**	**-**	**12**	**21.5**	**290**	**560**	**850**

SEMESTER – VI

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CS6T01	Compiler Design	3	-	-	3.0	30	70	100
2	20AM6T01	Deep Learning	3	-	-	3.0	30	70	100
3	20AM6T02	Cloud Architecture and Services	3	-	-	3.0	30	70	100
4		**Professional Elective - II**	3	-	-	3.0	30	70	100
5		**Open Elective-II / Job Oriented Elective-II**	2	-	2	3.0	30	70	100
6	20AM6L01	Deep Learning Lab	-	-	3	1.5	30	70	100
7	20AM6L02	Cloud Architecture and Services Lab	-	-	3	1.5	30	70	100
8	20AM6L03	R Programming Lab	1	-	3	1.5	30	70	100
9	20AM6S01	Natural Language Processing Lab	-	-	4	2.0	30	70	100
10	20AM6C01	Community Service Project	2	-	0	4	100	-	100
11	20BM6M01	Professional Ethics and Intellectual Property Rights	2	-	-	-	-	-	-
		Total	**21**	**-**	**15**	**25.5**	**370**	**630**	**1000**

SEMESTER – VII

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1		**Professional Elective - III**	3	-	-	3.0	30	70	100
2		**Professional Elective - IV**	3	-	-	3.0	30	70	100
3		**Professional Elective - V**	3	-	-	3.0	30	70	100
4		**Open Elective-III / Job Oriented Elective-III**	3	-	-	3.0	30	70	100
5		**Open Elective-IV / Job Oriented Elective-IV**	3	-	-	3.0	30	70	100
6	20HS7T01	Universal Human Values : Understanding Harmony	3	-	-	3.0	30	70	100
7	20AM7S01	**RESTful API Design with Node, Express, and MongoDB**	-	-	4	2.0	30	70	100
8	20AM7I01	Internship-II	-	-	-	3.0	50	-	50
		Total				23	260	490	750

SEMESTER – VIII

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20AM8P01	Project Work, Seminar and Internship in Industry	-	-	-	8	60	140	200
		Total	-	-	-	**8**	**60**	**140**	**200**

PROFESSIONAL ELECTIVE – I

S.No	Course Code	Course Title	Semester
1	20AM5E01	Principles of Software Engineering	V
2	20AM5E02	Computer Vision	V
3	20AM5E03	Data Visualization	V
4	20AM5E04	DevOps	V

OPEN ELCTIVE-I

S. No	Course Code	Course Title	Offering Dept.
1	20EE5O01	Non-conventional Energy sources	EEE
2	20ME5O01	Waste to Energy Conversion	ME
3	20CS5O01	Internet of Things and Applications	CSE
4	20CS5O02	Data Engineering	CSE
5	20BM5O01	Innovations and Entrepreneurship	MBA
6	20BM5O03	Digital Marketing	MBA
7	20BM5O04	Business Environment	MBA

JOB ORIENTED ELCTIVE-I

S. No	Course Code	Course Title	Offering Dept.
1	20IT5J01	Linux Administration	IT
2	20CS5J01	Full Stack with JAVA	CSE

PROFESSIONAL ELECTIVE – II

S.No	Course Code	Course Title	Semester
1	20CS6E01	Software Testing Methodologies	VI
2	20AM6E01	Human Computer Interaction	VI
3	20AM6E02	Ethics of Artificial Intelligence	VI
4	20AM6E03	Network Programming	VI

OPEN ELECTIVE – II

S. No	Course Code	Course Title	Offering Dept.
1	20CE6O01	Environmental Pollution and Control	CE
2	20CE6O02	Disaster Management	CE
3	20EE6O01	Fundamentals of Electrical Vehicle	EEE
4	20EC6O01	Mobile Communication and its Applications	ECE
5	20ME6O01	Basics of 3D Printing	MECH
6	20ME6O02	Farm Machinery	MECH
7	20CS6O01	Fundamentals of Software Engineering	CSE
8	20CS6O02	Fundamentals of Computer Networks	CSE
9	20BM6O01	Stress and Work Life Management	MBA
10	20BM6O02	Banking and Insurance	MBA
11	20MA6O01	Operation Research	S&H
12	20IT6O01	Introduction to Cloud Computing	IT
13	20IT6O02	E-Commerce	IT

JOB ORIENTED ELECTIVE – II

S.No	Course Code	Course Title	Offering Dept.
1	20CS6J01	AWS Cloud Practitioner	CSE
2	20CS6J02	Software Testing Tools	CSE
3	20IT6J01	Full Stack Development	IT
4	20IT6J02	Block Chain Technology	IT

PROFESSIONAL ELECTIVE – III

S. No.	Course Code	Course Title	Semester
1	20AM7E01	Block Chain Technologies	VII
2	20AM7E02	Reinforcement Learning	VII
3	20CS7E01	Cryptography and Network Security	VII
4	20EC7E03	Speech Processing	VII

PROFESSIONAL ELECTIVE – IV

S. No.	Course Code	Course Title	Semester
1	20AM7E03	NOSQL Databases	VII
2	20AM7E04	Robotic Process Automation	VII
3	20AM7E05	Video Analytics	VII
4	20IT7E05	Big Data Analytics	VII

PROFESSIONAL ELECTIVE – V

S. No.	Course Code	Course Title	Semester
1	20AM7E06	AI Chatbots	VII
2	20AM7E07	Social Network Analysis	VII
3	20AM7E08	Object Oriented Analysis and Design	VII
4	20AM7E09	Semantic Web	VII

OPEN ELECTIVE – III

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O01	Solid Waste Management	CIVIL
2	20CE7O02	Building Planning and Drawing	CIVIL
3	20EE7O01	Energy Auditing, Conservation and Management	EEE
4	20EC7O01	Introduction to Global Positioning Systems	ECE
5	20BM7O01	Industrial Sociology and Psychology	MBA
6	20ME7O01	Bio-Mechanical Engineering	MECH
7	20CS7O01	Full-Stack Development	CSE

OPEN ELECTIVE – IV

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O03	Introduction to Watershed Management	CIVIL
2	20EE7O02	Introduction to Programmable Logic Controller	EEE
3	20BM7O02	Business Skill Development	MBA
4	20EC7O02	Remote Sensing	ECE
5	20ME7O02	Green Engineering System	MECH
6	20CS7O02	Software Testing Techniques	CSE
7	20IT7O01	Introduction to Software Project Management	IT

MINOR DEGREE IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

S.NO	CODE	SUBJECT	L	T	P	C	IM	EM	TM
1	20AM4N01	Introduction to Artificial Intelligence and Machine Learning	3	1	0	4	30	70	100
2	20AM5N01	Machine Learning	3	1	0	4	30	70	100
3	20AM6N01	Deep Learning	3	1	0	4	30	70	100
4	20AM7N01	Reinforcement Learning	3	1	0	4	30	70	100
5	20AM7X01 20AM7X02	02 MOOCS courses@2credits each(any AI & ML related program core subjects from NPTEL/SWAYAM course of 8 weeks (2 credits) other than the courses listed above needs to be taken)				4			

I SEMESTER	L	T	P	C
	3	**-**	**-**	**3**
20MA1T01: LINEAR ALGEBRA				

COURSE OBJECTIVES:
1. This course will illuminate the students in the concepts of calculus and linear algebra.
2. This course equips the students with standard concepts and tools an intermediate level to advanced level and to develop the confidence; ability to handle various real world problems and their applications.

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications (K3)
CO2: Familiarize with functions of several variables which is useful in optimization (K3)
CO3: Learn important tools of calculus in higher dimensions. Students will become familiar with double integral(K3)
CO4: Familiarize with triple integral and also learn the utilization of special functions. (K4).
CO5: Apply double integration techniques in evaluating areas bounded by a region.(K4)

Bridge Course: Limits, continuity, Types of matrices

Unit I: Matrix Operations and Solving Systems of Linear Equations
Rank of a matrix by Echelon form, Normal form - solving system of homogeneous and non-homogeneous linear equations- Gauss Elimination, Jacobi and Gauss Seidel methods

Learning Outcomes:
At the end of this unit, the student will be able to
- solve system of linear equations. (K2)
- determine the rank of a matrix. (K2)

Unit II: Eigen values and Eigen vectors
Eigen values and Eigen vectors - and their properties (without proof). Cayley-Hamilton theorem (without proof), Finding inverse and powers of a matrix by Cayley-Hamilton theorem - Reduction of a matrix to diagonal form.

Learning Outcomes:
At the end of this unit, the student will be able to
- find eigen values and eigen vectors of a matrix. (K2)
- find inverse and powers of a matrix by Cayley-Hamilton theorem.(K2)

Unit III: Quadratic forms
Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

Learning Outcomes:
At the end of this unit, the student will be able to
- reduce a matrix to diagonal form and identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (K3)

Unit IV: Multivariable calculus
Expansions of functions: Taylor's and Maclaurin's series - Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- expand the given function as Taylor's and Maclaurin's series. (K3)
- find partial derivatives numerically and symbolically and use them to analyze and interpret the way in which a function varies. (K3)
- acquire the knowledge in maxima and minima of functions of several variables (K1)
- utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (K3)

Unit V: Multiple Integrals

Double Integrals: Change of order of integration, double integrals in polar coordinates, areas enclosed by plane curves.

Triple Integrals: Evaluation of triple integrals, change of variables.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates.(K3)
- apply double integration techniques in evaluating areas bounded by a region.(K4)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 43/e, Khanna Publishers, 2015.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. B.V. RAMANA, Higher Engineering Mathematics, Tata McGraw Hill, 2007.

I SEMESTER	L	T	P	C
	3	-	-	3
20BS1T02: ENGINEERING CHEMISTRY				

COURSE OUTCOMES
At the end of semester, the students will be able to

CO1: Explain the impurities present in raw water, problems associated and how to avoid them (K2)

CO2: Explain the advantages of Polymers in daily life (K2)

CO3: Explain the theory of construction of battery and fuel cells and theories of corrosion and prevention methods. (K2)

CO4: Differentiate conventional and non-conventional energy sources and their advantages and disadvantages. (K2)

CO5: Identify the usage of advanced materials in day to day life (K2)

UNIT I: WATER TECHNOLOGY   [9 Hours]
Part-A

Hard water-Types of hardness-Units of Hard Water-Disadvantages of hard water-Determination of hardness by EDTA complexometric method.

Portable water- its specifications-steps involved in purification of water (Sedimentation, Filtration, Disinfection)-chlorination, break point of chlorination.

Boiler Feed Water-Boiler troubles: Scale and sludge-priming and foaming-boiler corrosion-caustic embrittlement.

Part-B

Industrial Water Treatment: Softening methods: zeolite process-ion exchange process.
Brackish water treatment (desalination methods): Reverse osmosis - electro dialysis.

Learning Outcomes: At the end of this unit, the students will be able to Explain

The impurities present in raw water, problems associated with them and how to avoid them

UNIT-II: POLYMERS AND COMPOSITE MATERIALS   [9 Hours]
Part-A

Polymers-degree of polymerization-functionality-preparation, properties and applications of individual polymers-Bakelite-PVC-Poly styrene.

Plastics: Types (thermosetting and thermoplastic)-compounding of plastics-moulding Process. (Injection moulding, Compression moulding, Extrusion moulding, Transfer moulding)

Part-B

Rubbers and elastomers: Introduction-natural rubber-vulcanization of rubber-synthetic rubbers-Buna-N, Buna-S.

Composite materials: Fiber reinforced plastics-biodegradable polymers-biomedical polymers, Recycling of e-waste.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Discuss** natural and synthetic rubbers and their applications.

UNIT III: ELECTRO CHEMICAL CELLS AND CORROSION [12 Hours]

Electrochemical Cells: Introduction–single electrode potential - electrochemical cell-electrochemical series and applications. Reference electrodes-standard hydrogen electrode and calomel electrode-construction of glass electrode. Batteries: Construction, working and cell reaction of primary (dry cell) and Secondary (Pb acid and Li-ion) battery. Fuel cells (H_2-O_2, Methanol-Air cells).

Corrosion: Cause and consequences of corrosion-theories of corrosion (Chemical and Electrochemical corrosion)-types of corrosion (Galvanic, Differential aeration (waterline and pitting corrosion), stress Corrosion). Factors influencing rate of corrosion-nature of metal-nature of corrosive atmosphere. Corrosion Prevention methods: Cathodic protection-Sacrificial anodic method-Impressed voltage method. Metallic coatings: Galvanization-Tinning-Electro plating-Electro less plating.

Learning Outcomes: At the end of this unit, the students will be able to
- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

UNIT IV: CONVENTIONAL AND NONCONVENTIONAL ENERGY RESOURCES [9 Hours]

Conventional energy sources: Classification and characteristics of fuels-solid, Liquid and gaseous fuels-advantages and disadvantages-calorific value-higher and lower calorific values-construction and working of bomb calorimeter-analysis of coal-proximate and ultimate analysis-numerical problems related to bomb calorimeter, Dulong's formula and coal analysis-petroleum refining-cracking – petrol and diesel knocking – octane number and cetane number – gaseous fuels – Natural gas – CNG - LPG

Non-conventional energy sources: Solar energy: Advantages-disadvantages of solar cells-construction and working of photo voltaic cell -Introduction to hydro power-geo thermal power-tidal and wave power.

Learning Outcomes: At the end of this unit, the students will be able to
1. **Differentiate** conventional and non-conventional energy sources and their advantages and disadvantages.
2. **design** sources of energy by different natural sources

UNIT V: CHEMISTRY OF MATERIALS [9 Hours]
Part-A

Nano materials: Introduction-sol-gel method-characterization by SEM and TEM methods- carbon nanotubes and fullerenes: Types, preparation and applications

Semiconductors: Preparation (Distillation, Zone refining)
Part-B

Cement: Constituents of cement -Setting and Hardening of cement - Decay of Cement.

Refractories: Definition of refractory-classification and properties of refractoriness-applications of refractories.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure the surface properties of materials.
- **Illustrate** the commonly used industrial materials.

Text Books:
T1. A Text Book of Engineering Chemistry - N. Y. S. Murthy, V. Anuradha & K. Ramana Rao, Maruthi Publications. (2018)
T2. A Text Book of Engineering Chemistry - K. Sesha Maheswaramma, Mridula Chugh, Pearson Publications (2018).
Reference Books:

R1. Engineering Chemistry – Jain & Jain, Dhanpat Rai Publishing Company (Latest Edition)
R2. Text Book of Engineering Chemistry - Shashi Chawla, Dhanpat Rai & Co. (P) Limited ((Latest Edition))
R3. Chemistry –Prasanta Rath, Subhendu Chakroborthy, Cengage publications (2018)

I SEMESTER	L	T	P	C
	3	**-**	**-**	**3**
20HS1T01: ENGLISH				

A. PROGRAMME CONTENT

1. Intensive and extensive reading
2. Written communication
3. Listening and oral communication
4. Vocabulary consolidation and expansion
5. Practicing grammar

B. ELABORATION OF THE PROGRAMME CONTENT

1. Intensive and Extensive Reading

a. Identifying the main theme/the central idea of a passage
b. Understanding the meaning of words, phrases and sentences in context
c. Understanding the logical relationship between sentences (through recognition of grammatical structures such as linkers and connectors)
d. Distinguishing statements of fact from beliefs, opinions, hypotheses, and expressions of probability and certainty
e. Inferring facts, opinions, instances, reasons, causes, results, requests, conclusions, and general statements
f. Skimming passages to identify general ideas and information
g. Scanning passages to locate specific detail
h. The use of one's knowledge, opinions, and imagination to provide information / situations related to that given in the text; and comparison and contrast.

2. Written Communication

a. Writing outlines and summaries
b. Writing paragraphs with attention to topic sentences and supporting sentences
c. Writing paragraphs with attention to coherence and cohesion
d. Practicing clutter-free writing

3. Listening and Oral Communication

a. Effective listening involving
   - Identification of key words and phrases and specific information, application of one's previous knowledge of to understand the ideas dealt with in the text being listened to.
   - Attention to communication strategies such as approaching another person and opening a conversation with him/her, making friends with a stranger, thanking, apologizing, paying a compliment, seeking clarification, making enquiries, and creating an appropriate context for a formal discussion.
b. Taking part in speaking activities for interactional purposes such as,
   - Introducing oneself to others, introducing others, making enquiries, seeking information
   - Responding to enquiries, supplying information
   - Expressing agreement/disagreement in information situations
c. Taking part in speaking activities for transactional purposes with attention to the communication strategies listed in 1 (a) above.

4. Vocabulary consolidation and expansion

a. Inferring word meaning from available clues
b. Distinguishing words with similar meanings
c. Using connecting words
d. Learning one-word substitutes

Developing a verbal repertoire with the following dimensions:
   - Contexts of use
   - Collocations
   - Differences in speaking and writing
   - Strategic use

e. Using strategic vocabulary to organize and manage both oral and written communication successfully in academic, professional, and social contexts
f. Raising one's knowledge of redundancy, circumlocution, and imprecise and confusing expressions in order to avoid them in one's own speech and writing.

5.   Practicing grammar

a. Consolidation as well as remediation in the following areas:

Parts of speech, Tenses and usage of grammar in context

b. Learning to avoid some of the common pitfalls in the area of grammar in Indian usage of English (e.g. using the present continuous tense to describe actions which happen regularly; using state verbs in the continuous form; tense mixing)

C. TEXT BOOK: Building Effective Communication Skills

By Maruthi Publications (2019)

Syllabus :

U No	Content
UNIT –I	**Vocabulary Building** **1.1** Video Lesson 1.2.1 Word formation 1.2.2. Root words 1.2.3. Prefixes and Suffixes 1.2.4. Synonyms and Antonyms **1.3 Parts of Speech** **1.4 Note- making, Note-taking**
UNIT -II	**Basic Writing Skills** **2.1** Video Lesson 2.2.1 Basic sentence structure 2.2.2. Clauses and Phrases 2.2.3 Punctuations 2.2.4 Creating coherence 2.2.5 Organizing principles of paragraph documents 2.2.6 Techniques for writing precisely **2.3 Tenses** **2.4 Letter Writing**
UNIT-III	**Identifying Common Errors in Writing** **3.1** Video Lesson 3.2.1 Sub + verb agreement 3.2.2 Noun pronoun agreement 3.2.3 Articles 3.2.4 Preposition 3.2.5 Redundancies 3.2.6 Clichés **3.3.1 Active - Passive Voice** **3.3.2 Reported Speech** **3.4 Resume Writing**
UNIT-IV	**Nature and Style of sensible Writing** **4.1** Video Lesson 4.2.1 Describing 4.2.2 Classifying 4.2.3 Writing Introduction and conclusion **4.3.1 Conditional Sentences** **4.3.2 Degrees of Comparison** **4.4 Email writing**
UNIT-V	**Writing Practice** **5.1** Video Lesson 5.2.1 Comprehension 5.2.2 Precise writing 5.2.3 Essay Writing **5.3 Simple Compound and Complex Sentences** **5.4 Report Writing**

I SEMESTER	L	T	P	C
	3	-	-	3
20CS1T01 : PROBLEM SOLVING USING C PROGRAMMING				

COURSE OUTCOMES:

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

CO1: Analyse a computational problem and develop an algorithm/flowchart to find its solution **(K2)**

CO2: Develop C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or bitwise operators **(K3)**

CO3: Divide a given computational problem into a number of modules and develop C program with Arrays **(K3).**

CO4: Write C programs which use pointers for array processing and parameter passing **(K3)**

CO5: Develop C programs with structure or union and files for storing the data to be processed. **(K3)**

UNIT-I   **Contact Hours : 10**

INTRODUCTION TO PROGRAMMING: What is computer, Block diagram of Computer, Development of Computer languages, Translators, Computer Codes, Computer Arithmetic, Programming Techniques, Algorithm, Flowchart.

BASICS OF C : History of C, Character Set, Identifiers, Keywords, Tokens, Variables, constants, operators, Data types, expressions, expression evaluation, operator precedence and associativity, typecasting C program structure.

UNIT-II   **Contact Hours: 8**

CONSOLE I/O OPERATIONS   : Formatted I/O - printf & scanf, Unformatted I/O functions.

CONTROL FLOW STATEMENTS: Branching Statements - if, if – else, switch. **Looping statements-** while, do – while, for, nested for. **Unconditional Statements -** break, continue, goto, exit.

UNIT-III   **Contact Hours: 12**

ARRAYS: Array declaration, initialization and Accessing, Types of Arrays : 1-D and 2-D Arrays, Arrays as Function Arguments

FUNCTIONS: Introduction to Functions, Types of Function, Function prototypes, parameter passing techniques, Scope of variables, Storage classes, Recursion

UNIT-IV   **Contact Hours: 8**

STRINGS: Reading String from terminal, Writing string to Screen, String Handling Functions.

POINTERS: Pointer Declaration, Initialization and Accessing , Types of Pointers, Pointer Arithmetic, Dynamic memory allocation

UNIT-V   **Contact Hours: 10**

STRUCTURE: Introduction to structures, Definition of structure , declaration of structure variable, accessing of structure members, array of structures, **Union, enum, bit fileds, typedef**

FILES: Introduction to Files, Types of File, File Modes, Writing and Reading Files, File management I/O functions.

Text books:

- Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill
- Programming With C, Schaum Series

Reference Books:

- The 'C' programming language by Kernighan and Ritchie, Prentice Hall
- Computer Programming in 'C' by V. Rajaraman , Prentice Hall
- Programming and Problem Solving by M. Sprankle, Pearson Education
- How to solve it by Computer by R.G. Dromey, Pearson Education

Online Practice and Reference Material

http://www2.its.strath.ac.uk/courses/c/
http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html
http://www.stat.cmu.edu/~hseltman/Computer.html
http://projecteuler.net/

I SEMESTER	L	T	P	C
	-	-	3	1.5
20BS1L02 : ENGINEERING CHEMISTRY LAB				

OUTCOMES: The experiments introduce volumetric analysis: Acid-Base, complexometric, Redox, Conductometric and potentiometric titrations. Then they are exposed to a few instrumental methods of chemical analysis.

COURSE OUTCOMES:
Thus at the end of the lab course, the student is exposed and able to
CO1: Identify the concentration of given solution by different methods of chemical analysis (**K3**)
CO2: Analyze the water purity by checking hardness, DO and Acidity. (**K4**)
CO3: Estimate the Cu^{+2}, Fe^{+3}, Ca^{+2}, Mg^{+2} ions and Ascorbic acid present in given solution. (**K4**)
CO4: Identify the pour and cloud point of lubricants. (**K3**)
CO5: Understand the principles of conductometric and potentiometric titrations. (**K2**)

LIST OF EXPERIMENTS:

1. Estimation of HCl using standard Na_2CO_3 through acid-base titration.
2. Estimate the total hardness of water using standardized EDTA solution through complexometric titration.
3. Estimation of $KMnO_4$ using standard $H_2C_2O_4$ through redox titration method.
4. Estimation of Dissolved Oxygen in given water sample by Wrinkler's Method
5. Determination of Ferric (Fe^{+3}) ions using standard $K_2Cr_2O_7$ solution
6. Determination of Copper (II) using standard hypo solution.
7. Estimation of strong acid by using strong base through conductometric titration method.
8. Estimation of strong acid by using strong base through potentiometric titration method.
9. Preparation of polymer (Demo).
10. Determination of Vitamin 'C'.
11. Determination of Pour and Cloud Point of lubricating oils

Reference Books
1. A Textbook of Quantitative Analysis, Arthur J. Vogel.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20HS1L01 : ENGLISH PROFICIENCY LAB				

COURSE OBJECTIVES

1. To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
2. To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
3. To assist students to carry on the tasks and activities through guided instructions and materials.
4. To effectively integrate English language learning with employability skills and training.
5. To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
6. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES

a) **Reading Skills.**
 • Addressing explicit and implicit meaning of a text.
 • Understanding the context.
 • Learning new words and phrases.
 • Using words and phrases in different contexts.
b) **Writing Skills:**
 • Using the basic structure of a sentence.
 • Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
 • Retaining a logical flow while writing.
 • Planning and executing an assignment creatively.
c) **Interactive skills:**
 • Analyzing a topic of discussion and relating to it.
 • Participating in discussions and influencing them.
 • Communicating ideas effectively.
 • Presenting ideas coherently within a stipulated time.
d) **Life Skills and Core Skills:**
 • Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
 • Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
 • Understanding the importance of helping others-community service, enthusiasm.

RELATIONSHIP OF COURSE TO PROGRAMME OUTCOMES

A	Ability to apply knowledge of mathematics, science, and engineering.	
B	Ability to design and conduct experiments, as well as to analyze and interpret data.	
C	Ability to design an Engineering system, component, or process.	
D	Ability to function on multi-disciplinary teams	
E	Ability to identify, formulate and solve engineering problems.	
F	Understanding of professional and ethical responsibility.	
G	Ability to communicate effectively	√

H	Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.	√
I	Recognition of the need for and an ability to engage in life-long learning.	
J	Knowledge of contemporary issues.	
K	Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.	
L	Ability to find location of substations and benefits derived through their optimal location.	

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice English language in order to acquire proficiency in English. 'Enrich your interactive Skills: Part - A' is designed to provide opportunities for engineering students to revise and consolidate the basic skills in listening, speaking, reading and writing in addition to giving ample practice in various communicative functions and Life skills.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Syllabus:

Unit	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:
"InfoTech English" by Maruthi Publications
Reference Books:
1. Better English Pronunciation by O' Connor
2. Phonetics and Phonology – Peter Roach
3. A Grammar of Spoken English – Harold Palmer
4. English Phonetics – Bansal and Harrison

Testing Pattern:
  A) **Internal lab Exam:**   **30 Marks**
    Regular performance in the language /communication /lab completion in the lab manual 15M
    Written test   15M
  B) **External lab Exam Pattern:**   **70 Marks**
   Written test   30M
    Oral test   30M
    Viva (during exam marks will be awarded by external examiner)   10M

I SEMESTER	L	T	P	C
	-	-	3	1.5
20CS1L01 : C PROGRAMMING LAB				

COURSE OBJECTIVES:
1. To impart knowledge on various Editors, Raptor.
2. To make the students understand the concepts of C programming.
3. To nurture the students on Control Structures and develop different operations on arrays
4. To make use of String fundamentals and modular programming constructs.
5. To implement programs using dynamic memory allocation.
6. To explain the concepts of Structure, Unions and files for solving various problems.

COURSE OUTCOMES:
CO1: Implement basic programs in C and design flowcharts in Raptor.
CO2: Use Conditional and Iterative statements to solve real time scenarios in C.
CO3: Implement the concept of Arrays and Modularity and Strings.
CO4: Apply the Dynamic Memory Allocation functions using pointers.
CO5: Develop programs using structures, and Files.

LIST OF EXPERIMENTS:
1. Introduction to Algorithms and Flowcharts
   1.1) Implement Algorithm Development for Exchange the values of Two numbers.
   1.2) Given a set of n student's examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.
   1.3) Given a set of n numbers design an algorithm that adds these numbers and returns the resultant sum. Assume N is greater than or equal to zero.

2. Introduction to C Programming
   2.1) Exposure to Turbo C, Code Blocks IDE, Dev C++, Falcon C++.
   2.2) Writing simple programs using printf(), scanf() .

3. Raptor
   3.1) Introduction to Raptor.
   3.2) Draw a flow chart to find the Sum of 2 numbers.
   3.3) Draw a flow chart to find Simple interest.

4. Basic Math
   4.1) Write a C Program to convert Celsius to Fahrenheit and vice versa.
   4.2) Write a C Program to find largest of three numbers using ternary operator.
   4.3) Write a C Program to Calculate area of a Triangle using Heron's formula.

5. Control Flow- I
   5.1) Write a C Program to Find Whether the Given Year is a Leap Year or not.
   5.2) Write a C program to find the roots of a Quadratic Equation.
   5.3) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using Switch…case.

6. Control Flow- II
   6.1) Write a C Program to Find Whether the Given Number is Prime number or not.
   6.2) Write a C Program to Find Whether the Given Number is Armstrong Number or not.
   6.3) Write a C program to print Floyd Triangle.

7. Control Flow- III

7.1) Write a C program to find the sum of individual digits of a positive integer.

7.2) Write a C program to check whether given number is palindrome or not.

7.3) Write a C program to read two numbers, x and n, and then compute the sum of the geometric progression $1+x+x^2+x^3+\ldots\ldots\ldots+x^n$.

Practice Programs:

1. Write a C program to print all natural numbers from 1 to n. - using while loop
2. Write a C program to print all natural numbers in reverse (from n to 1). - using while loop
3. Write a C program to print all alphabets from a to z. - using while loop
4. Write a C program to print all even numbers between 1 to 100. - using while loop
5. Write a C program to print sum of all even numbers between 1 to n.
6. Write a C program to print sum of all odd numbers between 1 to n.
7. Write a C program to print table of any number.
8. Write a C program to find first and last digit of any number.
9. Write a C program to count number of digits in any number.
10. Write a C program to calculate sum of digits of any number.
11. Write a C program to calculate product of digits of any number.
12. Write a C program to swap first and last digits of any number.
13. Write a C program to enter any number and print its reverse.
14. Write a C program to enter any number and check whether the number is palindrome or not.
15. Write a C program to find frequency of each digit in a given integer.
16. Write a C program to enter any number and print it in words.
17. Write a C program to print all ASCII character with their values.
18. Write a C program to enter any number and print all factors of the number.
19. Write a C program to enter any number and calculate its factorial.
20. Write a C program to find HCF (GCD) of two numbers.
21. Write a C program to find LCM of two numbers.
22. Write a C program to check whether a number is Prime number or not.
23. Write a C program to check whether a number is Armstrong number or not.
24. Write a C program to check whether a number is Perfect number or not.
25. Write a C program to check whether a number is Strong number or not.
26. Write a C program to print Fibonacci series up to n terms.

8. Arrays

8.1) Write a C program to search an element in the given array (Linear Search).

8.2) Write a C program to perform matrix addition.

8.3) Write a C program to perform matrix multiplication.

Practice Programs:

1. Write a C program to read and print elements of array.
2. Write a C program to find sum of all array elements. - using recursion.
3. Write a C program to find maximum and minimum element in an array. - using recursion.
4. Write a C program to find second largest element in an array.
5. Write a C program to copy all elements from an array to another array.
6. Write a C program to insert an element in an array.
7. Write a C program to delete an element from an array at specified position.
8. Write a C program to print all unique elements in the array.
9. Write a C program to print all negative elements in an array.
10. Write a C program to count total number of even and odd elements in an array.
11. Write a C program to count total number of negative elements in an array.
12. Write a C program to count total number of duplicate elements in an array.

13. Write a C program to delete all duplicate elements from an array.
14. Write a C program to count frequency of each element in an array.
15. Write a C program to merge two array to third array.
16. Write a C program to find reverse of an array.
17. Write a C program to convert lowercase string to uppercase.
18. Write a C program to convert uppercase string to lowercase.
19. Write a C program to toggle case of each character of a string.
20. Write a C program to find total number of alphabets, digits or special character in a string.

