Pondicherry University

Curriculum and Syllabus

BACHELOR OF TECHNOLOGY

B.Tech.

Information Technology

2023-24

[Affiliated College]

1. Conditions for Admission:

a) Candidates for admission to the first semester of the 8 semester B.Tech. degree programme should be required to have passed:

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the different State Boards/ Central Boards or any other examination equivalent there to with minimum of 45% marks (40% marks in case of candidates belonging to reserved category) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / IT and equivalent/ Electronics/ Biology (Botany & Zoology) or Passed D.Voc Stream in the same or allied sector or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

b) Candidates for admission through Lateral entry into second year (third semester)of the 8 semester B.Tech. degree programme should be required to have passed :

Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to reserved category) in ANY branch of Engineering and Technology.

OR

Passed B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40% marks in case of candidates belonging to reserved category) and passed 10+2 examination with Mathematics as a subject.

OR

Passed D.Voc. Stream in the same or allied sector.

(The Universities/colleges will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

2. AgeLimit:

As per applicable AICTE norms.

3. Duration of Programme:

The Bachelor of Technology degree programme shall extend over a period of 8 semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.

4. Program Structure

The medium of instruction is English.

A student admitted to the B.Tech. programme in a particular branch of engineering will earn the degree in that branch by fulfilling all the requirements prescribed in the regulations during the course of study.

The student is also permitted to opt for earning an **Honors degree in the same discipline of Engineering or a Minor degree** in another discipline of engineering in addition to the degree in his own discipline of engineering. The student will be allowed to exercise this option at the end of first year based on his academic performance in the first year. The students admitted through lateral entry can exercise this option at the end of third semester, based on the GPA scored in the third semester examination.

The student opting for B.Tech. degree with **Honors or B.Tech. degree with Minor** is required to earn additional 20 credits starting from the third semester. The students admitted in the second year through lateral entry and opting for Honors / Minor degree will earn the additional 20 credits starting from the fourth semester.

5. Eligibility for the award of B.Tech. Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the Faculty of Engineering and has passed the prescribed examinations in all the semesters. Details regarding the possible exit for a B.Tech. Student – in line with one of the goals of the National Education Policy (NEP) 2020 are provided in section 13.

6. Branches of Study:

Branch I - Civil Engineering

Branch II – Mechanical Engineering

Branch III - Electronics & Communication Engineering

BranchIV - ComputerScience&Engineering

Branch V – Electrical & Electronics Engineering

Branch VI – Chemical Engineering

Branch VII - Electronics & Instrumentation Engineering

Branch VIII –Information Technology

Branch IX - Instrumentation & Control Engineering

Branch X– Biomedical Engineering

Branch XI - Robotics and Automation

Branch XII – Food Technology

Branch XIII - CSE (Internet of Things & Cyber security including Block chain Technology)

Branch XIV – Artificial Intelligence and Machine Learning

Branch XV – Artificial Intelligence and Data Science

or any other branch of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

7. Course Structure and Subjects of Study:

Definition of Credit:

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

Range of Credits: The total credits of all the branches for the four-year B. Tech. degree Programme shall be in the range of160 to 172 (Minor variation is allowed as per AICTE guidelines). ″Minor Degree or Honors will cumulatively require additional 20 credits in the specified area in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline".

The subjects of study shall include theory, practical courses and project work/internships as given in the curriculum and shall be in accordance with the prescribed syllabus.

The curriculum of every programme will have courses that are categorized as follows:

(i) Humanities, Social Sciences and Management Courses (HSM)

(ii) Basic Science Courses (BSC)

(iii) Engineering Science Courses (ESC)

(iv) Professional Core Courses (PCC)

(v) Professional Elective Courses (PEC)

(vi) Open Elective Courses (OEC)

(vii) Professional Activity Courses (PAC)

(viii) Mandatory non-Credit Courses (MCC)

Each course will have either one or more of three components namely Lecture (L), Tutorial (T) and Practice (P). Each course is assigned credits as detailed below:

(i) Theory courses will carry either 3 or 4 credits - 3 credits for courses with 3 lecture periods per week and 4 credits for courses with 3 lecture periods and 1 tutorial period per week.

(ii) All Elective courses including online courses will carry maximum 3 credits. The student can earn the credits towards the Open Elective Courses (OEC) by completing the online courses offered in NPTEL anytime between third and seventh semester on prior approval of the courses by the Academic Courses Committee of the Institute. Credits earned through the NPTEL courses will be confined to 2 or 3 credits and subject to a maximum of 9 credits during the entire programme of study.

(iii) Practical courses will normally carry either 1 or 1.5 credits – 1.5 credits for courses with 3 practice periods per week and 1 credit for courses with 2 practice periods per week.

(iv) Out of total credits required for successful completion of the degree, 14 to 22 credits can be assigned for Project work and/or Internship.