9. Pointers
9.1) Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers using Command line arguments.
9.2) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.
9.3) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions, Array & Pointers
10.1) Write a C Program to demonstrate parameter passing in Functions.
10.2) Write a C Program to find Fibonacci, Factorial of a number with Recursion and without recursion.
10.3) Write a C Program to find the sum of given numbers with arrays and pointers.

Practice Programs:
1. Program to change the value of constant integer using pointers.
2. Program to print a string using pointer.
3. Program to count vowels and consonants in a string using pointer.
4. Program to read array elements and print with addresses.

11. Strings
11.1) Implementation of string manipulation operations with library function:
   a) copy
   b) concatenate
   c) length
   d) compare
11.2) Implementation of string manipulation operations without library function:
   a) copy
   b) concatenate
   c) length
   d) compare
11.3) Verify whether the given string is a palindrome or not.

12. Structures
12.1) Write a C Program to Store Information of a book Using Structure.
12.2) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Files
13.1) Write a C program to open a file and to print the contents of the file on screen.
13.2) Write a C program to copy content of one file to another file.
13.3) Write a C program to merge two files and store content in another file.

14. Application
Creating structures to capture the student's details save them in file in proper record format, search and prints the student details requested by the user.

Note: Draw the flowcharts using Raptor from Experiment 3 to Experiment 6.

Reference Books:
1. Let Us C Yashwanth Kanetkar, 16th edition, BPB Publications.
2. Programming in C A-Practial Approach Ajay Mittal. Pearson Education.
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
4. Problem solving using C , K Venugopal,3rd Edition,TMG Publication.

Web Links:
1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5. https://raptor.martincarlisle.com/
6. https://nptel.ac.in/courses/106105085/2

I SEMESTER	L	T	P	C
	-	-	3	1.5
20IT1L01 : IT WORKSHOP				

COURSE OBJECTIVES:
1. The course focuses on enhancing student knowledge in computer peripherals and assembling.
2. To install operating system on computers and create new email account.
3. To understand basic software like WinRAR, WinZip, PDF readers and web browser.
4. To provide technical training to the students on Google tools like forms, calendar, drive, and classroom.

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to
CO1: Attain complete knowledge of a computer hardware
CO2: Able to install basic computer engineering software.
CO3: Able to do document task through MS office.
CO4: Attain technically strong usage of Google Tools and Email handling.
CO5: Able to understand network troubleshooting.

LIST OF EXPERIMENTS
1. Components of Computer & Assembling a Computer:
Learning about the different parts of the computer and its advancement
• Processor
• Memory – Types
• Motherboard
• Peripheral interfaces – I/O devices

2. Components of Computer & Assembling a Computer:
• Learn about the proper connectivity among the devices inside the PC
• Assembling the different parts of the computer inside the cabinet

3. Productivity Tools - Learning Basic Software:
• Installation of Productivity tools like WinRAR, WinZip, and PDF Reader.
• Installation of Application programs like Microsoft Office, Image Editor and Web browsers.
• Connect the Printer and Scanner Devices perform printing and scanning operation.

4. Productivity Tools:
Microsoft-Word orientation – To create project certificate, Formatting Fonts, Drop Cap, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option.

5. Productivity Tools:
Microsoft-Word orientation- Mail Merge, Macros, References.

6. Productivity Tools:
Microsoft-PowerPoint utilities - PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks, Inserting Images, Clip Art, Audio, Video, Objects, Tables and Charts.

7. Productivity Tools:
Microsoft-Excel orientation - Gridlines, Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel – average, std.deviation etc., Macros.

8. Productivity Tools:
Microsoft-Excel orientation- Charts, Hyper linking, Split cells, freeze panes, group and outline, Conditional formatting, Sort and Filter, .csv file.

9. Introduction to Google Tools:
• Design a Google form and collect a response data among students using Google Form.
• Schedule one day of your activities using Google Calendar.
• Store and retrieve data from cloud storage using Google Drive.
• Orientation towards Google Classroom.

10. Network basics:
Introduction, Types of networks, IP addressing, LAN, Network troubleshooting.

II SEMESTER	L	T	P	C
	3	**-**	**-**	**3**

20MA2T02: DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

COURSE OBJECTIVES:
1. To enlighten the learners in the concept of differential equations.
2. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Solve the differential equations related to various engineering fields (K3)
CO2: Identify solution methods of partial differential equations that model physical processes (K3)
CO3: Evaluate the approximate roots of polynomial and transcendental equations by different algorithms(K3)
CO4: Solve integrate and ordinary differential equations by various numerical techniques.(K3)
CO5: Solve ordinary differential equations by using different numerical schemes (K3).

Unit I: Linear differential equations of higher order:
Solutions of Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters.
Learning Outcomes:
At the end of this unit, the student will be able to
- identify the essential characteristics of linear differential equations with constant coefficients (K3)
- solve the linear differential equations with constant coefficients by appropriate method (K3)

Unit –II: Partial Differential Equations of First Order:
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equations and nonlinear (standard types) equations.
Learning Outcomes:
At the end of this unit, the student will be able to
- apply a range of techniques to find solutions of standard PDEs (K3)
- outline the basic properties of standard PDEs (K2)

Unit III: Interpolation
Finite differences, Differences of a polynomial, relation between operators, to find one or more missing terms, Newton's interpolation formulae, and interpolation with unequal intervals- Lagrange's formula.
Learning Outcomes:
After the completion of this unit student will be able to
- explain various discrete operators and find the relation among operators (K2)
- apply Newton's forward and backward formulas for equal and unequal intervals (K3)

Unit IV: Numerical Solution of Equations and Numerical integration
Numerical Solution of Equations: Solution of algebraic and transcendental equations - Bisection Method, Method of False Position, Newton-Raphson Method, useful deduction from Newton-Raphson Method.

Numerical Integration – Trapezoidal rule, Simpson's $\frac{1}{3}$ rule and Simpson's $\frac{3}{8}$ rule.

Learning Outcomes:
After the completion of this unit student will be able to
- find approximate roots of an equation by using different numerical methods (K3)
- find integral of a function by using different numerical methods (K3)

Unit V: Numerical Methods to Solve Ordinary Differential Equations
Numerical Methods to Solve Ordinary Differential Equations - Taylor's series, Euler's and modified Euler's methods, Runge-kutta method of fourth order for solving first order equations.

Learning Outcomes:
After the completion of this unit student will be able to
* solve ordinary differential equations by using different numerical schemes (K3)

Textbooks:
1. B. S. Grewal, Higher Engineering Mathematics, 43/e, Khanna publishers,2015.

References:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

	L	T	P	C
II SEMESTER	**3**	**-**	**3**	**3**
20BS2T01: ENGINEERING PHYSICS				

COURSE OUTCOMES

After completion of course student able to:

CO1: Describe Basic crystal systems and determination of crystal structures
CO2: Explain Magnetic and Dielectric Materials properties
CO3: Describe Concept of Magnetic Induction and Super Conducting properties
CO4: Explain Pure & Doped Semiconductor materials for better utility
CO5: Describe Optical fibers and Optical properties of materials and their applications

SYLLABUS

UNIT –I: CRYSTAL STRUCTURE AND X-RAY DIFFRACTION

CRYSTAL STRUCTURE:

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 in crystals- planes in crystals- Miller indices and procedure to find Miller indices- Various planes in crystals- Separation between successive (h k l) planes-Bragg's law-Bragg's Spectrometer.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the seven crystal systems
- **Interpret** the crystal structure based on Bragg's law

UNIT – II: MAGNETIC AND DIELECTRIC PROPERTIES

MAGNETIC PROPERTIES: Introduction-Magnetic permeability – Magnetization – Relation between three magnetic vectors - Origin of magnetic moment – Classification of Magnetic materials- Dia, Para, Ferro, Anti-Ferro and Ferri-magnetism – Hysteresis- soft and Hard Magnetic materials.

DIELECTRIC PROPERTIES: Introduction-Dielectric constant- Relation between three electric vectors-Electronic and ionic polarizations (Quantitative) - orientation polarization (Qualitative) - Internal fields in solids- Clausius - Mossotti equation.

Learning Outcomes: At the end of this unit, the students will be able to

- **Classify** the magnetic materials into dia, para, ferro, anti ferro and ferri
- **Explain** the importance of hysteresis
- **Explain** the concept of polarization in dielectric materials.
- **Summarize** various types of polarization of dielectrics .
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics.

UNIT-III: ELECTROMAGNETIC WAVES AND SUPERCONDUCTIVITY

ELECTROMAGNETIC WAVES: Introduction-Electric flux –magnetic flux- Gauss law in electrostatics-Gauss law in magnetostatics- Ampere's law - B for a Solenoid - Biot-Savart's law-Magnetic Induction due to current carrying circular loop- Faraday's law - Maxwell's equations (Integral and differential forms).

SUPERCONDUCTIVITY: General and Thermal properties –Meissner effect – Type-I and Type-II superconductors – Flux quantization – BCS Theory of Superconductivity - Josephson effects – Applications of Superconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Illustrate** the concept of electro magnetism based on fundamental laws of electro magnetism
- **Explain** Maxwell's equations
- **Summarize** various properties and applications of superconductors

UNIT-IV: PHYSICS OF SEMICONDUCTORS:

Classification of solids based on band theory - Intrinsic semiconductors- density of charge carriers- Equation for conductivity – Extrinsic semiconductors- P-type and N-type- density of charge carriers- Drift and diffusion – Einstein's equation – Hall Effect- Hall coefficient – Applications of Hall effect– direct & indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, the students will be able to
- **Summarize** various types of solids based on band theory.
- **Outline** the properties of n-type and p-type semiconductors.
- **Identify** the type of semiconductor using Hall effect

UNIT-V: LASERS AND OPTICAL FIBERS

LASERS: Introduction– Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion - Three level and four level laser pumping schemes - Ruby laser – Helium-Neon laser- Applications of Laser.

FIBER OPTICS: Introduction to Optical fibers- Critical angle of propagation- Total internal reflection- Acceptance angle and acceptance cone- Numerical aperture- Classification of optical fibers based on refractive index profile-Classification of optical fibers based on modes- Attenuation in optical fibers - Applications of optical fibers.

Learning Outcomes: At the end of this unit, the students will be able to
- **Design** various types of lasers
- **Explain** the principle and propagation of light through Optical fibers
- **Discuss** the application of lasers and Optical fibers

II SEMESTER	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**

20CS2T03: OBJECT ORIENTED PROGRAMMING WITH PYTHON

COURSE OBJECTIVES:
1. Acquire programming skills in core Python.
2. Acquire Object-Oriented Programming features implementation in Python.
3. To understand data structures in Python
4. Develop the ability to use Operating System functions in python applications
5. Able to use exception handling in python programs

COURSE OUTCOMES:
CO1: Recognize core programming basics and program design with functions using Python programming language.
CO2: Interpret the high-performance programs designed to strengthen the practical expertise.
CO3: Develop applications for real time problems by applying python data structure concepts.
CO4: Understand and apply the concepts of packages, handling, multithreading and socket programming.
CO5: Analyze the importance of object-oriented programming over structured programming.

UNIT – I:
Introduction to Python: Features of Python, History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.
Data types: Integers, Strings, Booleans.

UNIT – II:
Operators and Expressions: Types - Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations
Control Flow: if, if-elif-else, for, while, break, continue, pass

UNIT – III:
Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.
Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT – IV:
Object Oriented Programming in Python: Classes, Data hiding, 'self-variable', Methods, Constructor, methods, and inheritance: Various Types of Inheritance and Function Overloading, Overriding Methods.

UNIT – V:
Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions
Brief Tour of the Standard Library: Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times

Text Books:
1. Learning Python, Mark Lutz, Orielly
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. R Nageswara Rao, "Core Python Programming", Dream tech press, 2017 Edition
4. Dusty Philips, "Python 3 Object Oriented Programming", PACKT Publishing, 2nd Edition, 2015

Reference Books:
1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage
4. Michael H.Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.

Web References:
1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming

II SEMESTER	L	T	P	C
	3	-	-	3
20IT2T01: IT ESSENTIALS				

COURSE OUTCOMES:

After the completion of this course, students will be able to
CO1: Understand the concepts of operating systems.
CO2: Demonstrate the implementation of various software engineering tools.
CO3: Understand the basics of Internet.
CO4: Understand the orientation towards web basics.
CO5: Demonstrate the implementation of various computer graphics concepts.

UNIT-1
Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, Installation of Operating Systems, The Unix Operating System, Basic Unix commands.

UNIT-2
Software Engineering: The evolving role of software, changing nature of software, software myths, Structure of Software Life Cycle, Software engineering methodologies, software requirements, various software engineering tools.

UNIT-3
Internet Basics: Introduction, Features of Internet, Internet applications, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System, Security- Forms of attacks, legal approaches to network security.

UNIT-4
Web Basics: Introduction to web, web browsers, web servers, Protocol, HTTP/HTTPS, TCP/IP, Email, FTP, SMTP, SNMP, URL, HTML and CSS.

UNIT-5
Computer Graphics: Scope of Computer Graphics, Overview of 3D Graphics, Modelling- modelling individual objects, modelling entire scenes. Dealing with global lighting - Ray tracing, Radiosity. Rendering and Animation.

TEXT BOOKS
1. J. Glenn Brookshear, "Computer Science: An Overview", Addision-Wesley, TwelfthEdition, 2014.
2. Pradeep K Simha, "Computer Fundamentals- Concepts, Systems & Applications", 8[th]edition, BPB.

II SEMESTER	L	T	P	C
	3	-	-	3
20EE2T01: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING				

COURSE OUTCOMES:

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

CO1: Analyze different electrical networks using KVL, KCL and Theorems.

CO2: Understand the basic concepts of single-phase system for simple AC circuit.

CO3: Demonstrate the construction, working and operating characteristics of AC & DC machines.

CO4: Study the construction details, operation and characteristics of various semiconductor devices, digital and logic operations.

CO5: Apply concepts of binary number system, logic gates, Boolean algebra, De Morgan's theorem, Boolean expression simplification, half and full adders, and A/D and D/A conversions in digital electronics.

UNIT-I: ELECTRICAL CIRCUITS

Basic definitions – types of network elements Electrical Circuit Elements (R, L and C), Voltage and Current Sources, Ohms Laws, Kirchoff's Laws and Star/Delta Conversion, Series-Parallel- Series and Parallel (Only Resistor), Superposition, Thevenin's and Norton's Theorems, Problems in Simple Circuits with DC Excitation

UNIT-II: AC FUNDAMENTALS

Representation of Sinusoidal Waveforms, Peak and RMS Values. Real Power, Reactive Power, Apparent Power, Power Factor. Concept of phase angle and phase difference Single phase Circuits - Voltage and Current Relations in Star/Delta Connections-Simple Problems.

UNIT-III:ELECTRICAL MACHINES

Electrical Machines: DC Machines: Classification of DC Machines-DC Generator and Motor Construction-Principle of operation –EMF Equation-Performance Characteristics-Simple problems AC Machines: Classification of AC Machines-Transformers-Synchronous Machines, Induction motor Performance Characteristics-Starting Methods-Simple problems.

UNIT- IV:SEMI -CONDUCTOR DEVICES AND ITS CHARACTERISTICS

Characteristics of PN Junction Diode —— Zener Diode- Intrinsic and Extrinsic Semiconductors – Semiconductor Diodes– Bipolar Junction Transistors-CB, CE, CC Configurations and Characteristics – FET – MOSFET – Silicon-controlled Rectifier – DIAC – TRIAC-Half waveand Full wave Rectifiers- Voltage Regulation.

UNIT-V: INTRODUCTION TO DIGITAL ELECTRONICS

Binary Number System – Logic Gates – Boolean Algebra -De Morgan's Theorem-Simplification of Boolean Expressions using De Morgan's Theorem – Half and Full Adders – A/D and D/A Conversion.

TEXT BOOKS:
1. Basic Electrical Engineering, D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
2. Basic Electrical Engineering, P. V. Prasad, S. Sivanagaraju, K. R. Varmah, and Chikku Abraham, Cengage, 2019.
3. Basic Electrical & Electronics Engineering – J. B. Gupta, S. K. Kataria & Sons Publications, 2019 edition.

REFERENCE BOOKS:
1. Basic Electrical Engineering - D.C. Kulshreshtha, 2009, Tata McGraw Hill.
2. Fundamentals of Electrical Engineering, L.S. Bobrow, Oxford University Press, 2011
3. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010.
4. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989.
5. Principles of Electrical Engineering and Electronics", V K Mehta & Rohit Mehta,S Chand Publishers,2019 edition.

II SEMESTER	**L**	**T**	**P**	**C**
	-	-	3	1.5
20CS2L03 : OBJECT ORIENTED PROGRAMMING LAB WITH PYTHON				

COURSE OUTCOMES:

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

CO1: Apply core programming basics and program design with functions using Python programming language.

CO2: Interpret the high-performance programs designed to strengthen the practical expertise.

CO3: Develop applications for real time problems by applying python data structure concepts.

CO4: Test and apply the concepts of packages, handling, multithreading and socket programming.

CO5: Divide the importance of object-oriented programming over structured programming.

Exercise 1 - Basics

 a) Running instructions in Interactive interpreter and a Python Script

 b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

 a) Write a program to compute distance between two points taking input from the user.

 b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

 a) Write a Program for checking whether the given number is a even number or not.

 b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . .1/10

 c) Write a program using a for loop that loops over a sequence. What is sequence?

 d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

 a) Find the sum of all the primes below two million. Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

 b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 - DS

 a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

 b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

 a) Write a program combine lists that combines these lists into a dictionary.

 b) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise - 7 Files

 a) Write a program to print each line of a file in reverse order.

 b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions

 a) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius

If (distance between two balls centers) <= (sum of their radii) then (they are colliding)

 b) Find mean, median, mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued

 a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are

nearly equal when a can be generated by a single mutation on b.
b) Write a function dups to find all duplicates in the list.
c) Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions - Problem Solving

a) Write a function cumulative product to compute cumulative product of a list of numbers.
b) Write a function reverse to reverse a list. Without using the reverse function.
c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise 11 - Multi-D Lists

a) Write a program that defines a matrix and prints
b) Write a program to perform addition of two square matrices
c) Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules

a) Install packages requests, flask and explore them. using (pip)
b) Write a script that imports requests and fetch content from the page.
c) Write a simple script that serves a simple HTTP Response and a simple HTML Page

Exercise - 13 OOP

a) Class variables and instance variable and illustration of the self-variable
    i) Robot   ii) ATM Machine

Exercise - 14 GUI, Graphics

a) Write a GUI for an Expression Calculator using tk
Write a program to implement the following figures using turtle
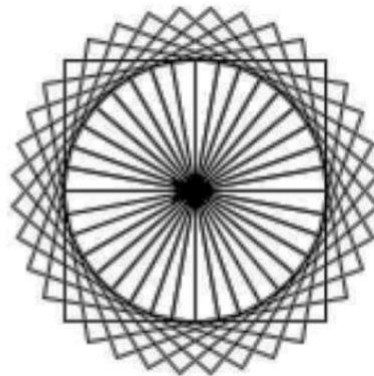
Text Books:
    5. Learning Python, Mark Lutz, Orielly
    6. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
    7. R Nageswara Rao, "Core Python Programming", Dream tech press, 2017 Edition
    8. Dusty Philips, "Python 3 Object Oriented Programming", PACKT Publishing, 2nd Edition, 2015

Reference Books:
    5. Think Python, Allen Downey, Green Tea Press
    6. Core Python Programming, W.Chun, Pearson.
    7. Introduction to Python, Kenneth A. Lambert, Cengage
    8. Michael H.Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.

Web References:
    5. https://realpython.com/python3-object-oriented-programming/
    6. https://python.swaroopch.com/oop.html
    7. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
    8. https://www.programiz.com/python-programming

	L	T	P	C
II SEMESTER	-	-	3	1.5
20EE2L01: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB				

COURSE OUTCOMES:

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

CO1: Acquire knowledge on electrical networks by using KVL,KCL.

CO2: Analyze the performance characteristics and to determine efficiency of DC machines.

CO3: Understand the characteristics of AC machines.

CO4: Apply knowledge on PN junction diode , transistor and Rectifiers

CO5: Analyze, and design half-wave and full-wave rectifiers with and without filters, considering their applications and performance characteristics in AC to DC signal conversion.

LIST OF EXPERIMENTS

SECTION A: ELECTRICAL ENGINEERING:

1. Verification of KCL & KVL.
2. Open circuit Characteristics of DC Shunt generator.
3. Swinburne's test on DC Shunt Motor.
4. Brake test on DC Shunt motor.
5. Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field flux control method
6. Open circuit and Short circuit test on a Single Phase Transformers.
7. Draw the Torque-Slip Characteristic of a Three Phase Induction Motor.
8. Regulation of Synchronous Machine using EMF Method.

SECTION B: ELECTRONICS ENGINEERING:

The following experiments are required to be conducted as compulsory experiments:

1. PN junction diode characteristics a) Forward bias b) Reverse bias (Cut in voltage and
    Resistance calculations)
2. Transistor CE characteristics (input and output)
3. Half wave rectifier with and without filters.
4. Full wave rectifier with and without filters.

Any 10 Experiments has to be conducted from Section A & B

Reference Books:

1. Department lab manual.

II SEMESTER	L	T	P	C
	-	-	3	1.5
20BS2L01: ENGINEERING PHYSICS LAB				

COURSE OUTCOMES
At the end of the course, student will be able to
CO1: Demonstrate the basic knowledge to know the frequency of a vibrator, hall coefficient, (K3)
CO2: Attain knowledge to verify some of the properties of physical optics. (K4)
CO3: Develop skills to plot various characteristic curves and to calculate the physical properties of given materials. (K4)
CO4: Calculate some the properties of semiconducting materials. (K2)
CO5: Determine the time constant for a C-R circuit, measure Planck's constant using a photo-cell, and determine the dielectric constant of a given material, showcasing a strong understanding of experimental methodologies and data analysis techniques.

STUDENT HAS TO DO ANY TEN OF THE FOLLOWING

1. Determination of wavelength of Laser using diffraction grating.
2. Determination of Numerical Aperture and Acceptance angle of an Optical Fiber.
3. Determination of the charge carrier density by using Hall Effect.
4. Determination of the Band Gap of a Semiconductor using a p-n junction diode.
5. Study of Characteristic curves (l/V) of a Zener diode to determine its Breakdown voltage.
6. Determination of Temperature coefficient of resistance of a Thermistor by using its Characteristic curve.
7. Study the variation of intensity of magnetic field along the axis of a circular current carrying coil by using Stewart and Gee's experiment.
8. Study of Characteristic curves (l/V) of a P-N diode.
9. Determine Frequency of given electrically driven tuning fork in Transverse and Longitudinal modes by using Melde's apparatus
10. Determine frequency of A.C. supply by using Sonometer.
11. Determination of the Time Constant for a C-R Circuit
12. Determination of the Planck's constant by using Photo-Cell
13. Determination of dielectric constant of a given material

II SEMESTER	**L**	**T**	**P**	**C**
	-	-	3	1.5
20HS2L02 - ENGLISH COMMUNICATIONS LAB				

COURSE OBJECTIVES

1. To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
2. To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
3. To assist students to carry on the tasks and activities through guided instructions and materials.
4. To effectively integrate English language learning with employability skills and training.
5. To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
6. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES

a) Reading Skills.
- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:
- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:
- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:
- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

RELATIONSHIP OF COURSE TO PROGRAMME OUTCOMES

A	Ability to apply knowledge of mathematics, science, and engineering.	
B	Ability to design and conduct experiments, as well as to analyze and interpret data.	
C	Ability to design an Engineering system, component, or process.	
D	Ability to function on multi-disciplinary teams	

E	Ability to identify, formulate and solve engineering problems.	
F	Understanding of professional and ethical responsibility.	
G	Ability to communicate effectively	√
H	Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.	√
I	Recognition of the need for and an ability to engage in life-long learning.	
J	Knowledge of contemporary issues.	
K	Ability to use the techniques, skills, and modern engineering tools necessary for engineering practices.	
L	Ability to find location of substations and benefits derived through their optimal location.	

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice English language in order to acquire proficiency in English. 'Enrich your interactive Skills: Part - A' is designed to provide opportunities for engineering students to revise and consolidate the basic skills in listening, speaking, reading and writing in addition to giving ample practice in various communicative functions and Life skills.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

SYLLABUS

UNIT	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:
"InfoTech English" by Maruthi Publications

Reference Books:
1. Better English Pronunciation by O' Connor
2. Phonetics and Phonology – Peter Roach
3. A Grammar of Spoken English – Harold Palmer
4. English Phonetics – Bansal and Harrison

Testing Pattern:
 B) Internal lab Exam: **30 Marks**
  Regular performance in the language /communication /lab completion in the lab manual   15M
  Written test   15M
 B) External lab Exam Pattern: **70 Marks**
   Written test   30M
   Oral test   30M
   Viva (during exam marks will be awarded by external examiner)   10M

III SEMESTER	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**
20IT3T01 : DISCRETE MATHEMATICS				

COURSE OBJECTIVES:

- Familiarise closed form solution of linear recurrence relations by various methods.
- To introduce basics of set theory and its applications
- Bring awareness of basic concepts of graphs and its applications.
- To teach the topics on Trees, spanning trees, minimal spanning trees and justification of Kruskal's algorithm.

COURSE OUTCOMES:

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

CO1: Identify programming errors efficiently through enhanced logical capabilities (k_3)

CO2: Find a general solution of recurrence equation (k_3)

CO3: Learn set theory, graph of the relations which are used in data structures (k_3)

CO4: Explain the concepts in graph theory (k_3)

CO5: Apply graph theory concepts in core subjects such as data structures and network theory effectively. (k_3)

UNIT 1: MATHEMATICAL LOGIC

Connectives, negation, conjunction, disjunction, statement formula and Truth Tables, conditional and bi-conditional, well formed formulae, tautologies, equivalence of formulae, duality, tautological implications, functionally complete set of connectives, other connectives, principal disjunctive and conjunctive normal forms, inference calculus, rules of inference, consistency of premises, indirect method of proof, Theory of inference for the statement calculus, validity using Truth tables.

Learning Outcomes:

After completion of this unit, student will be able to

- find equivalence formulas, implementation of logic for mathematical proofs (k_1)
- apply inference theory to verify the consistence of data (k_3)

UNIT 2: RECURRENCE RELATIONS

Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, Solution of In homogeneous Recurrence Relation.

Learning Outcomes:

After completion of this unit student will be able to

- formulate recurrence relations of the sequences (k_3)
- solve homogeneous linear recurrence relations (k_3)
- evaluate complementary function and particular integral for non homogeneous linear recurrence relations (k_3)
- apply substitution method to solve non-linear recurrence relations (k_3)

UNIT 3: SET THEORY AND RELATIONS

Relations and ordering, Relations, Properties of binary Relations in a set, Relation Matrix and the Graph of a Relation, partition and covering of a set, Equivalence, Compatibility Relations, Composition of Binary Relations, Partial ordering, Hasse diagram, Principle of Inclusion-Exclusion, Pigeonhole Principle and its applications.

Learning Outcomes:

After completion of this module student will be able to
- draw Hasse Diagram for the given poset (k_3)
- apply principle of inclusion and exclusion and pigeonhole principle to real world problems (k_3)

UNIT 4: GRAPH THEORY

Basic Concepts, Representation of Graph, Sub graphs, Multigraphs, Planar graphs, Euler Paths, Euler circuits, Hamiltonian Graphs and Graph Isomorphism and its related Problems, Chromatic Number.

After completion of this unit student will be able to
- identify different graphs and their properties (k_3)
- construct Euler and Hamiltonian graphs (k_3)
- construct the graph for the given data (k_3)

UNIT 5: TREES

Spanning Trees, minimal Spanning Trees, BFS, DFS, Kruskal's Algorithm, Prim's Algorithm, Binary trees, Planar Graphs.

Learning Outcomes:

After completion of this unit student able to
- construct the spanning tree and binary tress from graphs (k_3)
- build minimal spanning tree by using different algorithms (k_3)

Text Books:
1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 1997.
2. Joe L. Mott, Abraham Kandel and T. P. Baker, Discrete Mathematics for computer scientists & Mathematicians, 2/e, Prentice Hall of India Ltd, 2012.

References:
1. Keneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Richard Johnsonburg, Discrete Mathematics, 7/e, Pearson Education, 2008
3. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall of India, 2006.

III SEMESTER	L	T	P	C
	3	**-**	**-**	**3**
20AM3T01 : DATA STRUCTURES AND ALGORITHMS				

COURSE OBJECTIVES:

1. To impart the basic concepts of data structures and algorithms.
2. To be familiar with writing recursive methods.
3. To implement operations on Linked List, Stack and Queues.
4. To implement traversal operations of trees and graphs.
5. To understand concepts about various algorithm design techniques, searching and sorting techniques.

COURSE OUTCOMES:
On completion of the course the student will be able to
CO1: Understand the concept of recursive algorithms.
CO2: Demonstrate the different types of data structures.
CO3: Able to understand the operations on linear data structures.
CO4: Summarize searching and sorting techniques.
CO5: Choose appropriate data structure as applied to specified problem definition.
CO6: Understand and implement the various algorithm design techniques.

UNIT 1:

INTRODUCTION TO ALGORITHMS: Introduction to Data vs Information - Data Structures - Classification – Abstraction - Abstract data types (ADT) - Array - characteristics - Storage Representations. Array Order Reversal – Recursion - Array operations, Algorithm - complexity – Time and Space trade off.

UNIT 2:

LINKED LIST: Array vs Linked List – Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list – Polynomial Manipulation using List - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List.

UNIT 3:

STACKS & QUEUES: Introduction – Array Representation of a Stack – Linked List Representation of a Stack - Stack Operations - Algorithm for Stack Operations - Stack Applications: Tower of Hanoi - Infix to postfix Transformation - Evaluating Arithmetic Expressions. Queue – Introduction – Array Representation of Queue – Linked List Representation of Queue - Queue Operations - Algorithm for Queue Operations -. Queue Applications: Priority Queue.

UNIT 4:

TREES AND GRAPHS: Preliminaries of Tree ADT - Binary Trees - The Search Tree ADT–Binary Search Trees - AVL Trees - Tree Traversals - B-Trees - Heap Tree – Preliminaries of Graph ADT - Representation of Graph – Graph Traversal - BFS – DFS – Applications of Graph – Shortest - Path Algorithms – Dijkstra's Algorithm, Minimum Spanning Tree – Prims Algorithm

UNIT 5:

ALGORITHM DESIGN TECHNIQUES & SEARCHING AND SORTING TECHNIQUES: Divide and Conquer Strategy – Greedy Algorithm – Dynamic Programming – Backtracking Strategy - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.

TEXT BOOKS:

1. Jean-Paul Tremblay, Paul G. Sorenson, 'An Introduction to Data Structures with Application', TMH, 2017.
2. Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition, 2004.

REFERENCE BOOKS:

1. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Edition, 2004.
2. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

III SEMESTER	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**
20CS3T02 : DATABASE MANAGEMENT SYSTEMS				

COURSE OBJECTIVES:
The objectives of the course is
1. To describe a sound introduction to the discipline of database management systems.
2. To give a good formal foundation on Entity- Relationship (E-R) model, the relational model of data and usage of Relational Algebra.
3. To introduce the concepts of basic SQL as a universal Database language.
4. To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization.
5. To provide an overview of transaction management, Database storage and indexing techniques.

COURSE OUTCOMES:
Upon successful completion of this course, students should be able to:
CO1: Explain the basic concepts of database management system and design an Entity-Relationship (E-R) model and convert E-R model to relational model.
CO2: Construct database using Relational algebra and SQL.
CO3: Apply Normalization techniques to normalize the database.
CO4: Discuss transaction management using different concurrency control protocols and recovery algorithms.
CO5: Illustrate different file organization and indexing methods.

UNIT-1
Introduction-Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages, Database Architecture, Database Users and Administrators.
Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model.
Relational Model: Introduction to the Relational Model - Integrity Constraints over Relations.
Enforcing Integrity constraints, querying relational data, Logical data base Design, Views.

UNIT-II
Relational Algebra: Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division.
SQL: Form of Basic SQL Query - Examples of Basic SQL Queries, UNION, INTERSECT, and EXCEPT, Introduction to Nested Queries, Correlated Nested Queries, Set Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Outer Joins, Disallowing NULL values, Triggers.

UNIT-III
SCHEMA REFINEMENT AND NORMAL FORMS: Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of

Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form.

UNIT-IV

Transaction Management - The ACID Properties - Transactions and Schedules- Concurrent Execution of Transactions- Lock-Based Concurrency Control- 2PL, Serializability, and Recoverability- Dealing With Deadlocks - Concurrency Control without Locking.

CRASH RECOVERY: Introduction to ARIES- The Log - The Write-Ahead Log Protocol – Checkpoints - Recovering from a System Crash(ARIES) - Media Recovery.

UNIT-V

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing- Clustered Indexes, Primary and Secondary Indexes, Index data Structures - Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

Tree Structured Indexing: Intuitions for tree indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

TEXT BOOKS:

1. Raghurama Krishnan, Johannes Gehrke, "Data base Management Systems", 3rd Edition, McGrawHill Education, 2014.
2. A.Silberschatz, H.F. Korth, S.Sudarshan, "Data base System Concepts", 6th edition, McGraw Hill, 2016.
3. Brahmankar Pankajb, Sadaf Lqbal Shaikh, Raut Bhakti, "Database Management System", 1st Edition, tech-neo, 2019.

REFERENCE BOOKS:

1. Ramez Elmasri, Shamkant B Navathe "Fundamentals of Database Systems", 7th Edition, 2016.
2. C.J. Date, "Introduction to Database Systems", 8/e, Pearson, 2012.
3. Rob, Coronel, "Database System Design, Implementation and Management", 5/e, Thomson, 2012.

III SEMESTER	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**
20AM3T02 : ARTIFICIAL INTELLIGENCE				

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Comprehend different types of problem-solving agents and its applications.
CO2: Solve problems using informed and uninformed search strategies.
CO3: Compare various Knowledge Representation Logic using scripts and frames.
CO4: Comprehend and analyze the different types of learning.
CO5: Identify the need of Production system and Planning states.
CO6: Use expert system tools to realize the concepts and components of expert system.

Unit – I:
PROBLEM SOLVING: Introduction to AI- Agents and Environments – Uninformed Search Strategies(Breadth first search, Depth first search) - Informed Search Strategies(Greedy best-first search- A* search, Hill climbing) - Problem Formulation-Constraint Satisfaction Problem.

Unit – II:
NOWLEDGE REPRESENTATION: Introduction to Game Playing-Alpha Beta Pruning-Knowledge Representation using First order logic-Knowledge Engineering in First Order Logic-Proportional vs First Order Logic-Resolution-Structured representation of Knowledge Using Scripts and Frames.

Unit – III:
INFERENCE AND LEARNING: Inference- Forward and Backward Chaining-Unification-Uncertainty-Inference in Bayesian Network –Learning from Observations-Forms of Learning-Inductive Learning-Neural Network-Learning Decision trees-Reinforcement Learning-Case Study-Learning examples with python.

Unit – IV:
PRODUCTION SYSTEM AND PLANNING: Introduction to Production system-control strategies-Rete Algorithm-Planning-STRIPS-Planning with state space search-Partial Order Planning-Planning Graphs-Planning & acting in the real world.

Unit – V:
EXPERT SYSTEM: Expert System- Architecture and Roles of Expert System-Typical Expert System-MYCIN-XOON-DART-Case Study-Construction of simple reflex agent with sensor and actuator using Arduino.

TEXT BOOKS:
1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2010.
2. Joseph C. Giarratano, Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2015.

REFERENCE BOOKS:
1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. Janakiraman, K. Sarukesi, "Foundations of Artificial Intelligence and Expert Systems", Macmillan Series in Computer Science, 2000.

3. W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall of India, 2003.
4. Prateek Joshi, "Artificial Intelligence with Python", Packt Publishing, 2017.

E BOOKS:

1. https://www.pdfdrive.net/artificial-intelligence-a-modern-approach-3rd-edition-e32618455.html

MOOC:

1. https://www.coursera.org/learn/introduction-to-ai

III SEMESTER	L	T	P	C
	3	-	-	3
20AM3T03 : FUNDAMENTALS OF JAVA				

COURSE OBJECTIVES:

The learning objectives of this course are:

1. To identify Java language components and how they work together in applications
2. To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
4. To understand how to design applications with threads in Java

COURSE OUTCOMES:

By the end of the course, the student will be

CO1: Able to realize the concept of Object Oriented Programming & Java Programming Constructs

CO2: Able to describe the basic concepts of Java such as operators, classes, objects, inheritance, packages, Enumeration and various keywords

CO3: Apply the concept of exception handling and Input/ Output operations

CO4: Apply the concept of Multi-threaded Programming

CO5: Able to develop program using JDBC connectivity to access data from database and execute different queries to get required result.

UNIT I

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators: Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions, Nested try and catch Blocks, Rethrowing Exception, Throws Clause.

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Methods for Comparison of Strings, Methods for Modifying Strings, Methods for Searching Strings, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread- Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface, Creating JDBC Application, JDBC Batch Processing, JDBC Transaction Management

TEXT BOOKS:

1. Anitha Seth, B.L.Juneja, "Java one step ahead", Oxford, 2017.
2. Herbert Schildt, "The complete Reference Java", 8th Edition, TMH, 2017

REFERENCES BOOKS:

1. Y Daniel Liang, "Introduction to Java programming", 7th Edition, Pearson, 2013.
2. Joel Murach, "Murach's Java Programming", 4th Edition, Mike Murach & Associates Inc., 2011.

E-RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://www.w3schools.com/java/java_data_types.asp

	L	T	P	C
III SEMESTER	-	-	3	1.5
20AM3L01 : DATA STRUCTURES AND ALGORITHMS LAB				

COURSE OBJECTIVES:
1. To implement linear and non-linear data structures.
2. To understand the different operations of linear and linear data structures.
3. To implement linear search and binary Search.
4. To get familiarized to sorting algorithms.
5. To exploit appropriate algorithm for the problem.

COURSE OUTCOMES
On completion of the course, student will be able to

CO1: Remembering the concept of data structures through ADT including List, Stack and Queues and its operations.

CO2: Understand the operations on Trees and Graphs.

CO3: Able to apply and implement various sorting algorithms and ensure their correctness.

CO4: Ability to analyze algorithms and develop algorithms through step-by-step approach in solving problems with the help of fundamental data structures.

CO5: Understand the concepts of various Algorithm Design techniques. Design applications and justify use of specific linear data structures for various applications

CO6: Apply algorithms for real time problem solving

LIST OF EXPERIMENTS
1. Implement operations on Array using C.
2. Implement operations on a Singly linked list using C.
3. Implement operations on a Doubly linked list using C.
4. Implement a Stack using an Array and Linked list using C.
5. Convert an infix expression to postfix expression using C.
6. Implement Queue using an Array and Linked list using C.
7. Implement Circular Queue using C.
8. Implement display elements of a Queue according to their priority using C.
9. Search an element using Linear and Binary Search using C.
10. Binary search tree implementation using linked list and possible operations on binary search trees using C.
11. Implement the concepts of In-order, preorder and post order traversals using C.
12. Implement Depth first and Breadth first traversal in graphs using C.
13. Sort the elements using insertion sort using C.
14. Sort the elements using quick sort using C.
15. Sort the elements using merge sort using C.

TEXT BOOKS:
3. Jean-Paul Tremblay, Paul G. Sorenson, 'An Introduction to Data Structures with Application', TMH, 2017.
4. Richard F, Gilberg, Forouzan, "Data Structures", Cengage, 2nd Edition, 2004.

REFERENCE BOOKS:
3. Larry R. Nyhoff, ADTs, Data Structures, and Problem Solving with C++, Prentice Hall Edition, 2004.
4. Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

III SEMESTER	**L**	**T**	**P**	**C**
	-	**-**	**3**	**1.5**
20CS3L02 : DATABASE MANAGEMENT SYSTEMS LAB				

COURSE OUTCOMES:
At the end of the course student able to
CO1: Understand the different issues involved in the design and implementation of a database system
CO2: Design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data.
CO3: Create and maintain tables using SQL
CO4: Populate and query a database using SQL DML/DDL commands.
CO5: Understand the use of structured query language and its syntax, transactions, database recovery and techniques for query optimization.
CO6: Acquire a good understanding of database systems concepts and to be in a position to use and design databases for different applications.

LIST OF EXPERIMENTS:
1. Create a table STUDENT with appropriate data types and perform the following queries.
    Regdno, student name, date of birth, branch and year of study.
    a. Insert 5 to 10 rows in a table
    b. List all the students of all branches
    c. List student names whose name starts with 's'
    d. List student names whose name contains 's' as third literal
    e. List student names whose contains two 's' anywhere in the name
    f. List students whose branch is NULL
    g. List students of AIML who born after 1985
    h. List all students in reverse order of their names
    i. Delete students of any branch whose name starts with 's'
    j. Display student name padded with '*' after the name of all the students

2. Create the following tables with appropriate data typesand constraints.
    EMPLOYEE (Fname, Mname, Lname, SSN, Bdate, Address, Gender, Salary, SuperSSN,Dno)
    DEPARTMENT(Dnumber, Dname, MgrSSN, Mgrstartdate)
    DEPENDENT (ESSN, Dependent_Name, Gender, Bdate, Relationship)
    a. Insert 5 to 10 rows into all the tables.
    b. Display all employee's names along with their department names.
    c. Display all employee's names along with their dependent details.
    d. Display name and address of all employees who work for 'AIML' department.
    e. List the names of all employees with two or more dependents.
    f. List the names of employee who have no dependents.
    g. List the names of employees who have at least one dependent.
    h. List the names of the employees along with names of their supervisors using aliases.
    i. Display name of the department and name of manager for all the departments.
    j. Display the name of each employee who has a dependent with the same first name and gender as the employee.
    k. List the names of managers who have at least one dependent.

l. Display the sum of all employees' salaries as well as maximum, minimum and average salary in the entire departments department wise if the department has more than two employees.

m. List the departments of each female employee along with her name.

n. List all employee names and also the name of the department they manage if they happen to manage a dept

3. Consider the following schema for a Library Database:

BOOK (Book_id, Title, Publisher_Name, Pub_Year)

BOOK_AUTHORS (Book_id, Author_Name)

PUBLISHER (Name, Address, Phone)

BOOK_COPIES (Book_id, Branch_id, No-of_Copies)

BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out,Due_Date)

LIBRARY_BRANCH (Branch_id, Branch_Name, Address)

Write SQL queries to

a. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch

b. Get the particulars of borrowers who have borrowed more than 3 books in particular period.

c. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation

d. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query

e. Create a view of all books and its number of copies that are currently available in the Library.

f. Apply Drop, Alter, Order by, Group By clauses on the above tables

.

4. Create the following tables for university database

Department (deptname, building, budget, primary key (dept name))

Course (courseid, title, deptname, credits, primary key (course id))

Instructor (ID, name, deptname, salary, primary key (ID), foreign key (deptname) references department);

Section(courseid, sec id, semester, year, building, room number, time slot id, primary key (courseid, sec id, semester, year),foreign key (course id) references course);

Teaches (ID, course id ,sec id ,semester ,year numeric ,primary key (ID, course id, sec id, semester, year),foreign key (course id, sec id, semester, year) references section ,foreign key (ID) references instructor);

a. List the names of instructors along with the titles of courses that they teach

b. Find the names of all instructors whose salary is greater than at least one instructor in the AIML department

b. To find the set of all courses taught in the Even as well as in Odd semester

c. Find the average salary of instructors in the Computer Science department

d. Find the average salary in each department

e. To find all the courses taught in the Even semester in current year but not in previous year in the same semester

f. Delete all instructors with a salary between 15,000 and 35,000.

5. Create the following tables based on the above Schema Diagram with appropriate data types and constraints and perform the following queries.

SAILORS (Saild, Salname, Rating, Age)

RESERVES (Sailid, boatid, Day)

BOATS (Boatid, Boat-name, Color)

a. Insert 5 to 10 rows in all tables?
b. Find the name of sailors who reserved boat number 3.
c. Find the name of sailors who reserved green boat.
d. Find the colors of boats reserved by Particular Sailor
e. Find the names of sailors who have reserved at least one boat.
f. Find the all sailid of sailors who have a rating of 10 or have reserved boated 104.
g. Find the Sailid's of sailors with age over 20 who have not registered a red boat.
h. Find the names of sailors who have reserved a red or green boat.
i. Find sailors whose rating is better than some sailor called _Salvador'.
j. Find the names of sailors who are older than the oldest sailor with a rating of 10.

6. Queries on Working with Index, Sequence, Synonym, Controlling Access and Locking Rows for Update, Creating Password and Security features
    a. Write a PL/SQL Block to find whether the number is Armstrong or not.
    b. Write a PL/SQL program for generating Fibonacci series
    c. Write a PL/SQL program to print given number in reverse
    d. print different patterns using PL/SQL program
    e. Print Floyd's triangle in PL/SQL
    f. Count odd and even digits in a number in PL/SQL

7. Write a program that updates salaries of all employees with 10 % hike (use cursors).
8. Write a program to fetch salary and employee name from employee table for a given user input. When no data found raise an exception that prints the message "no data found".
9. Write a program to find the number of records of any given table using % ROWCOUNT.
10. Write a database trigger on employee table so that the trigger fires when all the DML statements are executed (print appropriate message).
11. Write a trigger in such a way that it should not allow insert or update or delete on Saturday and Sunday and display the proper message.
12. Write a database trigger on employee table so that the trigger fires when all the DML statements are executed (print appropriate message)
13. Write a cursor to display the list of employees and total salary department wise.
14. Write a procedure to display the name and salary of employee when user inputs SSN using IN/OUT parameters.
15. Write a function to check the validity of the given employee number from the employee table (print the appropriate message using PL/SQL block)
16. Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc.

III SEMESTER	L	T	P	C
	-	-	3	1.5
20IT3L02 : JAVA PROGRAMMING LAB				

COURSE OUTCOMES:
At the end of the course student able to
CO1: Able to identify java compiler installation and JVM execution process in various environments.
CO2: Able to practice hand on experience with oops concepts in java using console and eclipse environment.
CO3: Able to simulate Basics of java programming and Exception handling.
CO4: Able to develop multi-threaded programs.
CO5: Able to develop program using JDBC connectivity to access data from database and execute different queries to get required result.

LIST OF EXPERIMENTS:
Exercise - 1 (Basics)
   a) Write a JAVA program to display default value of all primitive data type of JAVA
   b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.
   c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.
   d) Write a case study on public static void main(250 words)

Exercise - 2 (Operations, Expressions, Control-flow, Strings)
   a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
   b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
   c) Write a JAVA program to sort for an element in a given list of elements using merge sort.
   d) Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3 (Class, Objects)
   a) Write a JAVA program to implement class mechanism. – Create a class, methods and invoke them inside main method.
   b) Write a JAVA program to implement constructor.

Exercise - 4 (Methods)
   a) Write a JAVA program to implement constructor overloading.
   b) Write a JAVA program implement method overloading.

Exercise - 5 (Inheritance)
   a) Write a JAVA program to implement Single Inheritance
   b) Write a JAVA program to implement multi level Inheritance
   c) Write a java program for abstract class to find areas of different shapes

Exercise - 6 (Inheritance, Interface)
   a) Write a JAVA program give example for "super" keyword.

b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?

Exercise – 7 (Packages)
a) Write a JAVA program illustrate class path
b) Write a case study on including in class path in your OS environment of your package.
c) Write a JAVA program that import and use the defined your package in the previous Problem

Exercise - 8 (Exception)
a) Write a JAVA program that describes exception handling mechanism
b) Write a JAVA program Illustrating Multiple catch clauses

Exercise – 9 (User defined Exception)
a) Write a JAVA program for creation of Illustrating throw
b) Write a JAVA program for creation of Illustrating finally
c) Write a JAVA program for creation of Java Built-in Exceptions
d) Write a JAVA program for creation of User Defined Exception

Exercise – 10 (Threads)
a) Write a JAVA program that creates threads by extending Thread class .First thread display "Good Morning "every 1 sec, the second thread displays "Hello "every 2 seconds and the third display "Welcome" every 3 seconds ,(Repeat the same by implementing Runnable)
b) Write a program illustrating **isAlive** and **join ()**
c) Write a Program illustrating Daemon Threads.

Exercise – 11 (Strings)
Develop a Java program that creates a string object and initializes it with your name and performs the following operations:
a) Find the length of the string object using appropriate string method.
b) Find whether the character 'a' is present in the string. If yes find the number of times 'a' appears in the name and the location where it appears.

Exercise – 12 (JDBC)
Develop a Java program using JDBC to prepare a mark list for ten students. The input is Register Number, Name, Mathematics Mark, Physics Mark and Chemistry Mark. Compute Total and Average.

TEXT BOOKS:
3. Anitha Seth, B.L.Juneja, "Java one step ahead", Oxford, 2017.
4. Herbert Schildt, "The complete Reference Java", 8th Edition, TMH, 2017

REFERENCES BOOKS:
3. Y Daniel Liang, "Introduction to Java programming", 7th Edition, Pearson, 2013.
4. Joel Murach, "Murach's Java Programming", 4th Edition, Mike Murach & Associates Inc., 2011.

E-RESOURCES:
3. https://nptel.ac.in/courses/106/105/106105191/
4. https://www.w3schools.com/java/java_data_types.asp

III SEMESTER	L	T	P	C
	-	-	4	2
20AM3S01 : EXPLORATORY DATA ANALYTICS USING MS EXCEL				

COURSE OUTCOMES:
At the end of the course student able to
CO1: To understand the basics of Excel as business analytics.
CO2: To use of basic functions and statistical functions in Excel
CO3: To obtain knowledge about using of pivot tables and charts
CO4: To understand the advanced business analytics related charts
CO5: To know about statistical concepts for data analysis and basics of Power BI.

Unit – I:
Introduction to spreadsheets: reading data, manipulating data. Basic spreadsheet operations and functions.
Introduction to Business analytics: Introduction, Types of Analytics, Area of Analytics.

Unit – II:
Spreadsheet Functions to Organize Data: Conditional formatting, Logical functions: Lookup and reference functions, IF, Nested IF, VLOOKUP, HLOOKUP, MATCH, INDEX and OFFSET functions in Excel.
Statistical functions: Introduction, SUMIFS, COUNTIF, PERCENTILE, QUARTILE, STDEV, MEDIAN and RANK Function

UNIT – III:
Introduction to Filtering, Pivot Tables, and Charts: Introduction to the data filtering capabilities of Excel, the construction of Pivot Tables to organize data and introduction to charts in Excel.
Pivot Table Introduction: Creating a Pivot Table, Grouping in Pivot Table, Custom Calculated Field and Calculated Item, Slicer Introduction, Creating a Slicer

Unit – IV:
Advanced Graphing and Charting: Constructing various Line, Bar and Pie charts. Using the Pivot chart features of Excel. Understanding and constructing Histograms and Scatterplots.
Business analytics with Excel: Introduction, Histogram, Data Table, Descriptive Statistics.

Unit – V:
Data Analysis Using Statistics: Introduction, Moving Average, Hypothesis Testing, ANOVA, Covariance, Correlation, Regression, Normal Distribution.
Power BI: Introduction, Power Pivot, Power View, Power Query, Power Map.

REFERENCE BOOKS:
1. Advanced Analytics with Excel 2019: Perform Data Analysis using Excel's Most Popular Features (English Editions), 2020
2. Beginning Excel What-If Data Analysis Tools: Getting Started with Goal Seek, Data Tables, Scenarios, and Solver – Illustrated, Paul Cornell, 2005.

E-Reference:
1. https://www.excel-easy.com/data-analysis.html

IV SEMESTER	L	T	P	C
	2	**-**	**-**	**-**
20CE3M01 : ENVIRONMENTAL SCIENCE				

COURSE OUTCOMES:
At the end of the course student able to
CO1: Analyze the interconnections between sustainability, global environmental challenges, information technology, and ecosystems, and their importance in environmental conservation and human well-being.
CO2: Understand the natural resource management and associated problems.
CO3: Understanding of biodiversity and its conservation, including genetic, species, and ecosystem diversity.
CO4: Understanding of environmental pollution, including its definitions, causes, effects, and control measures for air pollution, water pollution, soil pollution, noise pollution, and nuclear hazards.
CO5: Understanding of social issues and their relation to the environment.

UNIT-I: Multidisciplinary nature of Environmental Studies:
Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.
Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II: Natural Resources:
Natural resources and associated problems. Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III: Biodiversity and its conservation:
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-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV Environmental Pollution:
Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.
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.

UNIT – V Social Issues and the Environment:
Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution)

Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

TEXT BOOKS:
1. K. V. S. G. Murali Krishna , Environmental Studies,VGS Publishers, Vijayawada, 2010
2. R. Rajagopalan, Environmental Studies, 2nd Edition, Oxford University Press, 2011
3. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani, Environmental Studies, 2nd Edition , Pearson Education, Chennai,2015

REFERENCE:
1. Deeshita Dave & P. Udaya Bhaskar Text Book of Environmental Studies, Cengage Learning, 2011
2. Shaashi Chawla, A Textbook of Environmental Studies, TMH, New Delhi,2017
3. Benny Joseph, Environmental Studies, Tata McGraw Hill Co, New Delhi, 2006
4. Anubha Kaushik, C P Kaushik , Perspectives in Environment Studies, New Age International Publishers, 2014.

IV SEMESTER	L	T	P	C
	3	-	-	3
20MA4T07 : PROBABILITY AND STATISTICS				

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 of Engineering
3. To introduce the correlation and regression and method of least squares.

COURSE OUTCOMES:
At the end of this unit, the student will be able to
CO1: Make use of the concepts of probability and their applications (k3)
CO2: Apply discrete and continuous probability distributions(K3)
CO3: Design the components of a classical hypotheses test(K6)
CO4: Infer the statistical inferential metods based on small and large sampling tests(K6)
CO5: Adopt correlation methods and principle of least squares, regression lines (K$_4$)

UNIT-1: Probability:
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.
Learning Outcomes:
At the end of this unit, the student will be able to
- define the terms trial, events, sample space ,probability, and laws of probability (K$_1$)
- make use of probabilities of events in finite sample space from experiments (K$_3$)
- apply Baye's theorem to real time problems(K$_3$)
- explain the notion of random variable, distribution functions and expected value(K$_2$)

UNIT-2: Probability distributions:
Probability distribution-Binomial, Poisson approximation to the binomial distribution and normal distribution –their properties.
Learning Outcomes:
At the end of this unit, the student will be able to
- apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (K$_3$)
- interpret the properties of normal distribution and its applications (K$_2$)

UNIT-3: Sampling distribution and Testing of hypothesis, large sample tests:
Basic terminology in sampling, sample techniques (with and without replacement), sampling distribution of means for large and small samples (with known and unknown variance).
Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors.
Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems
Learning Outcomes:
At the end of this unit, the student will be able to
- Explain the concept of sampling distribution for large and small samples (K$_2$)
- apply the concept of hypothesis testing for large samples (K$_4$)

UNIT-4: Small sample tests:
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variance (F-test),Chi-square test for goodness of fit and independence of attributes.
Learning Outcomes:
At the end of this unit, the student will be able to

- apply the concept of testing of hypothesis for small samples to draw the inferences (K_3)
- estimate the goodness of fit (K_4)

UNIT-5: Curve Fitting and Correlation:

Curve Fitting : Method of least squares -Fitting a straight line, Second degree parabola -exponential curve-power curves

Correlation: Simple correlation, correlation coefficient (for ungrouped data), rank correlation. Linear regression, regression lines, regression coefficients.

Learning Outcomes:

At the end of this unit, the student will be able to

- Adopt correlation methods and principle of least squares, regression lines (K_4)

Text Books:

1. Probability and Statistics by Dr. K. Murugesan &P.Gurusamy, Anuradha Publications,2011
2. Higher Engineering Mathematics, 42nd Edition, Khanna Publications by Dr. B.S.Grewal,2012

Reference Books:

1. Ramana B.V., Higher Engineering Mathematics, Tata Mc Graw Hill New Delhi 11th Reprint2010
2. Probability and statistics for engineers by Miller & Freund

IV SEMESTER	L	T	P	C
	3	**-**	**-**	**3**
20CS4T01 : OPERATING SYSTEMS				

COURSE OUTCOMES:
At the end of the course student are able to
CO1: Define the Basic concepts about Operating System and its functions.
CO2: Describe Process management, CPU scheduling and Deadlocks.
CO3: Analyze Memory management
CO4: Describe and Implement File systems & Disk Structures.
CO5: Perform Case Study on LINUX, WINDOWS and Android OS.

UNIT – I:
OPERATING SYSTEMS OVERVIEW:
Introduction: OS Concepts – Evolution of OS, OS Structures- Kernel, Shell. Operating-System Services, System Calls, Types of System Calls, System Structure. UNIX- Introduction-Architecture, Logging In, Files and Directories, Input and Output, Programs and Processes, Error Handling, User Identification, Time Values, System Calls and Library Functions, Command-Line Arguments, UNIX File API'S.

UNIT – II:
PROCESS MANAGEMENT:
Process: Concept, Operations on Processes, Inter Process Communication, Threads-Multithreading Models, Threading Issues, Pthreads.
Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Critical Regions, Monitors, Classic Problems of Synchronization,
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms- CPU (Uniprocessor) scheduling algorithms, Multiprocessor and Real-time scheduling algorithms.
Deadlocks: Characterization – Prevention – Avoidance - Detection and Recovery

UNIT – III:
MEMORY MANAGEMENT: Basic Memory Management, Swapping, Contiguous Memory Allocation, Virtual Memory Concept, Demand Paging - Page Interrupt Fault, Page Replacement Algorithms, Segmentation – Simple, Multi-level, Segmentation with Paging, Memory Management.

UNIT – IV:
INFORMATION MANAGEMENT:
File system Interface: The concept of a file, Access Methods, Directory structure, File system mounting, file sharing, protection.
File System implementation: File system structure, allocation methods, free-space management
Mass-storage structure: Overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, Disk Management, Swap-Space Management, RAID Structure.

UNIT – V:
CASE STUDY:
The Linux System, Microsoft Windows 7, Android Software Platform**:** Android Architecture, Operating System Services, Android Runtime Application Development, Application Structure.

Text Books:
1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, "Operating Systems– Internals and Design", 7th Edition, Prentice Hall, 2016.
3. Alex A Aravind, Operating Systems-S Halder, Second Edition, Pearson Education, 2016.
4. Andrew Tanenbaum, Herbert Bos, "Operating Systems", 4th Edition, 2015.

Reference Books:
1. Ann McIver McHoes Ida M. Flynn, "Understanding Operating Systems" Sixth Edition, Course Technology-Cengage Learning, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Andrew S. Tanenbaum, Albert S. Woodhull - Amherst, "Operating Systems Design and Implementation", Third Edition, Prentice Hall, 2006.
4. W. Richard Stevens, "Advanced Programming in UNIX Environment", 2nd Ed, Pearson Education, 2005.
5. Terrence Chan, "UNIX System Programming Using C++", Prentice Hall India, 1999.

E-Reference:
1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Operating%20Systems/New_index1.html

IV SEMESTER	L	T	P	C
	3	-	-	3
20AM4T01 : DATA SCIENCE				

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

At the end of the course student are able to

CO1: At the end of the course Students will be able to:

CO2: Apply the skills of data inspecting and cleansing.

CO3: Determine the relationship between data dependencies using statistics

CO4: Can handle data using primary tools used for data science in Python

CO5: Represent the useful information using mathematical skills

CO6: Can apply the knowledge for data describing and visualization using tools.

UNIT I:

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

UNIT II:

DESCRIBING DATA I : Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

UNIT III:

PYTHON FOR DATA HANDLING: Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT IV:

DESCRIBING DATA II: Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean

UNIT V:

PYTHON FOR DATA VISUALIZATION: Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – three dimensional plotting – geographic data – data analysis using statmodels and seaborn – graph plotting using Plotly – interactive data visualization using Bokeh

Text Books:

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

Reference Books:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", 2nd Edition, O'Reilly Media, 2014.

IV SEMESTER	L	T	P	C
	3	**-**	**-**	**3**
20AM4T02 : FUNDAMENTALS OF MACHINE LEARNING				

COURSE OBJECTIVES:
1. To understand the need for machine learning and its diverse application.
2. To understand the concepts and algorithms of regression and classification models.
3. To understand graph models and clustering techniques.
4. To understand the ensemble models and its techniques.
5. To understand and evaluate the machine learning models built using available techniques.

COURSE OUTCOMES:
On completion of the course, the student will be able to
CO1: Understand the concepts and types of models in machine learning
CO2: Reduce the dimension of the data set using machine learning techniques
CO3: Implement a classification model for any real scenario
CO4: Implement an unsupervised learning application using clustering techniques
CO5: Implement the ensemble model
CO6: Implement model evaluations for built machine learning model.

UNIT 1:
INTRODUCTION TO MACHINE LEARNING: What is machine learning – Statistics vs. Machine Learning techniques – Supervised learning – Unsupervised learning – Semi-supervised learning – Reinforcement learning - Basics: Probability Theory-Linear Algebra.

UNIT 2:
DECISION THEORY: Statistical Decision Theory: Regression – Classification – Linear regression – Multivariate regression – Logistic regression – Classification predictive modeling – Binary classification – multi-class classification – multi-label classification

UNIT 3:
DIMENSIONALITY REDUCTION: Dimensionality Reduction – Subset Selection – Shrinkage Methods – Linear Discriminant Analysis –Principal Component Analysis – Separating hyper planes.

UNIT4:
PARAMETRIC ESTIMATION: Parameter Estimation – Maximum Likelihood Estimation –Bayesian Parameter Estimation–Support vector Machine – Decision Tree – Naïve Bayes' – Clustering methods – Partitional Clustering-Hierarchical clustering.

UNIT 5:
ENSEMBLE METHODS: Ensemble models – Applications of Ensembling – Types and techniques of Ensembling – Evaluation measures – Hypothesis testing – Cross-validation and Hyper parameter optimization – Bootstrapping and Uncertainties

Text Books:
1. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", 1st Edition, O'Reilly, 2016.