(v) Mandatory non-credit courses carry zero credit.

8. Examinations:

The theory and practical examinations shall comprise continuous internal assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April /May).

8.1. Evaluation Scheme

All Credit courses are evaluated for 100 marks comprising of Internal assessment and end-semester exam.

For Theory Course, the weightage of internal assessment is 40% and end semester examination is 60%

For Practical course, the weightage of internal assessment is 60% and end semester examination is 40%

For Project, the weightage of internal assessment is 60% and end semester examination is 40%

8.2. Internal Assessment (Theory)

Total Internal Assessment mark for a theory course is 40 marks. The breakup is as follows:

Criteria	Maximum Marks
a) Internal Assessment Tests	30
b) Percentage of Attendance	5
c) Assignment(s)	5
Total	**40**

Marks for Attendance are as follows:

Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

The Principal of the College/Institute schedules the Internal Assessment tests for all courses. All faculty members are expected to conduct this Internal Assessment tests for 1.30 hours duration and evaluate and required to upload the marks to the Controller of Examinations of University. Colleges are also requested to preserve the answer sheets of Internal Assessment tests until declaration of results by the University.

8.3. Internal Assessment (Practical's)

Faculty in-charge of Lab courses shall evaluate the practical course for 60 marks. The break up is as follows:

Criteria	Maximum Marks
a) Laboratory exercises and Record	30
c) Mid Semester exam (Average of 2 exams)	15
c) Internal Viva voce	5
d) Percentage of Attendance	10
Total	**60**

Marks for Attendance is as follows:

Below 75%	0
75% - 80%	2
81% - 85%	4
86% - 90%	6
91% - 95%	8
96% - 100%	10

8.4. Internal Assessment (Project)

The Project work carried out in the eighth semester shall be assessed as follows:

Criteria	Marks
a) Continuous assessment (Guide)	25
b) Project Evaluation Committee	35
Total	**60**

8.5 Requirement for appearing for University Examination

The Controller of Examinations (COE) of Pondicherry University schedules the End-Semester exams for all theory and practical courses based on the University academic calendar. A detailed Exam Time Table shall be circulated to all Colleges at least 15 days before the start of exams. Question Papers shall be set externally based on BOS approved syllabus.

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.
(*Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Assistant Director*)

ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester

iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.
A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

8.6 End Semester Exam Evaluation Pattern

Course	**Maximum marks**
a) Theory course (Sec A, Sec B and Sec C) Questions from all units of syllabus	60 marks
b) Practical course (Based on Lab exercises/Record/ Practicals /Viva)	40 marks
c) Internship /Project Work (Based on Seminar/Project Work/Project report/Presentation and viva voce)	40 marks

8.7 Consolidation of Marks and PassingMinimum

The Controller of Examinations of the University consolidates the Internal Assessment marks uploaded by the Colleges and marks secured by students in the end-semester examination.

A student shall be declared to have passed the examination in a subject of study only if he/she secures not less than **40% marks individually both in internal assessment and end- semester examination or an aggregate of 40%.**

A candidate who has been declared "Fail" in a particular subject may reappear for that subject during the subsequent semesters and secure pass marks. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

a) Applications for revaluation should be filed within 15 days from the date of declaration of resultsor 7days from the date of receipt of grade sheet whichever is earlier.
b) The candidate should have attended all the internal assessments conducted by the college as well as all the end semester examinations conducted by the University.
c) If a candidate has failed in more than two papers in the end semester examinations, his/her representation for revaluation will not be considered.
d) The request for revaluation must be made in the prescribed format duly recommended by the Head of the Institution along with the revaluation fee prescribed by theUniversity.

A student shall be declared to have passed the examination in a subject of study only **if he/she secures not less than 40% marks in the end-semester examination and secures an overall aggregate of 40%.**

8.8. Arrear Exams

A student who failed to secure 40% marks in aggregate is declared as "Fail" and he is eligible to take up a supplementary examination by registering to the said course in the following semester. All other candidates who failed due to shortage of attendance and those seeking to improve the grade shall repeat the course.

8.9. Letter Grades and Calculation of CGPA

Total Marks Secured by a student in each course shall be converted into a letter grade. The following Table shows the seven letter grades and corresponding meaning and the grade points for the calculation of Cumulative Grade Point Average (CGPA).

Each course(Theory/Practical)is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Range of Marks	**Assigned Grade**	Grade Points
91-100	A^+	10
81-90	A	9
71-80	B^+	8
61-70	B	7
51-60	C^+	6
46-50	C	5
40-45	D	4
<40	F	0
Not Applicable	F^R (Fail due to shortage of attendance and therefore, to repeat the course)	0

Note: -F- denotes failure in the course; - F^R - denotes absent / detainedas per AICTE norms. After the results are declared