2. Andriy Burkov, "The Hundred-Page Machine Learning Book", 1st Edition, Notion Press, 2019.

Reference Books:
1. Zhi-Hua Zhou, "Ensemble Methods: Foundations and Algorithms", CRC Press, 2012
2. https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python/
3. https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html

IV SEMESTER	L	T	P	C
	3	-	-	3
20BM4T01 : MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

COURSE OUTCOMES:
Upon completion of the course, the students will be able to

CO1: Understand the nature and scope of managerial economics, its relation to other disciplines, and the concept of demand.

CO2: Analyze production and cost in a business context, understanding the production function, the law of variable proportions, isoquants, and isocosts.

CO3: Understand and analyze different market structures, including perfect competition, monopoly, monopolistic competition, and oligopoly.

CO4: Understand various forms of business organizations, such as sole proprietorship, partnership, joint-stock companies, and state/public enterprises.

CO5: Understand capital budgeting concepts and sources, and apply techniques to evaluate capital budgeting decisions through simple problem analysis.

UNIT–I:
Managerial Economics and Demand Analysis: Definition – Nature and Scope of Managerial Economics - Relation with other disciplines - Concept of Demand-Types-Determinants - Law of Demand - Elasticity of Demand - Types and Measurement-Demand forecasting.

UNIT–II:
Production and Cost Analysis: Production function - Law of Variable proportions - Isoquants and Iso costs -Law of returns- Economies of Scale - Cost Concepts - Cost Volume Profit Analysis – Applications of BEP (Simple Problems).

UNIT-III:
Market Structures and Pricing Policies: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price & Output Determination - Pricing Methods.

UNIT-IV:
Forms of Organizations and Business Cycles: Business Organization- Sole Trader – Partnership - Joint Stock Company - State/Public Enterprises and their forms - Business Cycles: Meaning and Features - Phases of Business Cycle.

UNIT–V:
Capital Budgeting and Accounting: Concept and sources-Techniques of evaluating capital budgeting(Simple problems)

Introduction to Accounting: Branches-Systems of Accounting-Single Entry-Double Entry System-Journal-Ledger-Trail Balance-Final Accounts-Ratio Analysis(Simple problems)

TEXTBOOKS:
1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. T.V.Ramana& B. Kuberudu: Managerial Economics and Financial Analysis, Himalaya Publishing House,Mumbai
3. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCE BOOKS:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.

2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.

3. Suma Damodaran, Managerial Economics, Oxford University Press.

4. Lipsey &Chrystel, Economics, Oxford University Press.

5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.

6. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Thomson.   7. Narayanaswamy: Financial Accounting A Managerial Perspective, PHI.

8. Raghunatha Reddy &Narasimhachary: Managerial Economics& Financial Analysis, Scitech.

9. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas.

	L	T	P	C
IV SEMESTER	-	-	3	1.5
20AM4L01 : DATA SCIENCE LAB				

COURSE OBJECTIVES:

1. Understand the Python Programming packages Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Language.
2. To prepare data for data analysis through understanding its distribution.
3. Exposure on data processing using NUMPY and PANDAS
4. To acquire knowledge in plotting using visualization tools.
5. To understand and implement classification and Regression Model

COURSE OUTCOMES:
Upon completion of the course, the students will be able to

CO1: Develop relevant programming abilities.

CO2: Demonstrate knowledge of statistical data analysis techniques

CO3: Exhibit proficiency to build and assess data-based models.

CO4: Demonstrate skill in Data management & processing tasks using Python

CO5: Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

TOOLS: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh

LIST OF EXPERIMENTS

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions
5. Averages
6. Variability
7. Normal curves
8. Correlation and scatter plots
9. Correlation coefficient
10. Regression
11. Mini Project: any data science real-time problems using sample data sets.

References:
1. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

IV SEMESTER	**L**	**T**	**P**	**C**
	-	-	3	1.5

20CS4L02 : OPERATING SYSTEMS USING LINUX LAB

COURSE OUTCOMES:

At the end of the course students are able to

CO1: Interpret with the UNIX/LINUX environment

CO2: Infer the fundamentals of shell scripting/programming

CO3: Describe CPU scheduling and Write programs on it.

CO4: Demonstrate Bankers Algorithm for Dead Lock Avoidance.

CO5: Explain Disk allocation methods and Write programs on it.

CO6: Describe Page Replacements algorithms and Write programs on it.

LIST OF PROGRAMS:

1. a) Study of Vi editor, Bash Shell, Bourne Shell and C Shell in UNIX/LINUX Operating System.

   b) Study of UNIX/LINUX general purpose utility command list man,who,cat, cd, cp, ps, ls, mv,rm,mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.

   c) Study of Unix/Linux file system (tree structure).

   e) Study of .bashrc, /etc/bashrc and Environment variables.

2. UNIX/LINUX based exercises to practice/simulate File system related system calls and some of the process management concepts in LINUX Environment.

a) Write a C program that makes a copy of a file using standard I/O, and system calls

b) Write a C program to emulate the UNIX ls –l command.

c) Write a C program that illustrates how to execute two commands concurrently with a command pipe Ex: - ls –l | sort.

d) Write a C program that illustrates two processes communicating using shared memory.

e) Write a C program to simulate producer and consumer problem using semaphores.

f) Write C program to create a thread using pthreads library and let it run its function.

g) Write a C program to illustrate concurrent execution of threads using pthreads library.

3. Simulate FCFS and SJF CPU scheduling algorithm.

4. Simulate Priority CPU scheduling algorithm.

5. Simulate Round Robin CPU scheduling algorithm.

6. Simulate Bankers Algorithm for Dead Lock Avoidance.

7. Simulate Sequential file allocation strategy.

8. Simulate Linked file allocation strategy.

9. Simulate Indexed file allocation strategy.

10. Simulate First In First Out page replacement algorithm.

11. Simulate Least Recently used page replacement algorithm.

12. Simulate optimal page replacement algorithm.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.

2. William Stallings, "Operating Systems– Internals and Design", 7th Edition, Prentice Hall, 2016.

3. Alex A Aravind, Operating Systems-S Halder, Second Edition, Pearson Education, 2016.

4. Andrew Tanenbaum, Herbert Bos, "Operating Systems", 4th Edition, 2015.

Reference Books:

1. Ann McIver McHoes Ida M. Flynn, "Understanding Operating Systems" Sixth Edition, Course Technology-Cengage Learning, 2011.

2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

3. Andrew S. Tanenbaum, Albert S. Woodhull - Amherst, "Operating Systems Design and Implementation", Third Edition, Prentice Hall, 2006.

4. W. Richard Stevens, "Advanced Programming in UNIX Environment", 2nd Ed, Pearson Education, 2005.

6. Terrence Chan, "UNIX System Programming Using C++", Prentice Hall India, 1999.

E-Reference:

http://nptel.iitm.ac.in/courses/Webcourse-contents/IIScBANG/Operating%20Systems/New_index1.html

	L	T	P	C
IV SEMESTER	-	-	3	1.5
20AM4L02 : MACHINE LEARNING APPLICATIONS LAB				

COURSE OBJECTIVES:
- Make use of data sets in implementing the Machine Learning algorithms.
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Apply Machine Learning algorithms to real world problems.

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

CO1: Understand the implementation procedures for the Machine Learning algorithms.

CO2: Design python programs for various learning algorithms.

CO3: Apply appropriate data sets to the Machine Learning algorithms.

CO4: Identify and apply Machine Learning algorithms to solve real world problems.

CO5: Apply various clustering algorithms for various applications.

CO6: Analyze various Machine Learning algorithms and their applications.

LIST OF EXPERIMENTS:
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.
2. Implement Simple Linear Regression
3. Implement Multivariate Linear Regression
4. Implement Logistic Regression
5. Implement Multivariate Logistic Regression
6. Data preprocessing for classification
7. Confusion matrix for a binary classifier.
8. Implement Support Vector Machines.
9. 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.
10. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
11. Write a 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.
12. 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.
13. Implement k-Mean's algorithm to cluster a set of data stored in a .CSV file.
14. Implement Random Forest models for automatic classification
15. Implement Ensemble Model to perform classification.

Text Books:

1. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", 1st Edition, O'Reilly, 2016.

2. Andriy Burkov, "The Hundred-Page Machine Learning Book", 1st Edition, Notion Press, 2019.

Reference Books:

1. Zhi-Hua Zhou, "Ensemble Methods: Foundations and Algorithms", CRC Press, 2012.

2. https://machinelearningmastery.com/stacking-ensemble-machine-learning-with-python/
3. https://sebastianraschka.com/blog/2018/model-evaluation-selection-part4.html

IV SEMESTER	L	T	P	C
	-	-	4	2
20AM4S01: MOBILE APP DEVELOPMENT				

COURSE OBJECTIVES:
- To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices.

COURSE OUTCOMES:
At the end of this course, students will be able to:
CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms.
CO2: Critique mobile applications on their design pros and cons.
CO3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
CO4: Program mobile applications for the Android operating system that use basic and advanced phone features.
CO5: Deploy applications to the Android marketplace for distribution.

LIST OF EXPERIMENTS
1. Introduction to mobile technologies and devices, Android platform and applications overview
2. Setting Android development environments
3. Writing Android applications, Understanding anatomy of an Android application
4. Develop an application that uses GUI components, Font and Colours
5. Develop an application that uses Layout Managers and event listeners.
6. Write an application that draws basic graphical primitives on the screen.
7. Develop an application that makes use of databases.
8. Develop an application that makes use of Notification Manager
9. Implement an application that uses Multi-threading
10. Develop a native application that uses GPS location information
11. Implement an application that writes data to the SD card.
12. Implement an application that creates an alert upon receiving a message
13. Write a mobile application that makes use of RSS feed
14. Develop a mobile application to send an email.
15. Develop a Mobile application for simple needs (Mini Project)

References:
1. B.M. Harwani, "Android Programming unleashed", Pearson, 2013.
2. Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, "Android Programming (Big Nerd Ranch Guide)", Pearson, 2016
3. Hellman by Erik Hellman, "Android Programming – Pushing the limits", WILEY, 2013

Web References:
1. The Complete Android N Developer Course –Udemy
   https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526
2. Android Development Courses on Google developers training
   https://developers.google.com/training/android/
3. Mobile Computing - Video course- NPTEL

https://nptel.ac.in/courses/106/106/106106147/#

4. Android Tutorial – Tutorial Point

   https://www.tutorialspoint.com/android/index.htm

IV SEMESTER	L	T	P	C
	2	-	-	-
20BM4M01 – INDIAN CONSTITUTION				

COURSE OUTCOMES:

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

CO1: Understand the Indian Constitution, including its meaning, sources, and constitutional history.

CO2: Understand the structure and functioning of the Indian Union government and its administrative framework.

CO3: Understanding of the state government and its administration.

CO4: Understanding of local administration, including the role and importance of the head of district administration.

CO5: Understand the role and functions of the Election Commission, including the Chief Election Commissioner and the Election Commissionerate.

UNIT I:

Introduction to Indian Constitution-Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II:

Union Government and Administration Structure of the Indian Union: Federalism, Centre State relationship, President: Role, powers and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

UNIT III:

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

UNIT IV:.

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions of Pachayat Raj Institution: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT V:

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate -State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.

Textbooks:
 1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
 2. SubashKashyap, Indian Constitution, National Book Trust
 3. J.A. Siwach, Dynamics of Indian Government & Politics

Reference Books:
1. D.C. Gupta, Indian Government and Politics
2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, Indian Government andPolitics Hans
4. J. Raj IndianGovernment and Politics
5. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

6. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

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

SEMESTER V	L	T	P	C
	3	0	0	3
20CS5T01- COMPUTER NETWORKS				

COURSE OUTCOMES :
At the end of the course, student will be able to
CO1: Differentiate network reference models such as OSI, TCP/IP (K2)
CO2: Classify various Data Link Layer protocols such as Error Detection and correction. (K2)
CO3: Distinguish various MAC sub layer Protocols such as ALOHA, CSMA, CSMA/CD (K2)
CO4: Differentiate various Network layer and Transport layer protocols and Its Applications (K2)
CO5: Illustrate various application layer protocols such as WWW and HTTP etc (K2)

UNIT - I :
Data Communication: Components, Data Representation, Data flow (Simplex, Half- duplex and Full-Duplex), Types of connections: Point to Point and Multipoint, Various Categories of Topologies, Categories of Networks, Protocols and Standards, OSI network model, TCP/IP Protocol Suite, Transmission Media (Twisted pair cable, Coaxial cable and Fiber-optic cable).

UNIT - II :
Data Link Layer: Error Detection and Error Correction -Introduction, Block coding: Er- ror Detection, Error Correction, Hamming Distance, Minimum Hamming Distance, Cyclic Codes: Cyclic Redundancy check (CRC), Checksum, Framing, Flow control and Error con- trol.

UNIT - III :
Medium Access Sub Layer: Random Access protocols – ALOHA, Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA),1-persistent CSMA, Nonpersistent CSMA, p-Persistent CSMA, CSMA/CD, CDMA/CA.
Network Layer: Logical addressing – IPV4 Addresses: Classful and Classless Addressing, Subnetting, Network Address Translation (NAT), IPV6 Addresses-Structure and Address space, Address Mapping: ARP, RARP, BOOTP and DHCP.

UNIT - IV :
Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), UDP Format, uses of UDP, Transmission Control Protocol (TCP), TCP Services, TCP Fea- tures, TCP Segment, Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT - V :
Application Layer: Domain Name System (DNS), Domain Name Space, Distribution of Name Space, Remote Logging: TELNET, ELECTRONIC MAIL, SMTP, File Transfer Protocol (FTP), WWW, HTTP.

Text Books:
1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGrawHill, 2017
2. Computer Networks, 6th Edition, Andrew S. Tanenbaum, Pearson New International Edition, 2021.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India, 2017

Reference Books:
1. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

SEMESTER V	L	T	P	C
	3	0	0	3
20AM5T02 - AUTOMATA THEORY				

COURSE OUTCOMES:
At the end of the course, student will be able to

CO1: Able to understand the concept of abstract machines and their power to recognize the languages(K1)

CO2: Able to employ finite state machines for modelling and solving computing problems. (K2)

CO3: Able to design context free grammars for formal languages (K2)

CO4: Able to distinguish between decidability and undecidability (K2)

CO5: Able to gain proficiency with mathematical tools and formal methods (K2)

UNIT - I :

Introduction to Finite Automata: Structural Representations, Automata and Complex- ity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems.

Deterministic Finite Automata: Definition of DFA, How A DFA Process Strings, The language of DFA.

Nondeterministic Finite Automata: Formal Definition, an application, Finite Automata with Epsilon-Transitions Conversion of NFA with C-transitions to NFA without Ctransi- tions. Conversion of NFA to DFA.

UNIT - II :

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular Expressions.

Pumping Lemma for Regular Languages: Statement of the pumping lemma, Applications of the Pumping Lemma.

UNIT - III :

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Push Down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state, Acceptance by empty stack, Deterministic Pushdown Automata.

UNIT - IV :

Normal Forms for Context- Free Grammars: Eliminating useless symbols, Eliminating CProductions. Chomsky Normal form, Griebech Normal form.

Pumping Lemma for Context-Free Languages: Statement of pumping lemma, Applica- tions

Turing Machines: Introduction to Turing Machine, Formal Description, Instanta- neous description, The language of a Turing machine.

UNIT - V :

Types of Turing machine: Turing machines and halting

Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Counter machines.

Text Books:
1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.

2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrasekaran, 2nd edition, PHI.

Reference Books:
1. Introduction to Languages and The Theory of Computation, John C Martin, TMH.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press.
4. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.
5. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan, Rama R, Pearson.

SEMESTER V	L	T	P	C
	3	0	0	3
20AM5T02 - FULL STACK WEB DEVELOPMENT				

COURSE OBJECTIVES:

1. To Building Strong expertise to develop frontend application using HTML5and CSS.
2. To design interactive webpages using clientside and serverside scripting.
3. To understand the basics of AngularJS framework and MongoDB.

COURSE OUTCOMES :

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

CO1: Design simple web pages using markup languages like HTML and CSS (K4).

CO2: Create dynamic web pages using DHTML and java script that is easy to navigate and use (K3).

CO3: L Create web pages using Angular JS (K3).

CO4: Build web applications using Servlets JSP(K3).

CO5: Understand various operations on Mongo Data base (K2).

UNIT -I:

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds, CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT -II:

Client Side Scripting using Java Script and DOM

Java Script: The Basics of Java Script, Objects, Primitive operations and Expressions, Screen output and keyboard input, Control statements, Object Creation and modification, Arrays, functions, Constructors, Pattern matching using Regular Expressions.

DHTML: Positioning moving and Changing Elements.

DOM: Introduction to the Document Object Model DOM,HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT -III :

Introduction to AngularJS: Expressions, Modules, DataBinding, Scopes, DirectivesEvents, Cont Services, HTTP, Tables,Select, Fetching Data from MySQL.

UNIT -IV :

Servlet programming, Java Server Pages (JSP), JDBC with Servlets and JSP, Remote Method Invocation (RMI), CORBA Architecture.

UNIT -V:

Introduction to Mongo DB: Mongo DB Environment, Create Database, Drop Database, Create Collection,DropCollection, Read Operations, Write Operations.

Text Books:

1. Mastering Html, Css Javascript Web Publishing Paperback – 15 July 2016 by Laura Lemay (Author), Rafe Colburn (Author), Jennifer Kyrnin (Author).

2. Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful

3. Full Stack Development with MongoDB ISBN: 9789355510143 eISBN: 9789355510150 Authors: MANU SHARMA.

Reference Books:

1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer Paperback – Import, 20 November 2018.

2. AngularJS Web Application Development Blueprints,Published by Packt Publishing Ltd.Author Vinci R.

3. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer.

SEMESTER V	L	T	P	C
	3	0	0	3
20AM5E01-PRINCIPLES OF SOFTWARE ENGINEERING(PROFESSIONAL ELECTIVE-I)				

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Identify, formulate the various software engineering concepts[K1].
CO2: Analyze different software development process models[K4].
CO3: Analyze and specify software requirements with various stake-holders of a software development project[K4].
CO4: Apply systematic procedure for software design and deployment[K3].
CO5: Compare and contrast the various testing methods and art of Debugging[K4].

UNIT - I :
Software Engineering: The nature of Software: Define software (Software Characteris- tics), Software Application Domains, Legacy software, Software Engineering: Definition, Layered Technology, SOFTWARE PROCESS: Generic Process framework activities, Um- brella activities, software engineering Practice: the essence of Practice, general principles, Software Myths and Reality, Generic Process model, Capability, Maturity Model Integration (CMMI).

UNIT - II :
Process Models: Process Assessment and improvement. Prescriptive Process models: Waterfall Model, Incremental Process Model, Evolutionary Process Models: Prototyping, Spiral model, The Unified Process .Personal and Team process models: Personal software process (PSP), Team software process (TSP), Product and Process.
Agile Process: Agility and the cost of change, Agility Principles, the politics of agile development, Human Factors.

UNIT - III :
Requirements Analysis And Specification: Functional Requirements, Non- Func- tional Requirements, Software Requirements Document (Software Requirements Speci- fication SRS), Requirements Specification, Requirements Engineering, Establishing the Ground work, Eliciting Requirements (elicitation), Developing Use cases, Validating Re- quirements.
Requirements Management: Requirements Planning, Requirements Change manage- ment.

UNIT - IV :
Software Design: Design process, Design concepts: Abstraction, Architecture, Pat- terns, Separation of Concerns, Modularity, Information hiding, Functional independence, Refinement, Aspects, refactoring, Object oriented design concepts, Design classes.
The Design Model: Data Design Elements, Architectural Design elements, Interface De- sign Elements, Component-Level Design Elements, Deployment-Level Design Elements.
Designing Class Based Components: Basic Design Principles, Component-Level Design guidelines, Cohesion and coupling. User Interface Design: The Golden Rules.

UNIT - V :
Testing: Elements of software quality assurance, SQA Tasks and Goals. The strategies for Conventional Strategies: Unit Testing – Integration Testing. Test Strategies for Object- Oriented Software, Software testing fundamentals, white box testing- Basis path testing: Flow graph Notation, independent Program paths, Deriving test cases, Graph Matrices. control structure testing. black box testing: Graph Based Testing Methods, Equivalence Partitioning, Boundary value Analysis. Validation Testing, System Testing.
Art of Debugging: The Debugging process, Psychological Considerations, Debugging Strategies, Correcting the error.

Text Books:
1. Software Engineering, A practitioner's Approach- Roger S. pressman, 8th edition, McGraw-Hill international Edition, 2014.
2. Software Engineering, IanSommerville,10th Edition, Pearson Education Asia, 2016.

Reference Books:
1. Software Engineering, PankajJalote, APrecise Approach",Wiley India, 2010.
2. Systems Analysis and Design-Shely Cashman Rosenblatt,9th Edition, Thomson pub- lications, 2016.
3. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edi- tion, Tata McGraw Hill, New Delhi, 2012.

NPTEL LINK:
1. https://nptel.ac.in/courses/106101061/

SEMESTER V	L	T	P	C
	3	**0**	**0**	**3**
20AM5E02-COMPUTER VISION (PROFESSIONAL ELECTIVE-I)				

COURSE OBJECTIVES:

1. To introduce students the fundamentals of image formation.
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition.
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4. To provide the student with programming experience from implementing computer vision and object recognition applications.

COURSE OUTCOMES :

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

CO1: Identify basic concepts, terminology, theories, models and methods in the field of computer vision[K1].

CO2: Describe known principles of feature detection and matching[K2].

CO3: Describe basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal[K2].

CO4: Suggest a design of a computer vision system for a 3D Recon- struction, Albedos, image based rendering views and depths.[K3].

CO5: Understanding of 3D reconstruction techniques and image-based rendering methods.

UNIT - I :

Introduction: Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighborhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization.

UNIT - II :

Feature Detection and Matching: Points and Patches, Edges, Lines, Segmentation: Ac- tive Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature- Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric In- trinsic Calibration.

UNIT - III :

Structure and Motion: Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Trans- lation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion

UNIT - IV :

Image Stitching: Motion Models, Global Alignment, Composing, Computational Photog- raphy: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis.

UNIT - V :

3D Reconstruction: Shape From X, Active Range Finding, Surface Representation, Point-based Representation, Volumetric Representation, Model-based Reconstruction, Re- covering Texture Maps and Albedos, Image- based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumigraphs, Environment Mattes, Video-based Rendering.

Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011.
2. Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012.

Reference Books:
1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Haralick & Shapiro, "Computer and Robot Vision", Vol II.3
3. Gerard Medioni and Sing Bing Kang "Emerging topics in computer vision"

NPTEL LINK:
1. https://onlinecourses.nptel.ac.in/noc22 ee48/preview

SEMESTER V	L	T	P	C
	3	0	0	3
20AM5E03 - DATA VISUALIZATION (PROFESSIONAL ELECTIVE-I)				

COURSE OUTCOMES:

By completing the course the students will be able to:

CO1: Understand basics of Data Visualization[k2].

CO2: Implement visualization of distributions[k3].

CO3: Write programs on visualization of time series, proportions & associations[k3].

CO4: Apply visualization on Trends and uncertainty[k4].

CO5: Explain principles of proportions[k2].

UNIT - I :

INTRODUCTION TO VISUALIZATION: Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Sys- tems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations-Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

UNIT - II :

VISUALIZING DISTRIBUTIONS: Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots- Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT - III :

VISUALIZING ASSOCIATIONS TIME SERIES: Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlo- grams, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables

UNIT - IV :

VISUALIZING UNCERTIANITY: Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospa- tial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty- Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Vi- sualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots.

UNIT - V :

PRINCIPLE OF PROPORTIONAL INK: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Con- tour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information, Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

Text Books:
1.   Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.
2.   Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018

Reference Books:
1. Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O'Reilly, 2016

SEMESTER V	L	T	P	C
	3	0	0	3
20AM5E04-DevOps (PROFESSIONAL ELECTIVE-I)				

COURSE OBJECTIVES:

1. Introduces the basic concepts of Information System.
2. To understand the Management Control Framework and The Application Control Framework.

COURSE OUTCOMES:

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

CO1: Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility[K3].

CO2: Describe DevOps & DevSecOps methodologies and their key concepts[K2].

CO3: Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models[K2].

CO4: Set up complete private infrastructure using version control systems and CI/CD tools[K2].

CO5: Acquire the knowledge of maturity model, Maturity Assessment[K4].

UNIT - I :

Introduction: Phases of Software Development Life Cycle, Values and princi- ples 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 im- plementation, 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 matu- rity model, DevOps maturity Assessment.

Text Books:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016.
2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides O'Reilly publica- tions, 2012.

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3

20EE5O01 - NON-CONVENTIONAL ENERGY SOURCES

COURSE OUTCOMES:
By completing the course the students will be able to:
CO1: Analyze solar radiation data and solar thermal systems (k4)
CO2: Identify the methods and analysis of wind energy generation systems (k3)
CO3: Explain the biomass and geothermal energy, its mechanism of production and its applications (k2)
CO4: Explain basic principle and working of hydro, tidal energy systems. (k2)
CO5: Explain basics of Chemical Energy Sources(k2)

UNIT -I: Solar Energy:
Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT-II: Wind Energy:
Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT-III: Biomass and Geothermal Energy:
Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant
Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT-IV: Energy From hydro, oceans, Waves & Tides:
Hydro: Basic working principle – classification of hydro – types of turbines
Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.
Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices.
Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT-V: Chemical Energy Sources:
Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.
Hydrogen Energy: Introduction - Methods of Hydrogen production - Storage and Applications
Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types.

Text Books:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

Reference Books:

1. S.P.Sukhatme&J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20ME5O01 - WASTE TO ENERGY CONVERSION				

COURSE OBJECTIVES
1. To enable students to understand of the concept of waste to energy.
2. To link technical and management principles for production of energy from waste.
3. To learn about the best available technologies for waste to energy.
4. To facilitate the students in developing skills in the decision making process.

COURSE OUTCOMES: Students are able to
CO1: Describe of the concept of waste to energy, classifications and principles. [K2]
CO2: Explain management principles for production of energy from waste. [K2]
CO3. Explain the best available technologies for waste to energy. [K2]
CO4: Describe the waste to energy options landfill gas, and energy from plastics.[K2]
CO5: Apply the knowledge in planning and operations of waste to energy plants [K3]

UNIT-I   :   INTRODUCTION
Waste - types of waste, Principles of waste management, Waste utilization, Waste management hierarchy, 3R Principle of Reduce, Reuse and Recycle, Waste as a resource, alternate energy source.

UNIT-II: WASTE SOURCES & CHARACTERIZATION
Source of waste, Waste production in different sectors such as domestic, industrial, agriculture, postconsumer waste etc, Waste management tools and techniques for reducing waste segregation and scientific disposal, Characterization of waste for energy utilization, Waste selection criteria.

UNIT-III: TECHNOLOGIES FOR WASTE TO ENERGY
Energy biochemical conversion – energy production from organic waste through anaerobic digestion, fermentation, Thermo-chemical conversion – combustion, incineration, heat recovery, pyrolysis, gasification, plasma arc technology, other newer technologies, Case studies.

UNIT-IV: WASTE TO ENERGY OPTIONS
Waste to energy options **-** landfill gas, methane emission, collection and recovery, Refuse Derived Fuel (RDF), Fluff, Briquettes, Pellets, Alternate Fuel Resource (AFR) – production and use in cement plants, Energy from plastic wastes, Non-recyclable plastic wastes for energy recovery, Energy recovery from wastes and optimization of its use, Energy analysis.

UNIT-V: WASTE TO ENERGY PLANTS & ENVIRONMENTAL IMPLICATIONS
Wasteto Energy Plants: Waste management activities – collection, segregation, transportation and storage requirements, Location and Site of waste to energy plants.
EnvironmentalImplications: Environmental impact of waste to energy, Safety and environmental standards, Savings on non-renewable fuel resources, Carbon credits and its types.

Text Books:
  1. Marc Rogoff Francois Screve, Waste-to-Energy, 3rd Edition, William Andrew, 2019.
  2. B.T. Nijaguna, Biogas Technology, 1st Edition, New Age International Pvt. Ltd, 2002.
Reference Books:
  1. Vishal Prasad, BarkhaVaish, Advances in Waste-to-Energy Technologies, 1st Edition, CRC Press, 2019.
  2. Dev Vrat Kamboj, Manoj Kumar Solanki, Waste to Energy: Prospects and Applications,   1st Edition, Springer, 2021.
  3. P. Jayarama Reddy, Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies, 1st Edition, CRC Press/ Balkema, 2016.
Web Reference:
  1. https://archive.nptel.ac.in/courses/103/107/103107125/

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O01 - INTERNET OF THINGS AND APPLICATIONS				

COURSE OUTCOME:
At the end of the course students are able to
CO1: Explain Arduino IDE tool and Arduino Programming concept.
CO2: Illustrate concept hardware configuration with Firmata protocols.
CO3: Explain the knowledge Arduino pin configuration.
CO4: Differentiate various sensors configuration and workflows.
CO5: Define architecture of IoT.

UNIT-I: (Introduction to Arduino)
Introduction to Arduino, history of Arduino, variants, Uno board block diagram, installation of Arduino, Arduino IDE, Arduino programming, functions and statements.

UNIT-II (Configuration)
Connecting Arduino borad, introducing the Firmata Protocol, uploading a Firmata sketch to the Arduino board, testing the Firmata protocol.

UNIT-III (Components)
List of components, software flow design, hardware flow design, hardware prototyping software, designing the hardware prototype, Arduino sketch default functions and custom function, setting Arduino board, pin configuration, working with pins.

UNIT-IV (Prototype)
Potentiometer-continuous observation from an analog input connection, Buzzer-generating sound alarm pattern, DC motor-controlling motor speed using PWM, LED- controlling LED brightness using PWM, Servomotor- moving the motor to a certain angle.

UNIT-V (Networking and cloud)
Arduino and computer networking, networking fundamentals, Obtaining the IP address, Networking extensions for Arduino with libraries and class, architecture of IoT web applications, IoT cloud platforms, develop cloud-based IoT applications.

Textbooks:
1. Python programming for Arduino by Pratik desai, Packt Publishing.
2. Internet of Things with Arduino Cookbook by Marco Schwartz.
3. Introduction to Arduino by Alan G. Smith.

References
1. Beginning Arduino by Michael McRoberts, 2e.
2. Getting Started with Arduino Massimo Banzi Second Edition.

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O02 - DATA ENGINEERING				

COURSE OUTCOMES:
Student able to state and analyze:
CO1: Preprocessing techniques for various datasets,
CO2: Standard database systems concepts like tables, relations, query,NoSQL
CO3: Information retrieval techniques such as Relevance Ranking,Indexing etc
CO4: Data processing algorithms and data structures
CO5: Visualization techniques like Table, graph, histogram, pie-chart

UNIT- I:
Data Engineering:introduction, importance of data engineering, Data engineering vs data science
Data Collection: Various sources of data, types of data: text, video, audio, biology etc.
Data Preprocessing: data Cleaning: missing values, noise elimination, data integration, data transformation: Normalization, Data Reduction: data cube aggregation, dimensionality reduction.

UNIT-II
Data bases: Database Schema, ER diagram, introduction to SQL, functions and stored procedures, indexing: B+tree index files, data base system architecture: Client-Server Architecture, introduction to MongoDB,
NoSQL: The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL

UNIT-III
Information Retrieval: Relevance Ranking Using Terms,Relevance Using Hyperlinks,Synonyms, Homonyms, and Ontologies,Indexing of Documents,Measuring Retrieval Effectiveness,Crawling and Indexing the Web,Information Retrieval: Beyond Ranking of Pages, Directories and Categories

UNIT-IV
Data Analysis: correlation analysis: bivariate correlation, partial correlation, correlation coefficients. Regression: simple linear regression, multiple linear regression, principal component analysis, analysis of variance

UNIT- V
Data Visualization: Table, graph, histogram, pie-chart, area-plot, box-plot, scatter-plot, bubble-plot, waffle charts, word clouds.

Text Books:
1. Data mining concepts and techniques Jiawei Han and Micheline Kamber (UNIT-I)
2. Silberschatz, Korth, Sudarshan, "Database System Concepts" McGraw Hill Education, Sixth edition, 2010, ISBN-13: 978-9332901384 (UNIT-II, UNIT-III)
3. "NoSQL distilled" A Brief Guide to the Emerging World of Polyglot PersistencePramod J. Sadalage Martin Fowler, Addison Wesley (UNIT-II)
4. correlation and regression analysis by Dr. Mohamed Ahmed Zaid (UNIT-IV)

Reference Books:
1. Brian Shive, "Data Engineering: A Novel Approach to Data Design", Technics Publications, 2013. ISBN-13: 978-1935504603.
2. Joel Grus, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly, 2016. ISBN-13: 978-9352134915.
Web links:
1. https://chartio.com/learn/charts/essential-chart-types

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O01 - INNOVATIONS AND ENTREPRENEURSHIP				

COURSE OUTCOME:
At the end of the course students are able to
CO1: Understanding of the innovation process and its various stages, from ideation to commercialization.
CO2: Identifying and evaluating entrepreneurial opportunities.
CO3: Understand how to refine and validate ideas through feasibility analysis.
CO4: Developing an entrepreneurial mindset
CO5: Understand the components of a comprehensive business plan, including market analysis, financial projections, marketing strategies, and operational plans.

UNIT-I:
INNOVATION MANAGEMENT: Concept–Objectives-types of Innovation process of Innovation-sources of Innovation-Levels of Innovation -barriers of Innovation-– Open and Closed Innovation-challenges faced while managing innovation.

UNIT-II:
CREATIVE INTELLIGENCE: Concept of Creativity-Importance Characteristics-Types of Creativity-Traits Congenial to Creativity-Triarchic theory of Intelligence – Creative thinking –Types-process of creative thinking-Sources and techniques for generating ideas.

UNIT-III:
ENTREPRENEURSHIP: Concept- characteristics-Importance classification-Theories of Entrepreneurship-entrepreneurship development-entrepreneurial process- challenges-Women Entrepreneurs.

UNIT-IV:
PROJECT FORMULATION AND APPRAISAL: Concept -Need Significance-steps - Economic Analysis; Financial analysis; Market analysis; Technical feasibility-project Appraisal-techniques of project appraisal.

UNIT-V:
INSTITUTIONS PROMOTING SMALL BUSINESS ENTERPRISES: Central level Institutions; SIDBI, NSIC, KVIC,SSIDC - State level Institutions- DICs – SFC SSIDC- other financial assistance, Government policy and taxation benefits- government policy for SSIs

Text Books:
1. Vasanth Desai, ―Entrepreneurship, Himalaya Publishing House, New Delhi, 2012
2. Arya Kumar: ―Entrepreneurship, Pearson, Publishing House, New Delhi, 2012.
3. Keith Goffin and Rick Mitchell-Innovation Management,Springer,2016

References Books:
1. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
2. Vinnie Jauhari, SudanshuBhushan, Innovation Management, Oxford Higher Education, 2014

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O03 - DIGITAL MARKETING				

COURSE OUTCOME:
At the end of the course students are able to
CO1: Demonstrate an understanding of the concept, scope, and importance of digital marketing.
CO2: Identify types of content marketing and Measure and analyze the effectiveness of content marketing.
CO3: Develop a comprehensive understanding of Search Engine Optimization and Analyze the ecosystem of search engines.
CO4: Understand the fundamentals of Email Marketing.
CO5: Analyze email marketing metric

UNIT-1:
Introduction to Digital Marketing: Concept – scope- importance of digital marketing - Traditional marketing versus digital marketing – Types of digital marketing marketing mix and its implications for digital marketing--Challenges and opportunities for digital marketing

UNIT-II:
Content Marketing: Understanding Content Marketing, Content Creation Framework, Content marketing strategy and planning- Types of content marketing - Measuring and Analysing Your Content-Viral Marketing-Blog Marketing.

Unit-III:
Search Engine Optimization (SEO): What is SEO? SEO Importance and Its Growth in recent years, Ecosystem of a search Engine , kinds of traffic, Keyword Research & Analysis (Free and Paid tool & Extension), Recent Google Updates

UNIT IV:
Email and Mobile Marketing: Introduction, process, design, content,email marketing metrics. Mobile Marketing: Concept, Process-tools-opportunities and challenges.

UNIT V:
Social Media Marketing: Concepts- Process - Tools- Google and the Search Engine, Facebook, Twitter, YouTube and LinkedIn- Issues: Credibility, Fake News, Paid Influencers; social media and Hate/ Phobic campaigns.

Text Books:
1.Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Education Publications, 2nd edition 2019
2. Seema Gupta, "Digital Marketing", McGraw Hill Publications", 2nd edition 2020 3.Ryan Deiss, Russ Henneberry, "Digital Marketing For Dummies", Wiley Publications, 2020

References Books:
1. Joe Pulizzi, "Epic Content Marketing", McGraw Hill Education, 2019 2. Puneet Singh Bhatia , "Social Media & Mobile Marketing", Wiley Publications, 2019

SEMESTER V (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O04 - BUSINESS ENVIRONMENT				

COURSE OUTCOME:
At the end of the course students are able to
CO1: Understand the components and significance of the business environment.
CO2: Analyze the sectors of the Indian economy.
CO3: Understand sustainable development and its relevance in the business environment.
CO4: Analyze the causes and methods of correcting BOP disequilibrium and Study trade barriers and trade strategies.
CO5: Analyze foreign market entry methods and Study international trading blocks.

UNIT-I
Business Environment: Components and Significance – Economic Scope – Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

UNIT-II:
Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy - Policy Resolutions of 1991-Economic Reforms-PPP.

UNIT-III:
Indian Business Environment: Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment.

UNIT-IV:
International Trade: Balance of Payments – Concepts, Disequilibrium in BOP: Methods of Correction - Trade Barriers and Trade Strategy - Free Trade vs. Protection - World Financial Environment: Foreign Exchange Market Mechanism, Exchange Rate Determination, and Euro Currency.

UNIT-V:
Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trading Blocks – WTO Origin, Objectives, Organisation, Structure and Functioning – WTO and India.

Text Books:
1. Chidambaram, Indian Business Environment, Vikas, New Delhi
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.

References Books:
1. Pandey G.N., Environmental Management, Vikas Publishing House.
2. Sundaram& Black, International Business Environment – The Text and Cases, Prentice Hall of India.
3. Ghosh PK., Business Environment,Sultan Chand & Sons, New Delhi
4. Daniel John D and Redebough, Lee. H., International Business, AddisionWesley India
5. Saleem, Business Environment, Pearson, New Delhi.
6. Bhalla, V.K., & S. Sivaramu, International Business Environment and Business, Annual Publications

SEMESTER V (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20IT5J01 - LINUX ADMINISTRATION				

COURSE OUTCOMES:

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

CO1: Use various Linux commands that are used to manipulate system operations at admin level.
CO2: Write Shell Programming using Linux commands.
CO3: Design and write application to manipulate internal kernel level Linux File System.
CO4: Explain the user, group and storage management.
CO5: Configure SSH client and server.

UNIT -I:

Introduction To Linux And Linux Utilities: A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, unlink, du, find, unmask, ulimit, ps, finger, tail, head, sort, nl, uniq, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio, apt.

UNIT -II:

Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.
Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT -III:

Grep: Operation, grep Family(grep, egrep, fgrep), Searching for File Content.
Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.
Unix File Structure: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers.

UNIT -IV:

User and Group Management: User accounts, local groups and group memberships, Configure networking and hostname resolution statically or dynamically, start, stop, and check the status of network services and network related commands.
Storage Management: List, create, delete, and modify physical storage partitions and tools

UNIT -V:

Configuring SSH: Enabling the SSH Server, Using the SSH Client, Configuring Key- Based SSH Authentication, Using Graphical Applications with SSH.
Practical Learning: Installation of Any open source Linux Distribution, AWS Instance Creation and Learn How to Access through SSH.

Text Books:
1. W. Richard. Stevens, Advanced Programming in the UNIX Environment, 3rd edition,
Pearson Education, New Delhi, India.
2. Behrouz A. *Forouzan, Richard F. Gilberg*, Unix and shell Programming Thomson

Reference Books:
1. *Robert Love, O'Reilly*, Linux System Programming, SPD.
2. *W.R.Stevens*, Advanced Programming in the UNIX environment, 2nd Edition, PearsonEducation.
3. *W.R. Stevens*, UNIX Network Programming, PHI.
4. *Graham Glass, King Ables*, UNIX for Programmers and Users, 3rd Edition, Pearson Education.

SEMESTER V (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20CS5J01 - FULL STACK WITH JAVA				

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Design simple web pages using markup languages like HTML and CSS.
CO2: Create dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3: Create web pages using AngularJS.
CO4: Build web applications using Servlet and JSP.
CO5: Understand various operations on Mongo Database.

UNIT-I:
HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.
CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds,CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II:
Client-Side Scripting using Java Script and DOM
Java Script: The Basics of Java Script, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.
DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III:
Angular JS
Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV:
Servlet and JSP
Servlet: Servlet Basics, Need of Server Side Programming,Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives-include (), forward(), sendRedirect(), HttpServletRequest and HttpServlet Response in Servlet, Servlet and JDBC Integration.
JSP: JSP Basics, JSP Scripting Elements (Declaration, Expression, Scriptlet), Directive Elements (page,include,taglib) , Action Elements (jsp:forward, jsp: include,jsp:useBean), JSP Implicit Objects.
UNIT-V
 Mongo DB: Introduction to Mongo DB, Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

Text Books:
1.   Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2.   Web Technologies, Uttam K Roy, Oxford.
3.   Head First Servlet and JSP
4.   Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

Reference Books:
1.   Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2.   An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3.   Pro Angular JS by Adam Freeman
4.   MEAN Web Development by Amos Q. Haviv

SEMESTER V	L	T	P	C
	0	0	3	1.5
20CS5L01 - COMPUTER NETWORKS LAB				

COURSE OUTCOMES :
At the end of the course, student will be able to
CO1: Study and practicing various networking commands[K2].
CO2: Study and implementing different network cables[K2].
CO3: Understand various networking commands in packet traces Software[K2].
CO4: Configure a network using packet tracer software[K3].
CO5: Implement and configuring various routing algorithms using packet tracer[K3].

LIST OF PROGRAMS:
1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP) and Network Configuration Files.
2. Study of different types of network cables and practically implement the cross wired cable and straight through cable using crimping tool.
3. Implementing Data link layer farming methods such as bit stuffing and character stuffing.
4. Connect the computers in LAN network.
5. Study and practice basic network command and network configuration commands using packet tracer.
6. Performing initial Switch and Router configuration using packet tracer.
7. Configure a network topology using packet tracer software using two different net- works.
8. Configure a network topology using RIP protocol.
9. Configure a network topology using link state vector routing protocol.
10. Observing static routing and dynamic routing using packet tracer.
11. Static NAT configuration using cisco packet tracer.

SEMESTER V	L	T	P	C
	0	0	3	1.5
20CS5L02 - FULL STACK AND WEB DEVELOPMENT LAB				

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: To design static web pages for online books to reusing HTML[K6].
CO2: To manipulate the data of MongoDB To create web pages using Cascading Style sheets (internal or inline or external) and HTML[K3].
CO3: To develop web pages using Angular JS directives and filters [K3].
CO4: To build applications using PHP to manipulate data in MySql database[K3].
CO5: To manipulate the data of MongoDB[K3].

LIST OF PROGRAMS:
1. **Home Page:**
   The static home page must contain three frames.
   Top frame: Logo and the college name and links to Homepage,Login page,Registration page,Catalogue page and Cart page (the description of these pages will be given below).
   Left frame: At least four links for navigation,which will display the catalogue of respective links. For e.g.:When you click the link "B.Tech" the catalogue for B.Tech Books should be displayed in the Right frame.
   Right frame: The pages to the links in the left frame must be loaded here. Initially this page contains description of the web site.
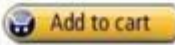
Logo	Website Name			
Home	Login	Registration	Catalogue	Cart
B.Tech M.Tech MCA MBA	Description of Website			

2. **Login Page:**

Logo	WebsiteName			
Home	Login	Registration	Catalogue	Cart
B.Tech M.Tech MCA MBA	Username Login: Password: ******** Submit Reset			

3. **Catalogue Page:** The catalogue page should contain the details of all the books avail- able in the website in a table. The details should contain the following:
    1. Snapshot of Cover Page.
    2. Author Name.
    3. Publisher.
    4. Price.
    5. Add to cart button.

4. **Registration Page:** Create a"registration form "with the following fields
    1. Name(Text field)
    2. Password(password field)
    3. E-mail id(text field)
    4. Phone number(text field)
    5. Sex (radio button)
    6. Date of birth (3 select boxes)
    7. Languages known(check boxes –English,Telugu, Hindi,Tamil)
    8. Address(text area)

5. **Design a web page using CSS (Cascading Style Sheets):**
    Use different font,styles: In the style definition you define how each selector should work(font,color etc.). Then,in the body of your pages, you refer to these selectors to activate the styles

6. Write a Java Script that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table for- mat.
7. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
8. Write a simple Hello program using Angular J S library.
9. Write a program that the AngularJS application consists of following three important parts:
    1. ng-app
    2. ng-model
    3. ng-bind
10. Write a program by using filters to convert the following
    1. uppercase
    2. lowercase

3. currency
4. order By
5. filter
6. date

11. Example PHP program for contact-us page.
12. Example PHP program for registering users of a website and login.
13. Install a database (Mysql or Oracle).

1. Create a table which should contain at least the following fields:name,password,email-id,phone number(these should hold the data from the registration form).
2. Write a PHP program to connect to that data base and extract data from the tables and display them. Experiment with various SQL queries.
3. Insert the details of the users who register with the website, when ever a new user clicks the submit button in the registration page.

14. Write a PHP which does the following job: Insert the details of the 3 or 4 users who register with the web site by using registration form.Authenticate the user when he submits the login form using the user name and password from the database(instead of cookies)
15. Design and Implement any 5 query using MongoDB.
16. Implement aggregation and indexing with suitable example using MongoDB.

SEMESTER V	L	T	P	C
	0	0	3	1.5
20HS5L03 - ADVANCED ENGLISH COMMUNICATION SKILL LAB				

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Gather ideas and organize information relevantly and coherently[K2].
CO2: Participate in group discussions and face interviews with confidence[K3].
CO3: Write Resume with covering letter[K3].
CO4: Make oral presentations and public speaking[K3].
CO5: Take part in social and professional communication[K3].
The following course content is prescribed for the Advanced English Communication Skills Lab:

UNIT- I: Communication Skills
- Introduce Yourself
- JAM
- J2M

Identifying one's career objective, projecting strengths and skills, organization of ideas within given time.

UNIT-II: Interaction Skills
- Body Language
- Role- Plays

Students start a conversation - Respond appropriately and relevantly in different situations with right body language.

UNIT-III: Oral Skills
- Presentations
- Public Speaking

Planning preparation and presentation - organization of ideas with clarity , coherence and style.

UNIT-IV: Writing Skills
- Covering Letter
- Resume Writing

To communicate the ideas relevantly and coherently in writing.

UNIT-V: Team Work Skills
- Group Discussion

Dynamics of Group Discussion - Modulation of voice, Body language, relevance, fluency and coherence.

Interview Skills

Pre-interview planning, opening strategies, answering strategies, interview through tele and video conference.

Reference Books:
1. Ashraf Rizvi- Effective Technical Communication - McGraw Hill Education- 2017.
2. Madhavi Apte - A Course in English Communication – Prentice - Hall of India- 2007.
3. Dr. Shalini Verma - Body Language – Your Success Mantra- S. Chand- 2006.
4. Sunita Mishra   C. Murali Krishna- Communication Skills for Engineers - Pearson Education - 2007.

SEMESTER V	L	T	P	C
	2	-	-	-
20BM5M01 – ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Understand the scope and importance of traditional knowledge

CO2: Understand the role of the government in harnessing TK.

CO3: Analyze the role of biodiversity management committees and access and benefit-sharing provisions in the Act.

CO4: Develop strategies to increase protection of traditional knowledge.

CO5: Analyze the significance of Traditional Knowledge in Different Sectors.

UNIT-I:
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2:
Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-3:
Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT-4:
Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-5:
Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Text books:
1. Traditional Knowledge System in India, by Amit Jha, 2009.

Reference Books:
1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

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

SEMESTER V	L	T	P	C
	-	-	-	1.5
20AM5I01 :: INTERNSHIP I				

	L	T	P	C
SEMESTER VI	**3**	**0**	**0**	**3**
20CS6T03 :: COMPILER DESIGN				

COURSE OBJECTIVES:

Understand the basic concept of compiler design, and its different phases which will be helpful to construct new tools like LEX, YACC, etc.

COURSE OUTCOMES:
At the end of the course students are able to
CO1: Understand about language processors and its phases and demonstrate about scanning of tokens.
CO2: Perform the syntax analysis by using parsing techniques
CO3: Perform Semantic analysis using attribute grammar
CO4: Compare different memory Management techniques in runtime environment
CO5: Ascertain optimization techniques for intermediate code forms and code generation

UNIT 1
Overview of language processing: – preprocessors – compiler – assembler – Linkers & loaders, difference between compiler and interpreter- structure of a compiler –phases of a compiler. **Lexical Analysis**: - Role of Lexical Analysis – Input Buffering – Specification of Tokens – Recognition of Token – The Lexical Analyzer Generator Lex.

UNIT 2
Syntax Analysis: – Role of a parser, Fuctions of parser, Context Free Grammar. Top Down Parsing: – Recursive Descent Parsing — Non recursive Predictive Parsing- FIRST and FOLLOW – LL(1) Grammar – Error Recovery in Predictive Parsing.

UNIT 3
Bottom up Parsing: – Reductions – Handle Pruning - Shift Reduce Parsing - Introduction to simple LR – Why LR Parsers – Model of an LR Parsers — Construction of SLR Tables.
More powerful LR parsers: - Construction of CLR (1) - LALR Parsing tables.

UNIT 4
Runtime Environment: - Storage organization - Stack allocation – Static allocation - Heap management - Parameter passing mechanisms.
Intermediate code: - DAG - Three address code – Quadruples - Triples - Indirect Triples.

UNIT 5
Common Optimization techniques : - Folding, Copy Propagation, Common Sub expression elimination, Frequency reduction, Strength reduction etc.
Machine dependent code optimization: - Peephole optimization – Register allocation - Instruction scheduling - Inter Procedural Optimization - Garbage collection via reference counting.

Text Books
1.Compilers: Principles, Techniques and Tools: 2nd Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ulman; 2nd Edition, Pearson Education.
2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press

Reference Books
1. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O‟reilly..
2. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley reamtech.
3. Engineering a Compiler-Cooper & Linda, Elsevier.
4. Compiler Construction, Louden, Thomson. Principles of compiler design, V. Raghavan, 2nd ed, TMH, 2011

SEMESTER VI	L	T	P	C
	3	**0**	**0**	**3**
20AM6T01 :: DEEP LEARNING				

COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Demonstrate the basic concepts fundamental learning techniques and layers

CO2: Discuss the Neural Network training, various random models.

CO3 : Explain different types of deep learning network models

CO4: Classify the Probabilistic Neural Networks

CO5: Implement tools on Deep Learning techniques

UNIT-I:

INTRODUCTION: Fundamentals of Deep Learning-Artificial Intelligence, Machine Learning and Deep Learning, Brief history of machine Learning, Why Deep learning. Feed forward neural network-Artificial Neural Network, activation function, multi-layer neural network

UNIT-II:

Training Neural Network: Risk minimization, loss function, back propagation, regularization, model selection and optimization. Deep Neural Networks**:** Difficulty of training deep neural networks, Greedy layer wise training.

UNIT-III:

Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNN

UNIT-IV:

Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, Long Short Term Memory Networks, RNN applications, Gated Recurrent Unit Networks

UNIT-V:

Applications: Object recognition, sparse coding, computer vision, natural language processing. Video Analytics

Textbooks:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016
2. Francois Chollet, Deep Learning with Python, Manning Publications,2018

Reference Textbooks:

1. DouweOsinga, ,Shroff Publishers "Deep learning Cook Book, Practical recipes to get started Quickly", O'Reilly, 2019
2. Josh Patterson and Adam Gibson "Deep learning: A practitioner's approach, , First Edition, 2017, O'Reilly Media
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009

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:

Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

SEMESTER VI	L	T	P	C
	3	0	0	3
20AM6T02 :: CLOUD ARCHITECTURE AND SERVICES				

COURSE OUTCOMES:
After completion of course, students would be able to:
CO1: Understanding Architecture and components of cloud computing
CO2: Understanding the key dimensions of the challenge of Cloud Computing
CO3: Assessment of the economics , financial, and technological implications for selecting cloud computing for own organization
CO4: Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.
CO5: Understanding the Cloud applications.

UNIT 1:
Cloud Platform Architecture: Introduction to Cloud computing, Cloud Computing Architecture, Cloud computing services ,Infrastructure as a service(Iaas), Platform as a service (Paas), Software as a service (Saas), Cloud computing Deployment models or types of cloud ,Public cloud, Private cloud, Hybrid cloud , Advantages of Cloud computing, Service Oriented Architecture (SOA), Cloud infrastructure, Economics of the cloud

UNIT-II:
Virtualization :Introduction, Characteristics of virtual environment, Classification of Virtual techniques, Virtualization and Cloud computing, Pros and cons of Virtualization ,Technology examples-VMware and Microsoft Hyper-V.

UNIT-III:
Introduction to Cloud Platforms: Amazon Web Services (AWS), Global Infrastructure, AWS services: compute, storage, database, networking, Introduction to Microsoft Azure, Introduction to Google App Engine (GAE).

UNIT-IV:
Cloud Security: Security, Security planning, understanding security of cloud, understanding data security, Encryption, cloud computing applications.
Software as a Service Security, Virtual machine security, Identity and access management

UNIT-V:
Cloud Applications: Scientific Applications, Health care, Geo science and Biology, Business and consumer applications, CRM and ERP, Social networking, Media Applications
Storage Systems: Evolution of storage technology, storage models, files systems and database, Amazon Simple Storage Service (S3).

Text Books:
1.   Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier.
2.   Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH.
3.   Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press.
4.   Cloud computing, Master cloud computing concepts,architecture and applications with real world examples and case studies, Kamal kanthiran,RuchiDoshi

Reference Books:
1.   Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH.
2.   Raj Kumar Buyya,"Cloud Computing: Principles and Paradigms",Wiley,2011.
3.   Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.

Links:
https://aws.amazon.com/what-is-cloud-computing/
https://www.geeksforgeeks.org/virtualization-cloud-computing-types/?ref=lbp
http://www.itbriefcase.net/network-server-storage-and-desktop-virtualization
https://www.javatpoint.com/virtualization-in-cloud-computing
https://www.tutorialspoint.com/cloud_computing/cloud_computing_security.htm

SEMESTER VI - PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	0	0	3
20CS6E01 :: SOFTWARE TESTING METHODOLOGIES				

COURSE OBJECTIVES:

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

COURSE OUTCOMES:
By the end of the course, the student should have the ability to:

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

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

CO3: Analyze the needs of software test automation

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

CO5: Basic understanding and knowledge of contemporary issues in software testing, such as component-based, web based and object oriented software testing problems

CO6: Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web based applications

UNIT-I:
Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and **Validation:** Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

UNIT-II:
Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.
White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

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

UNIT-IV:

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

UNIT V

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit . Test Automation using Selenium tool.
Testing Object Oriented Software: basics, Object oriented testingTesting Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems.

Text Books:

1) Software Testing, Principles and Practices, NareshChauhan, Oxford
2) Software Testing, Yogesh Singh, CAMBRIDGE

Reference Books:

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

E-Resources:

1) https://www.tutorialspoint.com/software_testing_dictionary/test_tools.htm

SEMESTER VI - PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	0	0	3
20AM6E01 :: HUMAN COMPUTER INTERACTION				

COURSE OBJECTIVE:

To impart knowledge on

1. To study the effectiveness of interacting with computers
2. To learn the various models that can be used for designing systems
3. To understand the importance of interaction styles
4. To learn to design web interface
5. To understand the applications of HCI

COURSE OUTCOME:

After completion of course, students would be able to:

CO1: Apply the Human Computer Interaction (HCI) principles while developing software

CO2: Identify the appropriate design model for HCI

CO3: Understand the importance of interaction styles

CO4: Postulate appropriate interaction styles Design a web interface for HCI

CO5: Apply HCI in real time systems

UNIT-I: INTRODUCTION AND DESIGN PROCESS

Interaction design basics – process of design – user focus – navigation – screen design and layout – Iteration and prototyping – HCI in the Software process – Software life cycle –Usability engineering – Iterative design and prototyping – Design Focus – Design rationale – Design Rules

UNIT -II: MODELS

Cognitive models – Goal and task hierarchies – Linguistic models – Challenge of display-based systems – Physical and device models – Cognitive architectures – Socio-organizational issues and stakeholder requirements – Socio- organizational issues and stakeholder requirements – Organizational issues – Capturing requirements – Communication and Collaboration models – Face-to-face communication – Conversation – Text-based communication – Group working.

UNIT -III: INTERACTION STYLES

Dialog notations and design –Dialog design notations – Diagrammatic notations – Textual dialog notations – Dialog semantics – Dialog analysis and design – Models of the system – Standard formalisms – Interaction models – Continuous behaviour – Modelling rich interaction – Status-event analysis – Rich contexts

UNIT -IV: WEB INTERFACE DESIGN - I

Designing Web Interfaces – Drag & Drop – Purpose – Module, List, Object, Action, Collection - Challenge – Direct Selection – Toggle, Collected, Object, Hybrid – Contextual Tools.

UNIT -V: WEB INTERFACE DESIGN - II

Overlays – Dialog, Detail, Input – Inlays – Dialog, List, Detail – Virtual Pages – Virtual Scrolling – Inline Paging – Scrolling Paging – Virtual Panning – Zoomable User Interface – Process Flow – Transitional Patterns – Purpose of Transitions.

Text Book:

1.Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd edition PearsonEducation, 2009.
2.Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.

Reference Book:
1. Julie A. Jacko (Ed), "The Human-Computer Interaction Handbook", 3rd edition, CRC Press, 2012.
2. M.G. Helander, "Handbook of Human-Computer Interaction", Elsevier, 2014
3. Andrew Sears, Julie A. Jacko, "Human-Computer Interaction: Design Issues, Solutions, and Applications", CRC Press, 2009.

Extensive Reading:
1. http://nptel.ac.in/courses/106103115/
2. http://hci.bham.ac.uk/
3. www.hcibook.com/e3/online

SEMESTER VI - PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	0	0	3
20AM6E02 :: ETHICS OF ARTIFICIAL INTELLIGENCE				

COURSE OBJECTIVES:

1. To understand the need for ensuring ethics in AI.

2. To understand ethical issues with the development of AI agents.

3. To apply the ethical considerations in different AI applications.

4. To evaluate the relation of ethics with nature.

5. To overcome the risk for Human rights and other fundamental values.

COURSE OUTCOMES:

CO1: Understand the ethical issues in the development of AI agents

CO2: Learn the ethical considerations of AI with perspectives on ethical values

CO3: Apply the ethical policies in AI based applications and Robot development

CO4: To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.

CO5: This study will help to overcome the evil genesis in the concepts of AI.

UNIT-I: INTRODUCTION TO ETHICS OF AI:

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

UNIT -II: FRAMEWORK AND MODELS:

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

UNIT -III: CONCEPTS AND ISSUES:

Accountability in Computer Systems, Transparency, Responsibility and AI.Race and Gender, AI as a moral right-holder.

UNIT -IV: PERSPECTIVES AND APPROACHES:

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents.

UNIT -V: CASES AND APPLICATION:

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics.

Reference Books:

1. Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017

2. Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press Edited book, 2020

3. S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press EditedBook, 2020

4. N. Bostrom and E. Yudkowsky."The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.

5.Wallach, W., & Allen, C, "Moral machines: ceaching robots right from wrong", Oxford University Press, 2008.

SEMESTER VI - PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	0	0	3
20AM6E03 :: NETWORK PROGRAMMING				

COURSE OBJECTIVES:
Having successfully completed this course, the student will be able to:
1. Demonstrate mastery of main protocols comprising the Internet.
2. Develop skills in network programming techniques.
3. Implement network services that communicate through the Internet.
4. Apply the client-server model in networking applications.
5. Practice networking commands available through the operating system

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Identifying different models and sockets
CO2: Demonstrate different TCP Echo server functions and I/O models
CO3: Rationalize IPV4 and IPV6 Socket options
CO4: Identifying daemon processing and Advanced input and output functions
CO5: Analyze Broadcasting and multicasting

UNIT -I:
Introduction to Network Programming: Introduction to Network Programming: OSI model, UNIX standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application Elementary Sockets: Sockets introduction, Elementary TCP sockets.

UNIT -II:
TCP client server: Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.I/O Multiplexing: I/O Models, the select and poll functions, Batch input and buffering, shutdown function.

UNIT -III:
UDP and Socket options: Elementary UDP sockets: Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. **Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function.

UNIT -IV:
Advanced Sockets and Daemon Processes: IPV4 and IPV6 interoperability, introduction, IPV4 client: IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data.

UNIT -V:
Broadcasting and Multicasting: Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multcast socket options. **Raw Sockets**: Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program

Text Books:
1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI.

Reference Books:
1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

	L	**T**	**P**	**C**
VI SEMESTER : OPEN ELECTIVE - II	**3**	**-**	**-**	**3**
20CE6O01:: ENVIRONMENTAL POLLUTION AND CONTROL				

COURSE OUTCOMES:
Students are able to
CO1: Identify the air pollutant causes and control devices. (K2)
CO2: Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods. (K2)
CO3: Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city. (K2)
CO4: Know the causes for noise pollution and ISO14000 standards. (K2)
CO5: Know Treatment and management of hazardous waste. (K2))

UNIT -I : Air Pollution
Air pollution causes-control methods–particulate control devices – methods of controlling Gaseous Emissions – Air quality standards.

UNIT -II: Industrial wastewater Management
Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT -III : Solid Waste Management
Solid waste characteristics–basics of on-site handling and collection–separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of land filling.

UNIT -IV: Noise Pollution
Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000

UNIT -V: Hazardous Waste
Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Text books:
1. K. Sasi Kumar, S.A. Gopi Krishna ,"Solid Waste Management",PHI New Delhi,2014.
2. D. Srinivasan, "Environmental Engineering", PHI Learning Private Limited, New Delhi, 2011.

References books:
1. Ruth F. Weiner and Robin Matthews , 'Environmental Engineering', 4th Edition Elesevier, 2003.
2. J.G. Henry and G.W. Heinke,'Environmental Science and Engineering'– Pearson Education,2002
3. Mackenzie L Davis & David A Cornwell, "Environmental Engineering ',McGraw Hill Publishing,2002.
4. Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus,"Environmental Engineering", Mc-Graw-Hill Book Company, New Delhi, 1985.

E-Resources:
1. https://nptel.ac.in/courses/123105001

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CE6O02 :: DISASTER MANAGEMENT				

Course Outcomes:
Students are able to
CO1: Identify the tools of integrating disaster management principles in disaster mitigation process. (K2)
CO2: Discuss about different approaches needed to manage pre and post- disaster activities**.** (K2)
CO3: Prepare the process of risk management and develop a basic understanding method for the role of public in risk management. (K2)
CO4: Administer the role of technology in Disaster management. (K2)
CO5: Conclude the planning strategies for education and community preparedness programmes. (K2)

UNIT-I : Natural Hazards and Disaster management:
Introduction of DM – Inter disciplinary nature of the subject- Disaster Management cycle- Five priorities for action. Case study methods of the following: floods, draughts -Earthquakes- global warming, cyclones & Tsunamis- Post Tsunami hazards along the Indian coast - landslides.

UNIT-II: **Man Made Disaster and their management along with case study methods of the following**:
Fire hazards - transport hazard dynamics -Solid waste management- post disaster – Bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

UNIT-III: **Risk and Vulnerability**:
Building codes and land use planning - social vulnerability - environmental vulnerability - Macroeconomic management and sustainable development, climate change risk rendition - financial management of disaster - related losses.

UNIT-IV: **Role of Technology in Disaster managements**:
Disaster management for infra structures, taxonomy of infrastructure - treatment plants and process facilities- electrical substations- roads and bridges- mitigation programme for earth quakes -flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training transformable indigenous knowledge in disaster reduction.

UNIT-V: **Education and Community Preparedness**
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

Text Books:
1. Jagbir Singh , 'Disaster Management - Future Challenges and Opportunities' , I K International Publishing House Pvt. Ltd-2017
2. Tushar Bhattacharya, 'Disaster Science & Management', Tata McGraw Hill Education Pvt. Ltd., New Delhi.-2012.

References Books:
1. Prof. R.B. Singh , "Disaster Management and Mitigation", World Focus 2016.
2. Rajib shah & R. Krishnamurthy, 'Disater Management - Global Challenges and Local Solutions' Universities press-2009.
3. H K Gupta , **'**Disaster Management', Universities press-2003
E-resources
1. https://archive.nptel.ac.in/courses/105/104/105104183/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EE6O01 :: FUNDAMENTALS OF ELECTRIC VEHICLES				

COURSE OUTCOMES:
After successful completion of this course, students should be able to:

CO1: Illustrate different types of electric vehicles

CO2: Select suitable power converters for EV applications

CO3: Design HEV configuration for a specific application

CO4: Choose an effective method for EV and HEV applications

CO5: Analyse a battery management system for EV and HEV

UNIT-I: INTRODUCTION

Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles.

UNIT-II: COMPONENTS OF ELECTRIC VEHICLES

Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT-III: HYBRID ELECTRIC VEHICLES

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.

UNIT-IV: MOTORS FOR ELECTRIC VEHICLES

Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT-V: ENERGY SOURCES FOR ELECTRIC VEHICLES

Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it's working.

Text Books:

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Denton - Tom. Electric and hybrid vehicles. Routledge - 2020.

Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EC6O01 :: MOBILE COMMUNICATION AND IT'S APPLICATIONS				

COURSE OUTCOMES:

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

CO1. Design Hexagonal shaped cells and how these are implemented in real world.

CO2. Explain different types of antenna systems in mobile communication.

CO3. Analyze Hand offs and different types of hand offs and Dropped call rates and their evaluation.

CO4. Describe the Parameters of Mobile multi-path channels, Types of small scale fading.

 CO5: Implement real world applications

UNIT-I
INTRODUCTION :

Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs), A Simplified Reference Model, Applications.

UNIT-II
ELEMENTS OF MOBILE COMMUNICATIONS:

General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

UNIT-III
THE MOBILE CONCEPT :

 Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring.

UNIT-IV
MOBILE RADIO PROPAGATION :

Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-V:
FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:

Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

Textbooks:

1. Wireless Communications by Theodore S. Rappaport, principles and practice,2nd Editions.(**Unit-I, III, IV& V**)

2. Mobile Cellular Communication by Gottapu Sasibhushana Rao, Pearson International, 2012.

(UNIT - I, II, III &IV)

3. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2nd Edn., 2006. **(UNIT -V &VI)**

References:

1. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.

2. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O01 :: BASICS OF 3D PRINTING				

COURSEOBJECTIVES:
1. To explore technology used in additive manufacturing.
2. ToacquireknowledgeforselectingcorrectCADformatsinmanufacturingprocess.
3. To understand the operating principles and limitations of liquid, solid and laser based additive manufacturing system.
4. To design the process of additive manufacturing including tools used for design.
5. Toacquireknowledgeonimportantprocessparametersforbio-manufacturing

COURSEOUTCOMES:
After successful completion of this course, students should be able to:

CO1: To impart the fundamentals of Additive Manufacturing Technologies for engineering applications [K2].

CO2: Select and use correct CAD for mats in the manufacture of a3D printed part [K2].

CO3: Explain the operating principles, capabilities, and limitations of liquid, solid and laser based additive manufacturing system[K2].

CO4: Enumerate the design process for additive manufacturing including tools used for design and some features required for design [K2].

CO5: Describe the important process parameters for bio-manufacturing and determine the suitable additive technique for bio-manufacturing, aerospace and manufacturing engineering[K2].

UNIT I
INTRODUCTION
3D printing Overview, History, Need, Classification, Additive Manufacturing Technology in product development, Materials for Additive Manufacturing Technology.

UNIT II
REVERSE ENGINEERING
BasicConcept–3DScanning   Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology, Part Orientation and support generation, Model Slicing, Tool path Generation.

UNIT III
ADDITIVE MANUFACTURING SYSTEMS
SOLID& LIQUID BASED- Classification, Stereo lithography Apparatus (SLA) - Principle, process, advantages, Fused Deposition Modeling –Principle, process, advantages.
LASERBASED- Selective Laser Sintering–Principle, Process, advantages, Three Dimensional Printing –Principle, process, advantages – Laser Engineered Net Shaping (LENS).

UNIT IV
DESIGN FOR AM
Motivation, Design for Manufacturing and Assembly (DFMA)-concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM-Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts, Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/numbers etc.

UNIT V
APPLICATIONS OF 3D PRINTING
Customized implants and prosthesis: Design and development, Bio-Additive Manufacturing- Computer Aided Tissue Engineering (CATE), Applications of 3D Printing in Aerospace, Automotive, Manufacturing and Architectural Engineering.

Text Books:
1. Patri K. Venuvinod., and Weiy in Ma., Rapid prototyping Laser based and other Technologies, First Edition, Springer Science +Business Media, LLC, 2004.
2. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, Third Edition, World Scientific Publishers, 2016.
3. Gebhardt A, Rapid prototyping, Hanser Gardener Publications,2017.
4. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications, World Scientific Publishers, Fourth Edition of Rapid Prototyping, 2018.

Reference Books:
1. LiouL.W.and LiouF.W.,Rapid Prototyping and Engineering applications:A toolbox for prototype development, CRC Press, 2017.
2. Kamrani A.K. and Nasr E.A., Rapid   Prototyping: Theory and practice, Springer, 2016.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2015.

Web References:
1. https://all3dp.com/
2. https://www.thingiverse.com/
3. https://additivemanufacturing.com/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O02 :: FARM MACHINERY				

COURSE OBJECTIVES:

The objectives of this course are

1. To impart the students to understand the fundamentals of machinery in farming.
2. To enable the students to acquire knowledge on tillage and equipment used.
3. To introduce the students about various types of earth moving equipment.
4. To enable the students to acquire knowledge on seeding and spraying equipment.
5. To introduce the fundamentals of transplanting machinery and fertilizer equipment.

COURSE OUTCOMES:

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

CO1: Explain various types of machinery in farming. [K2]

CO2: Illustrate types of farm operation for craft cultivation with scientific understanding. [K2]

CO3: Explain various types of earth moving equipment. [K2]

CO4: Summarize various seeding methods and sprayer types. [K2]

CO5: Explain transplanting methods and fertilizer equipment. [K2]

UNIT I

FARM MECHANIZATION:

Farm mechanization- objectives of farm mechanization, sources of farm power, classification of farm machines. Materials of construction and heat treatment. principles of operation and selection of machines used for production of crops, Field capacities of different implements and their economics, Problems on field capacities and cost of cultivation

UNIT II

TILLAGE EQUIPMENT:

Tillage equipment - classification and types of tillage, Primary tillage implements-mould board plough and its parts, disc plough, and other ploughs, Secondary tillage equipment- disc harrows, Implements-cultivators, intercultural implements. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipment, Draft and unit draft related problems.

UNIT III

EARTH MOVING EQUIPMENT

Earth moving equipment - terminology, construction and their working principles, shovels, bulldozers, trenches and elevators.

UNIT IV

SEED DRILLS AND SPRAYER:

Seeding - methods, types of seed metering mechanism, types of furrow openers. Calibration of seed drills, Adjustment of seed drills – objectives, uses of plant protection equipment

Sprayers - types of sprayers and dusters, sprayer calibration and selection, Constructional features of different components of sprayers and dusters

UNIT V
TRANSPLANTING AND FERTILIZER:
Transplanting and fertilizer - transplanting methods, different types of transplanting machinery, working principle, adjustments in transplanting equipment
Fertilizer - application equipment, fertilizer meeting mechanism calibration of fertilizer equipment.

Text Books:
1. Fakir Chara Das, Kishore Chandra and Shishira Kanth, Farm Machinery and Equipment, 1st Edition, Akinik Publications, 2020.
2. Triveni Prasad Singh, Farm Machinery, 1st Edition, Prentice Hall India Pvt, Limited, 2016.
Reference Books:
1. Surendra Singh, Farm Machinery Principal And Applications, 1st Edition, ndian Council of Agricultural Research, 2017.
2. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2007.
Web Reference:
1. https://nptel.ac.in/courses/126105009

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EC6O01:: FUNDAMENTALS OF SOFTWARE ENGINEERING				

COURSE OUTCOMES:
At the end of the course, the student should be able to
CO1: Identify, formulate the various software engineering concepts
CO2: Different software development process models.
CO3: Analyze and specify software requirements with various stakeholders of a software development project
CO4: Apply systematic procedure for software design and deployment.
CO5: Compare and contrast the various testing methods and art of debugging

UNIT I:

SOFTWARE AND SOFTWARE ENGINEERING: The nature of Softwaree: Define software (Software Characteristics), Software Application Domains, **Software Engineering**: Definition, Llayered Technology, **Software Process:** Generic Process framework activities, Umbrella activities, Software Myths and Reality, Generic Process model, Capability Maturity Model Integration (CMMI).

UNIT-II:
PROCESS MODELS: Process Assessment and improvement. Prescriptive Process models: Waterfall Model, Incremental Process Model, Evolutionary Process Models: Prototyping, Spiral model, The Unified Process.Personal and Team process models: Personal software process (PSP), Team software process (TSP), Product and Process,

UNIT-III:
REQUIREMENTS ANALYSIS AND SPECIFICATION: Functional Requirements, Non- Functional Requirements, Software Requirements Document (Software Requirements Specification SRS), Requirements Specification, Requirements Engineering, Eliciting Requirements(elicitation), Developing Use cases, Validating Requirements, Requirements Management: Requirements Planning, Requirements Change management.

UNIT-IV:
SOFTWARE DESIGN: Design process, **Design concepts**: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information hiding, Functional independence, Refinement, Aspects, refactoring, Object oriented design concepts, Design classes.
The Design Model: Data Design Elements, Architectural Design elements, Designing Class Based Components: Basic Design Principles, Component-Level Design guidelines, Cohesion and coupling.
User Interface Design: The Golden Rules

UNIT-V:
TESTING: The strategies for Conventional Strategies: Unit Testing – Integration Testing. Test Strategies for Object-Oriented Software, Software testing fundamentals, white box testing- Basis path testing: Flow graph Notation, independent Program paths, Deriving test cases, Graph Matrices. control structure testing. black box testing: Graph Based Testing Methods, Equivalence Partitioning, Boundary value Analysis. Validation Testing, System Testing. Art of Debugging: The Debugging process.

Text Books:
1. Software Engineering, A practitioner's Approach- Roger S. pressman, 8th edition, McGraw-Hill international Edition, 2014.
2. Software Engineering, Ian Sommerville, 10th Edition, Pearson Education Asia, 2016.
Reference Books:
1. Software Engineering, Pankaj Jalote, A Precise Approach", Wiley India, 2010.
2. Systems Analysis and Design- Shely Cash man Rosenblatt, 9th Edition, Thomson publications, 2016.
3. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

NPTEL LINK:
1. https://nptel.ac.in/courses/106101061/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6O02 :: FUNDAMENTALS OF COMPUTER NETWORKS				

COURSE OUTCOMES

At the end of the course students are able to

CO1: Differentiate network reference models such as OSI, TCP/IP

CO2: Classify variousData Link Layer protocols such as sliding window.

CO3: Distinguish various MAC sublayer protocols such as ALOHA, CSMA, CSMA/CD

CO4: Differentiate Network layer protocols IPv4 and IPv6

CO5: Distinguish various Transport layer protocols and its applications

UNIT -I:

Data communication Components: Representation of data and its flow of networks, Categories of Networks, Various Connection Topologies, Protocols and Standards, OSI network model, TCP/IP Protocol suit, addressing

UNIT -II:

Physical Layer: Transmission Media: Guided Media, Unguided Media

Data Link Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC, Flow Control and Error control protocols: Stop and Wait, Go back – N ARQ, Selective Repeat ARQ

UNIT -III:

Medium Access Sub Layer: Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA. Controlled Access protocols: Reservation, Polling, Token passing

UNIT -IV:

Network Layer: IPv4 address: Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation (NAT) **IPv6 Addresses**: Structure, Address Space

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP)

UNIT -V:

Application layer:

Domain name system (DNS), E-mail, File Transfer Protocol (FTP), www and HTTP

Text Books:

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGrawHill, 2017
2. Computer Networks, 6th Edition, Andrew S. Tanenbaum, Pearson New International Edition, 2021.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India, 2007

Reference Books:

1. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
2. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20BM6O01 :: STRESS AND WORK LIFE MANAGEMENT				

COURSE OUTCOMES
At the end of the course students are able to
CO1: Analyze work-related stress and Explore individual stress.
CO2: Understand time management and its importance and apply time management techniques.
CO3: Identify the benefits of work-life balance for employee.
CO4: Understand the role of group cohesion and team spirit.
CO5: Analyze how to improve Self-Development like Improving Personality, Leading with Integrity, Enhancing Creativity, Effective Decision Making and Sensible Communication.

UNIT-I:
Understanding stress: Meaning – Symptoms – Works Related Stress – Individual Stress –Reducing Stress – Burnout. Setting to Stress- Stress: Meaning - Approaches to stress, Good Stress Vs Bad Stress, The individual and work.

UNIT-II:
Common stress factors time & career plateauing**:** Time Management – Techniques – Importance of planning the day – Time management schedule – Developing concentration – Organizing the Work Area – Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say 'No

UNIT-III:
Introduction to Work-Life Balance - Importance of Work-Life Balance - Benefits of Work-Life Balance to Employees - Benefits of Work-Life Balance for Organization - Effects of Poor Work-Life Balance on Employees - Relation between Work-Life Balance & Stress - Outline for Work-Life Balance Planning- Approaches to Work-Life Balance planning - Process of Work-Life Balance - Steps of Work-Life Balance Planning

UNIT-IV:
Work place humour**:** Developing a sense of Humour – Learning to laugh – Role of group cohesion and team spirit – Using humour at work – Reducing conflicts with humour.

UNIT-V:
 Self-development: Improving Personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Meditation for peace – Yoga for Life. Organization and Stress Management - Recognize the signs, Approaches to the problem, Providers Assistance.

References
1. Cooper, Managing Stress, Sage, 2011
2. Waltschafer, Stress Management, Cengage Learning, 4th Edition 2009.
3. Jeff Davidson, Managing Stress, Prentice Hall of India, New Delhi, 2012.
4. Juan R. Alascal, Brucata, Laurel Brucata, Daisy Chauhan. Stress Mastery. Pearson
5. Argyle. The Psychology of Happiness. Tata McGraw Hill. 2012.
6. Bartlet. Stress – Perspectives & Process. Tata McGraw Hill. 2012.
7. Handbook on Work –Life Balance-A New Approach, 2017, Dr. C Swarnalatha,Mrs.S. Rajalakshmi,Lulu Press.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20BM6O02 :: BANKING AND INSURANCE				

COURSE OUTCOMES
At the end of the course students are able to
CO1: Understand the fundamentals of banking
CO2: Familiarize with insurance concepts including risk management, insurance policies, and the roles of insurers and policyholders.
CO3: Explore banking services such as savings and checking accounts, loans, credit cards, and electronic banking services.
CO4: Examine insurance products including life insurance, property insurance, health insurance, and liability insurance.
CO5: Understand regulatory frameworks such as central banks, financial regulators, and insurance commissions.

UNIT -I:
Origin of banking: Definition, Types of deposits, Origin, and growth of commercial banks in India. India's Approach to banking Sector Reforms, International security standards in banking, Global Financial Crisis and India's banking Sector.

UNIT -II:
Introduction to E-Banking-Impact of Information Technology on Banking Changing Financial Environment and IT as a strategic response Hardware and Software.

UNIT -III:
Delivery Channels-ATM, EFTPOS, Phone Banking, Internet Banking, SMS Banking, Mobile Banking, Credit/Debit Cards, Smart Cards E-Commerce-Secure Electronic Transfer (SET), Payment Gateways (Credit card/Debit cards), Authentication of payments, etc.

UNIT -IV:
Principles and Practice of Insurance-Introduction to Risk and Insurance, Types of Insurance-General and Life, Basic principles of General and Life Insurance,

UNIT -V:
General insurance products, underwriting concepts, standard conditions and warranties with respect to Fire, Marine, Motor, Engineering and Miscellaneous products.

Reference Books:
1. Agarwal, OP, Banking & Insurance, Himalaya Publishing House, Mumbai
2. George E Rejda, Principles of Risk Management & Insurance, Pearson Education, New Delhi
3. Balachandran S., General Insurance, Insurance Institute of India, Mumbai
4. Arthur C., William Jr., Michael Smith, Peter Young, Risk Management and Insurance, Tata McGraw Hill Publishing Company, New Delhi
5. Tripathy Nalini Prava & Prabir Pal, Insurance Theory & Practice, Prentice Hall of India Pvt. Ltd., New Delhi
6. Balachandran S., Life Insurance, Insurance Institute of India, Mumbai

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	**-**	**-**	**3**
20MA6O01 :: OPERATION RESEARCH				

COURSE OBJECTIVES:
1. Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, machines etc) more effectively.
2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in Industry.

COURSE OUTCOMES:
Students can able to
CO1: Formulate the resource management problem and identify appropriate methods to solve them. [K3]
CO2: Apply transportation model to optimize the industrial resources. [K3]
CO3: Solve sequencing problems using operation research techniques. [K3]
CO4: Apply the replacement model to increase the efficiency of the system. [K3]
CO5: Apply the inventory and queuing model to increase the efficiency of the system. [K4].

UNIT -I: LINEAR PROGRAMMING:
Introduction**-**General formulation LPP- Formulation of LP problems - Graphical solution –Slack and Surplus and Artificial variables-simplex method (simple problems) - artificial variable techniques – twophase method, Big-M-method(simple problems) –Concept of Duality-general rules for converting any primal into its dual.

UNIT -II: TRANSPORTATION PROBLEM:
Introduction-mathematical formulation-Feasible, Basic Feasible and Optimum solution -Methods for initial basic feasible solution to transportation problem-optimal Test by u, v method(MODI)-Degeneracy in Transportation problems –.Unbalanced Transportation problems

UNIT -III: SEQUENCING PROBLEM:
Introduction –Johnson's Algorithm for n jobs 2 machines- Optimal Solution for processing n jobs through two machines- processing n jobs through three machines - processing n jobs through m machines - processing two jobsthrough m machines

UNIT -IV: REPLACEMENT PROBLEMS:
Introduction – replacement policy for items whose maintenance cost increases with time, and money value is constant – Money value, present worth Factor and Discount Rate- replacement policy when maintenance cost increases with time and money valuechanges with constant rate – Individual Replacement Policy-group replacement of items that fail completely.

UNIT -V: WAITING LINES:
Introduction- transient and steady states-Probability Distributions in Queening systems-Kendall's notation for Representing Queening models- Single channel-Poisson arrivalsExponential service times-with infinitepopulation model (M/M/1: FIFO/∞/∞)
INVENTORY:
Introduction – types of inventory models – Costs involved in Inventory problems-Variables in inventory problem-Classification of Inventory Models-Concept of EOQ-The EOQ model without shortage – Quantity Discounts-purchase inventory models with one price break - purchase inventory models with two price breaks- purchase inventory models with any number of price breaks-shortages are not allowed

Text Books:
1. Operations Research / S.D.Sharma, Ramnath co,Meerut
2. Operations Research, P.K.Gupta, D.S.Hira,S.Chand
Reference Books:
1. Operations Research /A.M.Natarajan,P.Balasubramani, A.Tamilarasi/PearsonEducation.
2. Operations Research / R. Pannerselvam, PHI Publications.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O01 :: INTRODUCTION TO CLOUD COMPUTING				

COURSE OUTCOMES:

Upon completion of the course, it is expected that student will be able to:

CO1: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2: Learn the key and enabling technologies that help in the development of cloud.

CO3: Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

CO4: Explain the core issues of cloud computing such as resource management and security.

CO5: Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

UNIT-I:

Introduction: Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud – On-Demand Provisioning.

UNIT-II:

Cloud Enabling Technologies: Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery.

UNIT-III:

Cloud Architecture, Services And Storage: Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, IaaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, S3.

UNIT-IV:

Resource Management And Security In Cloud: Inter Cloud Resource

Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

UNIT-V:

Cloud Technologies And Advancements: Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation.

Text Books:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Morgan KaufmannPublishers.
2. Cloud Computing: Implementation, Management and Security, Rittinghouse, John W., and James F. Ransome, CRCPress.

References:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Tata McgrawHill.
2. Cloud Computing - A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Tata McGrawHill.
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), George Reese, O'Reilly.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O02 :: E-COMMERCE				

COURSE OUTCOMES

After the completion of the course the students are able to

CO1: Define the fundamentals E-commerce framework.

CO2: Explain the basics of Consumer Oriented Electronic models.

CO3: Distinguish different electronic payment systems and their issues.

CO4: Demonstrate Inter-organizational and intra-organizational electronic commerce.

CO5: Explain advertising and marketing on the Internet, consumer search and resource discovery and key multimedia concepts.

UNIT-I:

Electronic Commerce-Frame work, 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:

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks. 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.

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Text Books:

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

References Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, TharamDillon,Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
3. Electronic Commerce – Gary P.Schneider – Thomson.
4. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver.

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6J01 :: AWS CLOUD PRACTITIONER				

COURSE OUTCOMES:
After completing this course, students should be able to
CO1: Define AWS cloud and identify the Global Infrastructure components of AWS.
CO2: Demonstrate when to use Amazon EC2, AWS Lambda and AWS Elastic Beanstalk.
CO3: Differentiate Storage Services and demonstrate when to use AWS Database services.
CO4: Demonstrate Networking and Content Delivery Services.
CO5: Understand the Cloud economics and security.

UNIT -I:
CLOUD CONCEPTS OVERVIEW – Introduction to cloud computing, Cloud service models, Cloud computing Deployment models , Advantages of the cloud, Introduction to AWS.
AWS GLOBAL INFRASTRUCTURE OVERVIEW: AWS GLOBAL INFRASTRUCTURE, AWS Services and Service categories

UNIT -II:
COMPUTE – Compute services overview, Amazon EC2, Amazon EC2 pricing models, Benefits, use cases, four pillars of cost optimization, Container services, Introduction to AWS Lambda, Benefits of Lambda, Introduction to AWS Elastic Beanstalk, Benefits.

UNIT III:
STORAGE: Amazon Elastic Block Store (EBS), Amazon Simple Storage Service (Amazon S3), Amazon Elastic File System (Amazon EFS), Amazon Simple Storage Service Glacier (Amazon S3 Glacier).

DATABASES: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon RedShift, Amazon Aurora.

UNIT IV:
Networking and Content Delivery: Networking Basics, Amazon VPC, VPC Networking, VPC SECURITY, Amazon ROUTE-53, Amazon Cloud Front

UNIT V:
CLOUD ECONOMICS AND BILLING: Fundamentals of pricing, AURI,PURI,NURI ,Total cost of Ownership (TOC).
AWS CLOUD SECURITY: AWS Shared Responsibility Model, AWS IAM (Identity and Access Management),Elastic Load Balancing (ELB), Amazon CloudWatch.

Web references and AWS LMS portal :
https://aws.amazon.com/ec2
https://aws.amazon.com/ecs/
https://aws.amazon.com/about-aws/global-infrastructure/

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	**-**	**-**	**3**
20CS6J02 :: SOFTWARE TESTING TOOLS				

COURSE OUTCOMES:

At the end of the course students are able to

CO1: learn Manual testing techniques and software test levels

CO2: practice Java Programme for Selenium and Test frame works

CO3: learn Apache JMeter and Building a JMeter Test Plan

CO4: Running Multiple Scripts with JMeter and Different Types of JMeter Test Plans

CO5: Practicing JIRA and Test Management In JIRA (Using Zephyr Plug-in)

UNIT-I:

Manual Testing : Software Development Life Cycle (Requirements Gathering, Analysis and Planning, Software Design, Coding/Implementation, Testing, and Release and Maintenance Phase)

Software Test Levels (Unit Testing, Integration Testing, System Testing, and Acceptance Testing)

Software Test Types

Software Test Design Techniques

Software Test Life Cycle

Software Documents

Software Testing Standards

Software Testing certification/s

UNIT-II:

'Selenium with Java' : Java Programme for Selenium (Data Types, Variables, Operators, Control Flow, Strings, Arrays, IO, Methods, Exception Handling, and Object-Oriented Programming.)

- Selenium WebDriver (Web/HTML Elements, Inspecting Web Elements, Locating Elements, Selenium WebDriver API commands, Wait statements, and Page Object Model.
- TestNG Testing Framework (Create Test cases, Prioritise Test cases, Grouping Test Cases, Batch Testing, and Generating Test Results.)
- Automation Framework

UNIT-III:

JMeter:

- Introduction to Apache JMeter
- Elements of JMeter Test Plan
- Building a JMeter Test Plan
- Recording Tests Using JMeter
- Enhancements in Test Scripts

UNIT-IV:

JMeter Result Analysis

- Running Multiple Scripts with JMeter
- Different Types of JMeter Test Plans
- JMeter Distributed (Remote) Testing
- JMeter Functions, Variables and Regular Expressions
- JMeter Best Practices

UNIT-V:
Jira Tool Syllabus:
- Introduction of JIRA
- Getting started with JIRA
- Test Management In JIRA (Using Zephyr Plug-in)
- Defect Management In JIRA
- Advanced Search Using JQL
- Generating Reports In JIRA

Web References:
1. https://www.lambdatest.com/blog/selenium-with-java/
2. https://www.gcreddy.com/2021/09/apache-jmeter-syllabus.html
3. https://www.javatpoint.com/jira-tutorial

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6J01 :: FULL STACK DEVELOPMENT				

COURSE OUTCOMES:

At the end of the course students will be able to,
CO1: Identify the Basics concepts of Web Page and Markup Languages
CO2: Develop web Applications using Scripting languages and Frameworks
CO3: Creating and Running Applications using PHP
CO4: Creating First Controller Working with and Displaying in AngularJS and Nested Forms with ng-form
CO5: Working with the Files in React JS and Constructing Elements with Data

UNIT -I: HTML

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols- The World Wide Web-HTTP request message-response message-Web clients Web Servers. Markup Languages: XHTML, an introduction to HTML, History, Versions, Basics, XHTML Syntax and semantics some fundamentals of HTML Elements-Relative URLs-Lists-Tables-Frames-Forms-HTML 5.0

UNIT -II: Cascading Style Sheets (CSS)

Style Sheets: CSS-Introduction to Cascading Style Sheets- Features-Core Syntax-Style Sheets and HTML-Style Rule Cascading and Inheritance- Text Properties-Box Model Normal Flow Box Layout beyond the Normal Flow-CSS3.0, Introducing to Java Script, JavaScript basics, JavaScript objects, JSON.

UNIT -III: PHP

Introduction to PHP, Language Basics, Functions, Strings, Arrays. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables, Selecting Data from a Table, Updating Table, Deleting data from Table, Webpage creation.

UNIT -IV: Angular JS

Introducing Angular JS, Starting out with Angular JS, Basic AngularJS, Directives and Controllers, AngularJS Modules, Creating First Controller, working with and Displaying, Arrays, more Directives, working with ng-repeat, Unit Testing in AngularJS, Forms, inputs and Services, Working with ng-model, Working with Forms, Leverage Data-Binding and Models, Form Validation and States, Error Handling with Forms, ngModelOptions, Nested Forms with ng-form, Other Form Controls.

UNIT -V: React JS

Introduction to react, Obstacles and Roadblocks, keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, React DOM, Children, Constructing Elements with Data, React Components, DOM Rendering , Factories

Text Books:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
3. Brad Green, Shyam Seshadri, AngularJS, Up and Running Enhanced Productivity with Structured Web Apps, Publisher O'Reilly Media
4. Alex Banks, Eve Porcello,Learning React, Functional Web Development with React and Redux Publisher O'Reilly Media

Reference Books:

1. Bert Bates, Kathy Sierra,Head First Java, 2nd Edition Publisher O'Reilly Media, Inc

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6J02 :: BLOCK CHAIN TECHNOLOGY				

COURSE OUTCOMES

After the completion of the course the students are able to

CO1: Discover the secure and efficient transactions with crypto-currencies

CO2: Experiment with cryptocurrency trading and crypto exchanges

CO3: Explain bitcoin usage and applications

CO4: Develop private block chain environment and develop a smart contract on Ethereum

CO5: Build the hyper ledger architecture and the consensus mechanism applied in the hyper ledger.

UNIT -I:

CRYPTOCURRENCY AND BLOCKCHAIN- INTRODUCTION:

Blockchain- An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains

UNIT -II:

CRYPTO CURRENCIES: Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks

UNIT -III:

BITCOIN: Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

UNIT -IV:

ETHEREUM: The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console

UNIT -V:

HYPERLEDGER: Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Block chain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

Text Books:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018
2. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016.

Online References:

1. https://www.coursera.org/learn/ibm-blockchain-essentials-for-developers
2. https://museblockchain.com/
3. https://www.provenance.org/
4. https://www.coursera.org/learn/blockchain-basics
5. https://steemit.com/
6. https://101blockchains.comhttps://followmyvote.com/

	L	T	P	C
VI SEMESTER	**0**	**0**	**3**	**1.5**
20CS6L01 :: DEEP LEARNING LAB				

COURSEOUTCOMES:
At the end of the course, the student will be able to,
CO1: Understand the implementation procedures for the Deep Learning algorithms.
CO2: Design python programs for various learning algorithms.
CO3: Apply appropriate data sets to the Deep Learning algorithms.
CO4: Identify and apply Deep Learning algorithms to solve real world problems.
CO5: Apply various Deep Learning algorithms for various applications.

LIST OF EXPERIMENTS:

1. 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

2. Implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

3. Implement a single neural network and test for different logic gates.

4 Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets

5. Implement Lasso regression model to predict house price

6. Implement Ridge regression model to predict house price

7. Develop simple Neural Network Example with Tensorflow

8. Develop a small application   with keras

9. Implement a model to classify handwritten Digits   with Tensorflow

10 .Implement   a LSTM model to stock market prediction

11. Implement Convolution Neural Network

12. Implement Alex net model

13. Implement CNN model for image classification

VI SEMESTER	L	T	P	C
	-	-	3	1.5
20AM6L02 :: CLOUD ARCHITECTURE AND SERVICES LAB				

COURSE OUTCOMES:
At the end of this course, students are able to

CO1: Understand the concept and usage of cloud environment

CO2: Configure various virtualization tools such as Virtual Box, VMware workstation

CO3: Install and use a generic cloud environment that can be used as a private cloud

CO4: Learn how to simulate a cloud environment to implement new schedulers.

CO5: To learn the design and development process involved in creating a cloud based application

LIST OF EXPERIMENTS:

1. Create an word document of your class time table and store locally and on cloud with doc and pdf format.

2. Implementation of Virtualization in Cloud Computing to Learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System

3. Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

4. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

5. Write a Google app engine program to generate n even numbers and deploy it to Google cloud.

6. Google app engine program multiply two matrices.

7. Google app engine program to validate user; create a database login(username, password)in mysql and deploy to cloud.

8. Write a Google app engine program to display nth largest no from the given list of numbers and deploy it in Google cloud.

9. Google app engine program to validate the user use mysql to store user info and deploy on to cloud.

10. Implement prog1-5 using Microsoft Azure.

11. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.

VI SEMESTER	**L**	**T**	**P**	**C**
	-	**-**	**3**	**1.5**
20AM6L03 :: R-PROGRAMMING LAB				

Prerequisites:

Any Programming Language.

COURSE OUTCOMES :

At the end of the Course, the Student will be able to:

CO1: Setup R Programming Environment.

CO2: Understand and use R – Data types.

CO3: Understand and use R – Data Structures.

CO4: Develop programming logic using R – Packages.

CO5: Analyze data sets using R – programming capabilities

LIST OF EXPERIMENTS:

1. Download and install R-Programming environment and install basic packages using install.packages() command in R.

2. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.)

3. Write a program to find list of even numbers from 1 to n using R-Loops.

4. Create a function to print squares of numbers in sequence.

5. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.

6. Implement different String Manipulation functions in R.

7. Implement different data structures in R (Vectors, Lists, Data Frames)

8. Write a program to read a csv file and analyze the data in the file in R.

9. Create pie chart and bar chart using R.

10.   Create a data set and do statistical analysis on the data using R.

Text Book:

1. Norman Matloff, The Art of R Programming, UC Davis 2009.

Web Reference:

1. https://www.r-project.org/

VI SEMESTER	L	T	P	C
	-	-	4	2
20AM6S01 :: NATURAL LANGUAGE PROCESSING LAB				

COURSE OUTCOMES:

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

CO1: Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.

CO2: Develop speech-based applications that use speech analysis (phonetics, speech recognition, and synthesis).

CO3: Analyze the syntax, semantics, and pragmatics of a statement written in a natural language.

CO4: Develop a conversational agent that uses natural language understanding and generation.

CO5: Apply machine learning algorithms to natural language processing.

LIST OF EXPERIMENTS:

1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming).

2. Morphological Analysis.

3. N-gram model

4. POS tagging

5. Chunking

6. Named Entity Recognition

7. Virtual Lab on Word Generator

   Demonstrate Any NLP Application

VII SEMESTER	L	T	P	C
	2	-	-	-
20BM6M01 :: PREOFESSIONAL ETHICS AND INTELLECTUAL PROPERTY				

COURSE OUTCOMES:
At the end of the course, the student will be able to,

CO1: Identify the professional roles played by an engineer and illustrate the process of Social experimentation

CO2: Determine Engineer's responsibilities and rights towards the society

CO3: Analyze various aspects of Intellectual Property Rights and recognize the process of protecting the copyrights

CO4: Describe the registration process of Patents and trademarks

CO5: Demonstrate the concept of trade secrets and cybercrimes.

UNIT -I:
ENGINEERING ETHICS:
Importance of Engineering Ethics-–Professional and Professionalism –Professional Roles to be played by an Engineer –Professional Ethics.

UNIT -II:
ENGINEERING AS SOCIAL EXPERIMENTATION :
Role of engineering in knowledge society- Knowledge acquired – Conscientiousness – Relevant Information Engineers as Managers, Consultants, and Leaders.
ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK: Role and importance of Safety and risk Types of Risks –Threshold Levels for Risk– Risk Benefit Analysis.

UNIT -III:
ENGINEERS' RESPONSIBILITIES AND RIGHTS:
Collegiality-Conflict of Interest-solving conflict problems – Ethical egoism-Collective bargaining -
Confidentiality-Acceptance of Bribes/Gifts--Occupational Crimes-industrial espionage-Whistle Blowing types of whistle blowing.

UNIT -IV:
INTELLECTUAL PROPERTY AND COPY RIGHTS:
Introduction to Intellectual Property Law - Types of Intellectual Property – Infringement, Copyrights: Introduction to Copyrights – Principles of Copyright – Rights Afforded by Copyright Law –Copyright Formalities and Registration.

UNIT -V:
PATENTS AND TRADEMARKS:
Introduction to Patent Law –Rights under Patent Law – Patent Requirements – Patent Application Process and Granting of Patent – Double Patenting – Patent Cooperation Treaty. Trademarks:Introduction to Trade Mark – Trade Mark Registration Process – Trade Markmaintenance – Likelihood of confusion

Text Books:
1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar- "Engineering Ethics and Human Values" by PHI Learning Pvt. Ltd-2009.
2. Deborah E.Bouchoux, "Intellectual Property". Cengagelearning , NewDelhi, BS Publications (Press)
3. PrabhuddhaGanguli,' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi.

VII SEMESTER PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20AM7E01 :: BLOCK CHAIN TECHNOLOGIES				

COURSE OBJECTIVES:
To understand block chain technology and Crypto currency works

COURSE OUTCOMES:
After the completion of the course, student will be able to
CO1: Demonstrate the block chain basics, Crypto currency.
CO2: To compare and contrast the use of different private vs. public block chain and use cases.
CO3: Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins.
CO4: Classify Permission Block chain and use cases – Hyper ledger, Corda.
CO5: Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others.

UNIT -I:
Introduction: Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Crypto currency, How a Crypto currency works, Financial services, Bitcoin prediction markets.

UNIT II:
Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment

UNIT III:
Introduction to Bitcoin: Bitcoin Block chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics, Bit coin MOOCs.

UNIT IV:
Ethereum continued, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency

UNIT V:
Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems.

Text Books:
1. Blockchain Blue print for Economy by Melanie Swan

Reference Books:
1. Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition, by Daniel Drescher.

VII SEMESTER PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20AM7E02 :: REINFORCEMENT LEARNING				

COURSE OBJECTIVE:

1. Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

COURSE OUTCOMES:

CO1: Understand basic concepts of Reinforcement learning.

CO2: Identifying appropriate learning tasks for Reinforcement learning techniques

CO3: Understand various methods and applications of reinforcement learning.

CO4: Understanding the RL framework: Gain a deep understanding of the fundamental components of RL.

CO5: Study and implement various RL algorithms.

UNIT -I:

Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe

Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Non stationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm

UNIT -II:

Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions,

Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNIT -III:

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step Q(σ)

UNIT -IV:

Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance

Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)

UNIT -V:

Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization for Continuous Actions

Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double.

Text Books:

1. Reinforcement Learning An Introduction By Richard S. Sutton, Andrew G. Barto 2018.

2. Foundations of Deep Reinforcement Learning Theory and Practice in Python By Laura Graesser, Wah Loon Keng · 2019

VII SEMESTER PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20CS7E01 :: CRYPTOGRAPHY AND NETWORK SECURITY				

COURSE OBJECTIVES:

The main objectives of this course are to explore the working principles and utilities of various crypto-graphic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Explain different security threats and countermeasures and foundation course of cryptography mathematics.

CO2: Classify the basic principles of symmetric key algorithms and operations of some symmetric key algorithms and asymmetric key cryptography

CO3: Revise the basic principles of Public key algorithms and Working operations of some Asymmetric key algorithms such as RSA, ECC and some more

CO4: Design applications of hash algorithms, digital signatures and key management techniques

CO5: Determine the knowledge of Application layer, Transport layer and Network layer security Protocols such as PGP, S/MIME, SSL,TSL, and IPsec.

UNIT -I:

Basic Principles: Security Goals, Security Attacks,Security Services,Security Mechanisms, Symmetric Cipher Model,Substitution Techniques,Transposition Technique, Phishing and Defensive Measure,Web-Based Attacks,Structured Query Language(SQL) Injection attacks.

UNIT -II:

Traditional Block Cipher Structure:Stream Cipher and Block Cipher.
 Symmetric Encryption: Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard,IDEA(International Data Encryption Algorithm),Advanced Encryption Standard.

UNIT -III:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography,Asymmetric Key Cryptography, RSA Algorithm,Algorithm for Diffe-Hellman Key Exchange,Elliptic Curve Cryptography.

UNIT -IV:

Data Integrity, Digital Signature Schemes & Key Management:Hash Function, Applications of Cryptographic Hash Functions,SHA(Secure Hash Algorithm),Message Integrity and Message Authentication, , Digital Signature, Key Management and Distribution.

UNIT -V:

Network Security-I: Remote User Authentication Principles,Kerberos,Web Security
 ,Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, Network Security-II: Secure Shell(SSH),Security at the Network Layer: IPSec, System Security

Text Books:
1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb deep Mukhopadhyay, McGraw Hill,2015
2. Cryptography and Network Security,4th Edition, William Stallings, (6e) Pearson,2006
3. Everyday Cryptography, 1st Edition, Keith M.Martin, Oxford,2016

Reference Books:
1.   Network Security and Cryptography, 1st Edition, Bernard Meneges, Cengage Learning,2018.

VII SEMESTER PROFESSIONAL ELECTIVE-III	L	T	P	C
	3	-	-	3
20EC7E03 :: SPEECH PROCESSING				

COURSE OUTCOMES:
Upon completion of the course, students will be able to:

CO1: Illustrate the speech production system and describe the time domain methods.(K1,K3)

CO2: Describe the frequency domain methods in speech processing (K1)

CO3: Explain the linear predictive analysis of speech processing.(K2)

CO4: Develop various speech enhancement techniques.(K3)

CO5: Understanding the basics of speech production and perception(K4)

UNIT- I: SPEECH PRODUCTION:
Speech signal; Speech Production process: Lungs, Larynx and Vocal folds, Vocal tract; Acoustic Phonetics: Vowels, Diphthongs, Semi vowels, Nasals, Unvoiced fricatives, Voiced fricatives, Voiced and unvoiced stops; Acoustic theory of speech production; Digital model for speech signals.

UNIT-II: TIME DOMAIN METHODS FOR SPEECH PROCESSING:
Time domain parameters of Speech signal, Methods for extracting the speech parameters (Energy, Average Magnitude, Zero crossing Rate), Silence Discrimination using Zero crossing Rate and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

UNIT-III : FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING:
Short-Time Fourier Transform (STFT), Sampling the STFT in Time and Frequency, The Speech Spectrogram, homomorphic speech analysis: homomorphic systems for convolution, Definition of the Cepstrum and complex Cepstrums, pitch extraction using homomorphic speech processing.

UNIT-IV: LINEAR PREDICTIVE ANALYSIS OF SPEECH:
Linear prediction of speech, auto correlation, formulation of Linear prediction coding equations, Solution of Linear prediction coding equations, Levinson Durbin recursion, Application of Linear prediction coding parameters: Pitch detection using Linear prediction coding parameters, Deriving acoustic parameters PLPs, LPCCs, and MFCCs from LPCs

UNIT-V: SPEECH ENHANCEMENT:
Nature of Interfering Sounds; Speech Enhancement (SE) Techniques: Basic principles of Spectral Subtraction; Wiener Filtering; Wiener filtering for noise reduction; Statistical-Model-based method: Maximum-likelihood estimator for speech enhancement; Applications of speech enhancement.

Text Books
1. Lawrence R. Rabiner and Ronald W. Schafer, "Introduction to Digital Speech Processing" now Publishers Inc. Hanover, USA, 2007.
2. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Ed., PE, 2008.
3. Philipos C. Loizou, "Speech Enhancement" 2ndEdition, CRC Press, Taylor & Francis Group, 2013

References
1. Douglas O Shaughnessy, "Speech Communications Human and Machine" 2nd Edition, IEEE Press, 2000.
2. Speech and Audio Signal Processing, Processing and Perception of Speech and Music- Ben Gold and Nelson Morgan, Wiley- India Edition, 2006.

VII SEMESTER PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20AM7E03 :: NOSQL DATABASES				

COURSE OBJECTIVE:
The student will be able to
1. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

COURSE OUTCOMES:
At the end of the course, student will be able to
CO1: Discuss about Aggregate Data Models
CO2: Explain about Master-Slave Replication, Peer-to-Peer Replication
CO3: Describe the Structure of Data, Scaling, Suitable Use Cases
CO4: Make use of Complex Transactions Spanning Different Operations
CO5: Identify Routing, Dispatch and Location-Based Services

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, Multi operation 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, No SQL Distilled: A Brief Guide to the Emerging world of polyglot persistence, Pearson Addision Wesley,2012.

Reference Books:
1. Dan Sullivan, "NoSQL for Mere Mortals", 1st Edition Pearson Education India, 2015.(ISBN 13: 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-Power full and scalable data storage", 2nd Edition, O'Reilly publications,2013. (ISBN-13:978-9351102694).

	L	**T**	**P**	**C**
VII SEMESTER PROFESSIONAL ELECTIVE-IV	**3**	**-**	**-**	**3**
20AM7E04 :: ROBOTIC PROCESS AUTOMATION				

COURSE OUTCOMES:
At the end of the course, the student will be able to,

CO1: Describe RPA, where it can be applied and how it's implemented.

CO2: Describe the different types of variables, Control Flow and data manipulation techniques.

CO3: Identify and understand Image, Text and Data Tables Automation.

CO4: Describe how to handle the User Events and various types of Exceptions and strategies.

CO5: Understand the Deployment of the Robot and to maintain the connection.

UNIT I:
Introduction to Robotic Process Automation: Scope and techniques of automation, Robotic process automation, What can RPA do, Benefits of RPA, Components of RPA, RPA platforms, The future of automation.

RPA Basics: History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated, RPA Advanced Concepts, Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team, Process Design Document/Solution Design Document, Industries best suited for RPA, Risks & Challenges with RPA, RPA and emerging ecosystem.

UNIT II:
RPA Tool Introduction and Basics:

Introduction to RPA Tool: The User Interface, Variables, Managing Variables, Naming Best Practices, The Variables Panel, Generic Value Variables, Text Variables, True or False Variables, Number Variables, Array Variables, Date and Time Variables, Data Table Variables, Managing Arguments, Naming Best Practices, The Arguments Panel, Using Arguments, About Imported Namespaces, Importing New Namespaces, Control Flow, Control Flow Introduction, If Else Statements, Loops, Advanced Control Flow, Sequences, Flowcharts, About Control Flow, Control Flow Activities, The Assign Activity, The Delay Activity, The Do While Activity, The If Activity, The Switch Activity, The While Activity, The For Each Activity, The Break Activity, Data Manipulation, Data Manipulation Introduction, Scalar variables, collections and Tables, Text Manipulation, Data Manipulation, Gathering and Assembling Data

UNIT III:
Advanced Automation Concepts & Techniques: Recording Introduction, Basic and Desktop Recording, Web Recording, Input/ Output Methods, Screen Scraping, Data Scraping, Scraping advanced techniques, Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors, RPA Challenge, Image, Text & Advanced Citrix Automation, Introduction to Image & Text Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps, Excel Data Tables & PDF, Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF.

UNIT IV:
Handling User Events & Assistant Bots, Exception Handling: What are assistant bots, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger, Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event.

Exception Handling: Debugging and Exception Handling, Debugging Tools, Strategies for solving issues, Catching errors.

UNIT V:
Deploying and Maintaining The Bot: Publishing using publish utility, Creation of Server, Using Server to control the bots, Creating a provision Robotfrom the Server, Connecting a Robot to Server, Deploy the Robot to Server, Publishing and managing updates, Managing packages, Uploading packages, Deleting packages.

Text Books:
1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

Reference Books:
1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation:a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate RepetitiveTasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. Srikanth Merianda, "Robotic Process Automation Tools, Process Automation and their benefits:Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots andautomate business processes", Packt Publishing, 1st Edition 2018.

Web References:
1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

VII SEMESTER PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20AM7E05 :: VIDEO ANALYTICS				

COURSE OBJECTIVES:
The main objectives of the course is to make student understand the need for video Analytics, the basic configuration of video analytics, the functional blocks of a video analytic system and to get exposed to the various applications of video analytics

COURSE OUTCOMES:
At the end of the course, the student should be able to:

CO1: Design video analytic algorithms for security applications

CO2: Design video analytic algorithms for business intelligence

CO3: Design custom made video analytics system for the given target application

CO4: Understanding of the principles and concepts underlying video analytics**.**

CO5: Understand how preprocessing techniques can improve the accuracy and reliability of video analytics
algorithms

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

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

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

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

UNIT -V:
Video Analytics For Business Intelligence & Traffic Monitiring And Assistance: Customer behavior analysis, people counting, Traffic rule violation detection, traffic congestion identification for route planning, driver assistance, lane change warning

Text Books:
1.   Graeme A. Jones, Nikos Paragios, Carlo S. Regazzoni, "Video-Based Surveillance Systems: Computer Vision and Distributed Processing", Kluwer academic publisher, 2001
2.   Nilanjan Dey, Amira Ashour and Suvojit Acharjee, "Applied Video Processing in Surveillance and Monitoring Systems", (IGI global) 2016

Reference Books:
1.   Zhihao Chen, Ye Yang, Jingyu Xue, Liping Ye, Feng Guo, "The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite", CreateSpace Independent Publishing Platform, 2014
2.   Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.

VII SEMESTER PROFESSIONAL ELECTIVE-IV	L	T	P	C
	3	-	-	3
20IT7E05 :: BIG DATA ANALYTICS				

COURSE OUTCOMES
After the completion of the course the students are able to
CO1: Explain the basic concepts of Big Data and Big Data Analytics
CO2: Understand the HDFS architecture
CO3: Design and develop the Map Reduce application
CO4: Identify and understand various Hadoop Ecosystem technologies
CO5: Apply the Advanced Analytical methods for classification, clustering and Text Analysis

UNIT -I: Introduction
Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Non Definitional traits of Big Data – Business Intelligence vs. Big Data – Data warehouse and Hadoop environment – Coexistence.
Big Data Analytics: Classification of analytics – Data Science – Terminologies in Big Data – CAP Theorem

UNIT -II: Hadoop Distributed File System
Introduction to Hadoop, frame work, features, advantages, HDFS concepts, HDFS architecture, Command Line Interface, hdfs commands, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives,

UNIT -III: Map Reduce
Understanding Hadoop API for MapReduce Framework, features, Techniques to Optimize MapReduce Jobs; Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression, I/O formats, Uses of MapReduce, Ingestion layer in big data stack

UNIT -IV: Hadoop Ecosystem
Serialization: AVRO, Co-ordination: Zookeeper. Databases: HBase Concepts, Clients, Example, HBase Versus RDBMS, Hive-architecture, data types, file formats, HQL. Scripting language: Pig-features, anatomy, pig on Hadoop, pig latin over view, data types, running pig, execution modes of pig, Streaming: Flink, Storm

UNIT -V: Advanced Analytics
Clustering: k-means, k-mode algorithm, Association Rules: Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Classification: Decision Trees, Naïve Bayes. Time Series Analysis: Overview of Time Series Analysis, ARIMA Model.
Text Analysis: Regular expressions, Collecting Raw Text, Representing Text (bag of words), Term Frequency—Inverse Document Frequency (TFIDF)

Text Books:
1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly, 4th Edition, 2015.
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services- Wiley

Reference Books:
1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop Map Reduce Cookbook, Srinath Perera, Thilina Gunarathne.
3. Big Data Analytics with R and Hadoop-Vignesh Prajapati.

Software Links:

E-Resources:
1. Hadoop:http://hadoop.apache.org/
2. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html

VII SEMESTER PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20AM7E06 :: AI CHATBOTS				

COURSE OBJECTIVES:
1. 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.
2. 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 the completion of the course the students are able to,
CO1: Develop an in-depth understanding of conversation design, including onboarding, flows, utterances, entities, and personality.
CO2: Design, build, test, and iterate a fully-functional, interactive chatbot using a commercial platform.
CO3: Deploy the finished chatbot for public use and interaction.
CO4: Understanding the fundamentals of chatbot technology
CO5: Understand the advantages, limitations, and appropriate use cases for each architecture.

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.

VII SEMESTER PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20AM7E07 :: SOCIAL NETWORK ANALYSIS				

COURSE OBJECTIVES:
1. Formalize different types of entities and relationships as nodes and edges and represent this information as relational data
2. Plan and execute network analytical computations
3. Use advanced network analysis software to generate visualizations and perform empirical investigations of network data
4. Interpret and synthesize the meaning of the results with respect to a question, goal, or task
5. Collect network data in different ways and from different sources while adhering to legal standards and ethics standards

COURSE OUTCOMES:
After the completion of the course the students are able to,
CO1: Know basic notation and terminology used in network science
CO2: Be able to visualize, summarize and compare networks
CO3: Illustrate basic principles behind network analysis algorithms
CO4: Develop practical skills of network analysis in R programming language
CO5: Be capable of analyzing real work networks

UNIT -I:
Social Network Analysis: Preliminaries and definitions, Erdos Number Project, Centrality measures, Balance and Homophily.

UNIT -II:
Random graph models: Random graphs and alternative models, Models of network growth, Navigation in social Networks, Cohesive subgroups, Multidimensional Scaling, Structural equivalence, roles and positions.

UNIT -III:
Network topology and diffusion, Contagion in Networks, Complex contagion, Percolation and information, Navigation in Networks Revisited.

UNIT -IV:
Small world experiments, small world models, origins of small world, Heavy tails, Small Diameter, Clustering of connectivity, The Erdos Renyi Model, Clustering Models.

UNIT -V:
Network structure -Important vertices and page rank algorithm, towards rational dynamics in networks, basics of game theory, Coloring and consensus, biased voting, network formation games, network structure and equilibrium, behavioral experiments, Spatial and agent-based models.

Text Books:
1. S. Wasserman and K. Faust. "Social Network Analysis: Methods and Applications", Cambridge University Press.
2. D. Easley and J. Kleinberg, "Networks, Crowds and Markets: Reasoning about a highly connected world", Cambridge University Press, 1st edition,2010

Reference Books:
1. Maarten van Steen. "Graph Theory and Complex Networks. An Introduction", 2010.
2. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction". Cambridge University Press 2014.
3. Maksim Tsvetovat and Alexander Kouznetsov. "Social Network Analysis for Startups". O'Reilly Media, 2011.

E-Resources:
1. https://www.classcentral.com/course/edx-social-network-analysis-sna-9134
2. https://www.coursera.org/learn/social-network-analysis

VII SEMESTER PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20AM7E08 :: OBJECT ORIENTED ANALYSIS AND DESIGN				

COURSE OBJECTIVES:
The main objective is the students to
1. Become familiar with all phases of OOAD.
2. Master the main features of the UML.
3. Master the main concepts of Object Technologies and how to apply them at work   and develop the ability to analyze and solve challenging problem in various domains.
4. Learn the Object design Principles and understand how to apply them towards Implementation.

COURSE OUTCOMES:
After finishing this course student will be able to:
CO1: Analyze the nature of complex system and its solutions.
CO2: Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships
CO3: Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications.
CO4: Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams.
CO5: Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.

UNIT -I:
Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. Case Study: System Architecture: Satellite-Based Navigation

UNIT -II:
Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Case Study: Control System: Traffic Management.

UNIT -III:
Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. Advanced Structural Modeling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Case Study: AI: Cryptanalysis.

UNIT -IV:
Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. Case Study: Web Application: Vacation Tracking System

UNIT -V:
Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams
Case Study: Weather Forecasting

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

Reference Books:
1. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

VII SEMESTER PROFESSIONAL ELECTIVE-V	L	T	P	C
	3	-	-	3
20AM7E09 :: SEMANTIC WEB				

COURSE OBJECTIVES:
1. To learn Web Intelligence
2. To learn Knowledge Representation for the Semantic Web
3. To learn Ontology Engineering
4. To learn Semantic Web Applications, Services and Technology
5. To learn Social Network Analysis and semantic web

COURSE OUTCOMES:
 After the completion of the course, student will be able to
CO1: Demonstrate social network analysis and measures.
CO2: Analyze random graph models and navigate social networks data
CO3: Apply the network topology and Visualization tools.
CO4: Analyze the experiment with small world models and clustering models.
CO5: Compare the application driven virtual communities from social network Structure.

UNIT -I:
Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT -II:
Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

UNIT -III:
Ontology Engineering: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT -IV:
Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

UNIT -V:
Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features.

Text Books:
1. Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

Reference Books:
1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer,
2. P. Warren, John Wiley & Sons.
3. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
4. Information sharing on the semantic Web – Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications.
5. Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD.

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CE7O01 :: SOLID WASTE MANAGEMENT				

COURSE OUTCOMES:
 After the completion of the course, student will be able to
CO1: Recall classification of solid waste generated.
CO2: Know the collection systems of solid waste of a town.
CO3: Analyze the importance of transfer and transport of solid waste.
CO4: Apply the knowledge in processing of solid waste.
CO5: Design treatment of municipal solid waste and landfill.

UNIT- I:
Introduction to Solid Waste Management:
Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste - sampling and characterization – Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT- II:
Collection of Solid Waste:
Type and methods of waste collection systems, analysis of collection system optimization of collection routes– alternative techniques for collection system.

UNIT- III:
Transfer and Transport:
Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements.

UNIT- IV:
Processing and Treatment:
Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- V:
Disposal of Solid Waste:
Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate
collection systems –designated waste landfill remediation.

Text/ Reference books:
1. George Techobanoglous, Frank Kreith , Integrated Solid Waste Management- McGraw Hill Publication, 1993.
2. R.Saravanan, R.Dinesh Kumar, A.Suriya , Muncipal solid waste management, Lakshmi publications-2015.
3. Vesilind, P.A., Worrell, W., Reinhart, D.,"Solid Waste Engineering", Cenage learning, New Delhi, 2004.

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CE7O02 :: BUILDING PLANNING AND DRAWING				

COURSE OUTCOMES

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

CO1: Understand the building bye-laws, plan various buildings as per the building by-laws.
CO2: Plan the individual rooms with reference to functional and furniture requirements.
CO3: prepare different sign conventions and bonds
CO4: Learn the skills of drawing building elements like doors and windows.
CO5: Develop the skills of Drawing Plans, Sections and Elevations of different buildings.

UNIT-I:

BUILDING BYELAWS AND REGULATIONS: Introduction - terminology - objectives of building Bye laws - floor area ratio - floor space index - principles under laying building bye laws - classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.

UNIT -II:

RESIDENTIAL AND PUBLIC BUILDINGS

Residential buildings: Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types residential buildings.

   Public buildings: Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT-III:

SIGN CONVENTIONS AND BONDS: Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT- IV:

DOORS, WINDOWS, VENTILATORS AND ROOFS: Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.

UNIT-V:

PLANNING AND DESIGNING OF BUILDINGS: Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

Text /Reference Books:

1. Y.S. Sane., Planning and Design of buildings, 2010.
2. Gurucharan Singh and Jagadish Singh , Planning, designing and scheduling, 2015.
3. M. Chakravarthi., Building planning and drawing, 2015.
4. 'A' Series & 'B' Series of JNTU Engineering College, Anantapur.
5. Shah and Kale , Building drawing, 2013.

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20EE7O01 :: ENERGY AUDITING, CONSERVATION AND MANAGEMENT				

COURSE OUTCOMES:
After successful completion of this course, students should be able to:
CO1: Understand the principles of energy audit.
CO2: Explain the role of Energy Manager and Energy Management program.
CO3: Design a energy efficient motors and good lighting system
CO4: Evaluate the methods to improve the power factor.
CO5: Estimate the computational techniques with regard to economic aspects.

UNIT-I: PRINCIPLES OF ENERGY AUDIT
Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts – Sankey diagrams and load profiles - Energy conservation schemes and energy saving potential - Energy audit of industries- energy saving potential - energy audit of process industry - thermal power station - building energy audit– Numerical problems.

UNIT-II: ENERGY MANAGEMENT
Principles of energy management - organizing energy management program - initiating – planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions – language - Questionnaire – check list for top management.

UNIT-III: ENERGY EFFICIENT MOTORS AND LIGHTING
Energy Efficient Motors: Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit.
Lighting : lighting system design and practice - lighting control - lighting energy audit.

UNIT-IV: POWER FACTOR IMPROVEMENT AND ENERGY INSTRUMENTS
Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.

UNIT-V: ECONOMIC ASPECTS AND COMPUTATION
ECONOMIC ASPECTS: Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis.
COMPUTATION ASPECTS: Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.

Text Books:
1. Energy management by W.R.Murphy & G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

Reference Books:
1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition – 1995.
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition – 1998.
   Energy management and good lighting practice : fuel efficiency- booklet12

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3

20EC7O01 :: INTRODUCTION TO GLOBAL POSITIONING SYSTEMS

COURSE OUTCOMES:
After completion of this course, the students are able to,
CO1: Describe global navigation satellite systems (K1)

CO2: Understand GNSS Satellite signal characteristics (K2)

CO3: Develop knowledge about the various components and equipment used in GPS systems.(K3)

CO4: Develop GNSS Receiver (K3)

CO5: Analyze the impact of various error sources on the precision of positioning. (K4)

UNIT I : FUNDAMENTALS OF SATELLITE NAVIGATION:
Concept of Ranging using Time of arrival Measurements: Two-Dimensional Position Determination, Principle of Position Determination via Satellite-Generated Ranging signals, Fundamentals of satellite orbits: Orbital Mechanics, Constellation Design, Positioning determination using Ranging codes: Determining Satellite-to-User Range, Indian Developed GNSS- Indian Regional Navigation Satellite System (IRNSS) : NavIC and its applications, *GPS*-Aided Geo-Augmented *Navigation (GAGAN)*

UNIT II : GLOBAL POSITIONING SYSTEM SEGMENTS:
Space Segment Description: GPS Satellite Constellation Description, Constellation Design Guidelines, Space Segment Phased Development, Control Segment: Current Configuration, CS Planned Upgrades , User Segment: GPS Set Characteristics, GPS Receiver Selection

UNIT-III : GPS SATELLITE SIGNAL CHARACTERISTICS:
Modulations for Satellite Navigation: Modulation Types, Multiplexing Techniques, Signal Models and Characteristics, Legacy GPS Signals: Frequencies and Modulation Format, Power Levels, Autocorrelation Functions and Power Spectral Densities, Cross-Correlation Functions and CDMA Performance, Navigation Message Format.

UNIT-IV : GNSS RECEIVER:
Acquisition: Single Trial Detector, Tong Search Detector, M of N Search Detector, Combined Tong and M of N Search Detectors, FFT-Based Techniques, Direct Acquisition of GPS Military Signals, Vernier Doppler and Peak Code Search, carrier tracking, code tracking: Carrier Loop Discriminator, sequence of initial receiver operation.

UNIT-V: GNSS ERRORS:
Introduction, Measurement errors: satellite clock error, ephemeris error, relative effects, atmospheric effects, receiver noise and resolution, multipath and shadowing effects, hardware bias errors, Pseudo range error budgets.

TExt Books:
1. Elliott D. Kaplan, Christopher J. Hegarty, Understanding **GPS/GNSS** principles and applications, third edition, artech house publishers, Boston, 2017
2. G S Rao, Global Navigational satellite system, Tata McGraw-Hill education private Ltd, New Delhi, 2015.

References:
1. ISRO-IRNSS-ICD-SPS-1.1, Bangalore, 2017
2. Bhatta, B. ". Global Navigation Satellite Systems: Insights Into GPS, Glonass, Galileo, Compass, and Others", BS Publications, New Delhi, 2015.

E-References:
1. https://archive.nptel.ac.in/courses/105/107/105107194/
2. https://d1.amobbs.com/bbs_upload782111/files_33/ourdev_584835O21W59.pdf

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20BM7O01 :: INDUSTRIAL SOCIOLOGY AND PSYCHOLOGY				

COURSE OUTCOMES:
After completion of this course, the students are able to,
CO1: Understanding the social and psychological factors influencing work behavior [K2]
CO2: Understand how organizational structures, power dynamics, communication patterns, and leadership styles affect employee behavior, decision-making, and job performance. [K2]
CO3: Identifying workplace stressors and their impact [K3]
CO4: Understanding employee motivation and engagement: Explore theories and models of employee motivation and engagement. [K3]
CO5: Understand the dynamics of teamwork and collaboration in industrial contexts. [K4]

UNIT -I:
Industrial Sociology: Nature and Scope of Industrial Sociology-Development of Industrial Sociology, Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social relations in industry.

UNIT -II:
Group Dynamics: Concept- factors influencing individual behaviour- Work Teams & Groups, Group Behavior, Group formation & development, Decision Making by Individuals, Groups Decision making process-techniques.

UNIT -III:
Industrial Psychology: Nature and Meaning of Industrial Psychology, Role of Industrial Psychology, Organizational Attitude, Motivation at work-Theories of Motivation (Theory X and Y, McClelland's Theory, Maslow's Need Theory, Herzberg's Two Factor Theory), Cultural Differences in Motivation.

UNIT -IV:
Organizational Design and Leadership: Organizational Design & Structure- organizational design- process, Structural differentiations, factors influencing design of organizations, Leadership-concept, types, Leadership vs. Management, Leadership Theories, Emerging issues in Leadership.

UNIT -V:
Organizational Conflicts and Change management: - Causes and Consequences of Conflict- Conflict handling techniques, Managing Change, Forces for change in Organization, Resistance to change.

Text Books:
1. Nelson, Quick and Khandelwal, ORGB : An innovative approach to learning and teaching Organizational Behaviour. A South Asian Perspective, Cengage Learning, 2012
2. Luthans, Fred, Organizational Behavior, McGraw Hill, 2008.
3. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

References Books:
1. Schneider Engno V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi,2011.
2. Ivancevich, Konopaske & Maheson, Organisational Behaviour & Management, 7th edition, Tata McGraw Hill, 2008.
3. L.M.Prasad.,Organisational Behaviour, 5th Edition, Sulthan Chand & Sons.,2014

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20ME7O01 :: BIO-MECHANICAL ENGINEERING				

COURSE OBJECTIVES:
The main objectives of this course are
1. To make the student familiar with fundamentals of bio mechanics.
2. To gain knowledge about musculoskeletal system.
3. To impart knowledge about linear kinetics and angular kinetics
4. Make the student to illustrate the mathematical models used in the analysis of bio-mechanical systems

COURSE OUTCOMES:
 After completion of this course, the students are able to,
CO1: Explain about fundamentals of Bio mechanics. [K2]
CO2: Describe the mechanics of musculoskeletal system. [K2]
CO3: Relate the concept of kinetics with human motion. [K3]
CO4: Explain mechanical analysis of human motion. [K3]
CO5: Analyze human movements. [K4]

UNIT-I:
INTRODUCTION TO BIO MECHANICS
Principles of mechanics in human movement, Qualitative and quantitative Analysis, Key mechanical concepts of mechanics and basic units, Nine fundamentals of biomechanics, Nine principles for application of Biomechanics.

UNIT-II:
MECHANICS OF MUSCULOSKELETAL SYSTEM
Principles of joint motions, Muscle structures, Mechanical method of muscle action analysis, Tissue loads and forces, Biomechanics of bones and ligaments, Three mechanical characters of muscle, stretch-shortening cycle (SSC).

UNIT-III:
LINEAR KINETICS AND ANGULAR KINETICS
Vector analysis of angle of pull and muscle angle pull, Contact forces, Impulse-Momentum Relationship, Force-Time Principle, Work-Energy relationship, Segmental interaction principle, Torque, Equilibrium, Center of gravity and Principle of balance.

UNIT-IV:
MECHANICAL ANALYSIS OF HUMAN MOTION
Linear kinematics - linear kinematic analysis, position and displacement, velocity and speed, acceleration, differentiation and integration, kinematics of running, kinematics of projectiles, equations of constant acceleration, Angular kinematics - angular motion, measurements of angles, types of angles, representation of angular motion vectors, lower extremity joint angles, relationship between angular and linear motion, angular kinematics of running.

UNIT-V:
APPLICATIONS OF MEDICAL REHABITATION
Qualitative analysis of kicking technique, batting, catching, throwing techniques, injury risk assessment, equipment design for strength training, Injury mechanics, injury prevention.

Text Books:
1. Ronald L. Huston, Principles of Biomechanics,1st edition CRC Press, 2019.
2. Joseph E. Muscolino, " Kinesology", 3rd edition, Mosby, 2016.
3. Subrata Pal, "Textbook of Biomechanics", 1st edition, Springer US, 2016.

Reference Books:
1. Duane Knudson, "Fundamentals of Biomechanics", 2nd edition, Springer, 2013.
2. Ajay Bahl, "Basics of Biomechanics", 1st edition, Jaypee Brothers Medical Publishers, 2010.
3. Robert frost, "Applied Kinesiology", 1st edition, North Atlantic Books, 2013.
4. David A. Winter, "Biomechanics and Motor Control of Human Movement", John Wiley & sons, 2009.

Web Reference:
1. https://archive.nptel.ac.in/courses/112/105/112105305/
2. https://archive.nptel.ac.in/courses/112/106/112106248/

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CS7O01 :: FULL-STACK DEVELOPMENT				

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Design simple web pages using markup languages like HTML and CSS.
CO2: Create dynamic web pages using DHTML and java script that is easy to navigate and use.
CO3: Create web pages using AngularJS.
CO4: Build web applications using Servlet and JSP.
CO5: Understand various operations on Mongo Database.

UNIT-I: HTML and CSS
HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.
CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds, CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II: Client-Side Scripting using Java Script and DOM
Java Script: The Basics of Java Script, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.
DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III: Angular JS
Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV: Servlet and JSP
Servlet: Servlet Basics, Need of Server Side Programming, Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives- include(), forward(), sendRedirect(), HttpServletRequest and HttpServletResponse in Servlet, Servlet and JDBC Integration.
JSP: JSP Basics, JSP Scripting Elements(Declaration, Expression, Scriptlet), Directive Elements(page, include, taglib), Action Elements(jsp:forward,jsp:include,jsp:useBean), JSP Implicit Objects.

UNIT-V: Mongo DB
Introduction to Mongo DB: Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

Text Books:
1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford.
3. Head First Servlet and JSP.
4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman.
4. MEAN Web Development by Amos Q. Haviv

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CE7O03 :: INTRODUCTION TO WATERSHED MANAGEMENT				

Course Outcomes:
At the end of the course, the student should be able to:
CO1: Analyze watershed characteristics to take appropriate management action.
CO2: Quantify soil erosion and design control measures.
CO3: Apply land grading techniques for proper land management.
CO4: Suggest suitable harvesting techniques for better watershed management.
CO5: Apply appropriate models for watershed management.

UNIT-I: Introduction:
Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics.

UNIT-II: Principles of Erosion:
Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT-III: Water Harvesting:
Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, farm ponds and dugout ponds, percolation tanks.

UNIT-IV: Land Management:
Land use and Land capability classification, management of forest, agricultural, grassland and wild land, Reclamation of saline and alkaline soils.

UNIT-V: Watershed Modeling:
Data of watershed for modeling, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

Text/ References books:
1. Abrar Yousuf and Manmohanjit Singh, 'Watershed Hydrology, Management and Modeling', Taylor & Francis Ltd; 1st edition, 2021.
2. Das MM and M.D Saikia , 'Watershed Management', PHI Learning Pvt. Ltd, 2013.
3. Murthy VVN , 'Land and Water Management', Kalyani Publications, 2007.
4. Murthy J V S, 'Watershed Management', New Age International Publishers, 2006.
5. Wurbs R A and James R A 'Water Resource Engineering', Prentice Hall Publishers, 2002.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20EE7O02 :: INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER				

COURSE OUTCOMES:

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

CO1: Illustrate I/O modules of PLC systems and ladder diagrams.

CO2: Demonstrate various types registers and programming instructions.

CO3: Examine various types of PLC functions and its applications.

CO4: Assess different data handling functions and its applications.

CO5: Describe the analog operations and PID modules

UNIT-I: INTRODUCTION TO PLC SYSTEMS

I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O Modules. Digital logic gates - programming in the Boolean algebra system - conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system

UNIT-II: PLC PROGRAMMING & REGISTERS

PLC Programming: Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation.

PLC Registers: Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.

UNIT-III: PLC FUNCTIONS

Timer functions & Industrial applications - counters - counter function industrial applications - Arithmetic functions - Number comparison functions - number conversion functions

UNIT-IV: DATA HANDLING FUNCTIONS

SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS – CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register – sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions

UNIT-V: ANALOG PLC OPERATION

Analog modules & systems - Analog signal processing - Multi bit Data Processing - Analog output Application Examples - PID principles - position indicator with PID control - PID Modules - PID tuning - PID functions.

Text Books:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition – PHI.
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth & nF.D Hackworth Jr. –Pearson - 2004

Reference Books:

1. Introduction to Programmable Logic Controllers- Gary A. Dunning - 3rd edition – Cengage Learning - 2005.
2. Programmable Logic Controllers –W.Bolton - 5th Edition - Elsevier publisher - 2009.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20BM7O02 :: BUSINESS SKILL DEVELOPMENT				

UNIT- I:

Communication in Business Objectives of communication - The Process of Human Communication – Types of Communication-Written, Oral, Visual, Audio Visual - Developing Listening Skills – Types, essentials of good listening and tips.

UNIT –II:

Managing Organizational Communication– Formal and Informal Communication – Intra- personal–Inter-Personal Communication-Communication Models - Johari Window, Transactional Analysis, and Social Exchange theory. Role of emotion, barriers to interpersonal communication- Gateways to effective interpersonal communication.

UNIT –III:

Nonverbal communication and Body language: Kinesics, Proxemics, Paralanguage, Haptics, handshakes, Appropriate body language and Mannerisms for interviews: business etiquettes- cultural effects of communication. Communication styles.

UNIT- IV:

Business Correspondence- Essentials of Effective Business Correspondence, Norms for business letters-Letter for different kinds of situations- Business Letter and Forms, Resume writing, Meeting, Telephonic Communication – Use of Technology in Business Communication.

UNIT –V:

Report Writing and Presentation skills – Formal and Informal Reports-Reports and Proposals Prerequisites for effective presentation -Types and Stages of presentation – Communication skills for group discussion and interviews-interview techniques.

Text / Reference Books
1. K Bhardwaj, Professional Communication, IK Int Pub House, New Delhi
2. Rayudu, CS: "Communication", Himalaya Publishing House, Mumbai.
3. Krizan: "Essentials of Business Communication", Cengage Learning, New Delhi.
4. UrmilaRai& S.M. Rai, Business Communication, Himalya Publishers,
5. Dalmar Fisher: "Communication in Organizations", JAICO Publishing House, New Delhi, 2007.
6. Paul Turner: "Organisational Communication", JAICO Publishing House, New Delhi.
7. Meenakshi Rama: "Business Communication", Oxford University Press, New Delhi.

VII SEMESTER : OPEN ELECTIVE - IV	**L**	**T**	**P**	**C**
	3	**-**	**-**	**3**
20EC7O02 :: REMOTE SENSING				

COURSE OUTCOMES:
After Completion of this course, students are able to
CO1: Understand the subject of satellite communication and remote sensing with the core knowledge of space and satellite, communication and the international space laws.
CO2: Comprehend different remote sensing signaling techniques, capable of interpreting signature of satellite communication from bodies like soil, vegetation and ocean.
CO3: Analyze various components used in satellite communication and remote sensing applications.
CO4: Acquire and keep abreast of designing satellite remote sensing system and also analyze the sensor data for drawing inference and conclusions.

UNIT –I:
Introduction: Historical background, International space laws, Advantages of space based observations, Global coverage, Multi scale observation, repeat observation immediate transmission and digital format, Source of information on remote sensing region.

UNIT -II:
Principles of remote sensing: Fundamentals of remote sensing signals, The electromagnetic spectrum, Terms and units of measurements, EM radiation laws, Spectral signature in the solar spectrum, vegetation reflectance, soil reflectance, water in the solar spectrum, The thermal infrared domain, characteristics of EM radiation in thermal infrared, Thermal properties of vegetation, Soils thermal domain, thermal signature of water and snow, The microwave region, Atmospheric interaction.

UNIT –III:
Sensors and remote sensing satellite: Type of sensors, Resolution of sensor systems, spatial, spectral, radiometric, temporal, angular - resolution, passive sensors, photographic cameras, cross and along track - scanners, active sensors, Radar and Lidar, satellite remote missions, Satellite orbits, Landsat programs, SPOT satellites, IRS program, High resolution commercial satellites, Polar orbiting meteorological satellites, Terra Aqua, Geostationary meteorological satellites.

UNIT –IV:
Basis for interpretations of remote sensing images: Constraints in using remote sensing data, types of interpretation, Costs of data acquisitions, end-user requirements, Thematic classification, Generation of biophysical variables, Change detection, spatial patterns, organization of remote sensing project, interpretation phase, presentation of study cases.

UNIT –V:
Characteristic of photographic images, Feature identification, criteria for visua interpretation, Brightness, color, texture, spatial contexts, shadows, spatial patterns, shap and size, stereoscopic view, period of acquisition, elements of visual analysis, Geometric characteristics of satellite image, Color composites, Multitemporal approaches.

Textbooks:

1. Emilio Chuvieco, "Fundamentals of Satellite Remote Sensing", CRC press, Edition,2009.

References:

1. C. H. Chen, "Signal Processing for Remote Sensing‖, CRC press, Edition-2007.
2. R. N Mutagi, "Satellite Communication Principles and Applications", Oxford University press, 2016.
3. Enrico Del Re, and Marina Ruggieri, "Satellite communications and navigation systems", Springer.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20ME7O02 :: GREEN ENGINEERING SYSTEM				

COURSE OBJECTIVES

1. To understand the basic concept of solar energy.
2. To gain knowledge about renewable energy.
3. To learn about the best energy efficient systems.
4. To impart knowledge about energy efficient processes

COURSE OUTCOMES:

After Completion of this course, students are able to

CO1: Recognize the energy scenario and explain solar radiation conversion and collection phenomena [K3].

CO2: Illustrate solar energy storage methods and applications and also explain the principles of wind energy, classification, conversion and applications [K4].

CO3: Explain the principle, classification, conversion and applications of Bio mass, geothermal energy and ocean energy [K3].

CO4: Describe the importance of energy efficient systems and interpret working of a few mechanical and electrical efficient systems[K2].

CO5: Identify the need of energy efficient processes and analyze their significance in view of their importance in the current scenario and their potential future applications [K4].

UNIT – I:

INTRODUCTION: Energy chain and common forms of usable energy – Present energy scenario – World energy status – Energy scenario in India, Traditional energy systems, Renewable energy – sources and features.

SOLAR RADIATION:

Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II:

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III:

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels,   I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – IV:

ENERGY EFFICIENT SYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmental friendly and energy efficient compressors and pumps

GREEN BUILDINGS: Definition features and benefits.

UNIT – V:

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems - vegetable based cutting fluids, zero waste manufacturing.

Text Books:
1. Sukhatme S.P. and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2018.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2015.
3. Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2016.

References Books:
1. Alternative Building Materials and Technologies, K. S. Jagadeesh, B.V. Venkata Rama Reddy and K. S. Nanjunda Rao, New Age International (P) Ltd.
2. Principles of Solar Engineering, Yogi Goswami, Frank Krieth and John F Kreider, Taylor and Francis
3. Non-Conventional Energy , Ashok V Desai, Wiley Eastern
4. Renewable Energy Technologies, Ramesh & Kumar, Narosa
5. Non-Conventional Energy Sources, G. D. Rai, Kanna Publishers, New Delhi, 2018.

Web Reference:
1. https://archive.nptel.ac.in/courses/112/104/112104225/
2. https://archive.nptel.ac.in/courses/105/102/105102195/

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CS7O02 :: SOFTWARE TESTING TECHNIQUES				

COURSE OBJECTIVES:

6. To study fundamental concepts in software testing and discuss various software testing issues and solutions in software unit, integration, regression and system testing
7. To learn how to plan a test project, design test cases and data, conduct testing, manage software problems and defects, generate a test report
8. To expose the advanced software testing concepts such as object-oriented software testing methods, web-based and component-based software testing
9. To understand software test automation problems and solutions
10. To learn how to write software test documents and communicate with engineers in various forms

COURSE OUTCOMES:
By the end of the course, the student should have the ability to:

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

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

CO3: Analyze the needs of software test automation

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

CO5: Basic understanding and knowledge of contemporary issues in software testing, such as component-based, web based and object oriented software testing problems

CO6: Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web based applications

UNIT-I:
Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification and **Validation:** Verification & Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

UNIT-II:
Dynamic Testing-Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.
White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

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

UNIT-IV:

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

UNIT V

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit . Test Automation using Selenium tool.
Testing Object Oriented Software: basics, Object oriented testingTesting Web based Systems: Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems.

Text Books:
1) Software Testing, Principles and Practices, NareshChauhan, Oxford
2) Software Testing, Yogesh Singh, CAMBRIDGE

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

E-Resources:
   1) https://www.tutorialspoint.com/software_testing_dictionary/test_tools.htm

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20IT7O01 :: INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT				

COURSE OUTCOMES:
Upon the completion of the course students will be able to:-
CO1: Apply the process to be followed in the software development life-cycle models.
CO2: Apply the concepts of project management & planning.
CO3: Implement the project plans through managing people, communications and change
CO4: Conduct activities necessary to successfully complete practices in software development and close the Software projects
CO5: Implement communication, modeling, and construction & deployment

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:
The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.
Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.
Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III:
Model Based Software Architectures: A Management perspective and technical perspective.
Work Flows of the Process: Software process workflows, Iteration workflows.
Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

UNIT – IV:
Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.
Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.
UNIT – V:
Process Automation: Automation Building blocks, The Project Environment.
Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.
Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

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

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

B. TECH VII SEM	L	T	P	C
(Humanities and Social Science Elective)	3	0	0	3
20HS7T01 :: UNIVERSAL HUMAN VALUES : UNDERSTANDING HARMONY				

COURSE OUTCOMES:
Upon the completion of the course students will be able to:-
CO1: Understand the need, basic guidelines, content and process of value education; explore the meaning of happiness and prosperity.
CO2: Distinguish between the Self and the Body, understand the meaning ofHarmony in the Self the Co-existence of Self and Body.
CO3: Analyze the value of harmonious relationship based on trust and respect in life and profession
CO4: Examine the role of a human being in ensuring harmony in society and nature.
CO5: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

UNIT 1: INTRODUCTION-BASIC HUMAN ASPIRATION
Understanding the need, basic guidelines, content and process for Value Education-Self-Exploration, its content and process - 'Natural Acceptance' and 'Experiential Validation' as the mechanism for self exploration-Continuous Happiness and Prosperity the basic requirements for fulfillment of aspirations of every human being with their correct priority- Understanding Happiness and Prosperity correctly-Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT 2: HARMONY IN THE HUMAN BEING
Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I'-Understanding the characteristics and activities of 'I' and harmony in 'I'.

UNIT 3: HUMAN-HUMAN RELATIONSHIPS
Understanding values in human-human relationship-Meaning of justice-Nine universal values in relationship-Meaning of trust and respect-Difference between respect and differentiation-Harmony in society-undivided society-from family to world family.

UNIT 4: NATURE AND EXISTENCE
Self exploration – self awareness and self evaluation- Self realization-Understanding and contemplation in the Self - Realization of Co-existence- Understanding of harmony in Nature and contemplation of participation of Human in development of harmony.

UNIT 5: IMPLICATIONS OF HARMONY ON PROFESSIONAL ETHICS
Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order- Case studies of typical holistic technologies-management models-Production systems-Strategy for transition from the present state to universal human order.

Text Books:
1. R R Gaur, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2010.

Reference Books:
1. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
2. Mahadev Desai, Shriman Narayan, "The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi", Navajivan Mudranalaya, Ahemadabad, India.1925
3. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. P. L. Dhar& R. R. Gaur, "Science & Humanism – towards a unified worldview", Commonwealth Publishers, New Delhi-1990.
5. J. C. Kumarappa, "Economy of Permanence – (a quest for social order based on non-violence)", Sarva-Seva-Sangh-Prakashan, Varansi, India-2010.

VII SEMESTER : SKILL COURSE	L	T	P	C
	-	-	4	2
20AM7S01 :: RESTful API Design with Node, Express, and MongoDB (Infosys Spring Board)				

COURSE OUTCOMES:

Upon the completion of the course students will be able to:-

CO1: Understanding RESTful API Development: Gain a solid understanding of building RESTful APIs, including key concepts, principles, and best practices.

CO2: Secure Authentication System: Learn how to implement secure user authentication using JWT and the Passport authentication library, ensuring the security of web applications.

CO3: Building Real-World Features: Implement advanced functionalities such as user following, pagination, rate limiting, and caching to create feature-rich applications.

CO4: Testing and Debugging APIs: Develop proficiency in using tools like Postman to test and debug API endpoints, ensuring error handling, input validation, and overall API reliability.

CO5: Deployment and Production Readiness: Acquire insights into deploying APIs for public access, including knowledge of cloud providers, database providers, and production optimization for performance and security.

Week 1:
- Exercise 1: Course Overview
- Exercise 2: Setting Up the Development Environment
- Exercise 3: RESTful API Concepts and Principles

Week 2:
- Exercise 4: Express App Boilerplate
- Exercise 5: Integrate Error Handling
- Exercise 6: Diving into Validations

Week 3:
- Exercise 7: Consume and Test with Postman
- Exercise 8: CRUD Operations to Create API

Week 4:
- Exercise 9: Creating the Post Model
- Exercise 10: Store Post and Multer
- Exercise 11: Adding Post Index and Show Routes

Week 5:
- Exercise 12: Update Post Route
- Exercise 13: Delete Post Route
- Exercise 14: JWT and User Model

Week 6:
- Exercise 15: Passport for Authentication
- Exercise 16: Login Endpoint
- Exercise 17: Signup Endpoint

Week 7:
- Exercise 18: Authenticate Routes
- Exercise 19: Following Feature Considerations
- Exercise 20: User Schema Tweaks

Week 8:
- Exercise 21: Follow Endpoint
- Exercise 22: Fix Posts Index Route
- Exercise 23: Consume and Test New Features

Week 9:
- Exercise 24: Add Posts Pagination
- Exercise 25: Integrate Rate Limiting
- Exercise 26: Discover Caching and Redis

Week 10:
- Exercise 27: How to Cache Queries?
- Exercise 28: Serve Valid Data
- Exercise 29: Explore the Cloud Provider

Week 11:
- Exercise 30: Explore the Database Provider
- Exercise 31: Production Tweaks to Codebase
- Exercise 32: Final Testing of Public API

Week 12:
- Exercise 33: Wrap-Up

Course source link:
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330140419073638417066_shared/overview

VII SEMESTER	L	T	P	C
	-	-	-	2
20AM7I01 :: INTERNSHIP II				

VIII SEMESTER	L	T	P	C
	3	-	-	3
20AM8P01 :: PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY				

IV SEMESTER MINOR COURSE	L	T	P	C
	3	-	-	3

20AM4N01 :: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

COURSE OBJECTIVES:
1. To provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. To provide a basic exposition to the goals and methods of Artificial Intelligence.
3. To provide fundamentals of machine learning.

COURSE OUTCOMES:
CO1: Upon successful completion of the course, the student will be able to:
CO2: Enumerate the history and foundations of Artificial Intelligence
CO3: Apply the basic principles of AI in problem solving
CO4: Choose the appropriate representation of Knowledge
CO5: Enumerate the Perspectives and Issues in Machine Learning
CO6: Identify issues in Decision Tree Learning

UNIT –I:
Introduction: What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT –II:
Problem Solving: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT –III:
Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

UNIT –IV:
Introduction to Machine Learning: Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning.
Concept Learning and The General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate-Elimination, Inductive Bias

UNIT-V:
Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

Text Books:
1) Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition,Pearson
2) Tom M. Mitchell, Machine Learning, McGraw Hill Edition, 2013

Reference Books:
1) Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
2) Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3) David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

4) Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.

5) Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.

6) ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

Web Resources:

1) https://nptel.ac.in/courses/106105077

2) https://nptel.ac.in/courses/106106126

3) https://aima.cs.berkeley.edu

4) https://ai.berkeley,edu/project_overview.html

5) http://www.zuj.edu.jo/download/machine-learning-tom-mitchell-pdf/

6) http://www.ntu.edu.sg/home/egbhuang/pdf/ieee-is-elm.pdf

7) https://swayam.gov.in/nd1_noc20_cs73/preview

V SEMESTER MINOR COURSE	L	T	P	C
	3	-	-	3
20AM5N01 :: MACHINE LEARNING				

COURSE OBJECTIVES:
This course will enable students to learn and understand different Data sets in implementing the machine learning algorithms.

COURSE OUTCOMES:
CO1: Implement procedures for the machine learning algorithms
CO2: Design and Develop Python programs for various Learning algorithms
CO3: Apply appropriate data sets to the Machine Learning algorithms
CO4: Develop Machine Learning algorithms to solve real world problems
CO5: Understand the principles behind these algorithms, their strengths, weaknesses, and their applicability to different types of problems.
CO6: Understand the importance of feature engineering and feature selection in improving model performance.

UNIT –I:
Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.
Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

UNIT –II::
Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines

UNIT –III:
Binary Classification: Multiclass/Structured outputs, MNIST, Ranking. Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

UNIT –IV:
Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

UNIT –V:
Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.
Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA

Requirements: Develop the following program using Anaconda/ Jupiter/ Spider and evaluate ML models.
List of Experiments:

Experiment-1:
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-2:
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-3:
Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier

Experiment-4: Develop a program for Bias, Variance, Remove duplicates , Cross Validation

Experiment-5:
Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

Experiment-6: 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-7:
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-8:
Write a program to Implement Support Vector Machines and Principle Component Analysis

Text Books:
1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
2. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020

Reference Books:
1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

VI SEMESTER MINOR COURSE	L	T	P	C
	3	-	-	3
20AM6N01 :: DEEP LEARNING				

COURSE OUTCOMES:
 After the completion of the course, student will be able to:
CO1: Implement deep neural networks to solve real world problems
CO2: Choose appropriate pre-trained model to solve real time problem
CO3: Interpret the results of two different deep learning models
CO4: Understanding neural networks
CO5: Study and implement various deep learning architectures

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, Overfitting and Underfitting. [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, TensorFlow, 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: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation,

UNIT -V:
Recurrent Neural Networks: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. [Text Book 3]

Software Packages required:
- Keras
- Tensorflow
- PyTorch

List of Experiments:
1. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
3. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
4. Design a neural network for predicting house prices using Boston Housing Price dataset.
5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification

Text Books:

1. Deep Learning- Ian Goodfellow, 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, Aglaé 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
5. Reza Zadeh and BharathRamsundar, "Tensorflow for Deep Learning", O'Reilly publishers, 2018

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.
4. https://github.com/fchollet/deep-learning-with-python-notebooks

Web Link:

Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview

VII SEMESTER MINOR COURSE	L	T	P	C
	3	-	-	3
20AM7N01 :: REINFORCEMENT LEARNING				

COURSE OBJECTIVE:
Learn various approaches to solve decision problems with functional models and algorithms for task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning.

COURSE OUTCOMES:
By completing the course the students will be able to:
CO1: Understand basic concepts of Reinforcement learning
CO2: Identifying appropriate learning tasks for Reinforcement learning techniques
CO3: Understand various methods and applications of reinforcement learning
CO4: Understanding the RL framework: Gain a deep understanding of the fundamental components of RL
CO5: Study and implement various RL algorithms

UNIT -I:
Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper –Confidence-Bound Action Selection, Gradient Bandit Algorithm

UNIT -II:
Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming

UNIT -III:
Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step Q(σ)

UNIT -IV:
Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance
Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ)

UNIT -V:
Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE: Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods, Policy

Gradient for Continuing Problems, Policy Parameterization for Continuous Actions

Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double Wagering, Optimizing Memory Control, Personalized Web Services

Text Books:

1. R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018.

References:

1. Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010.
2. Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs74/preview
2. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning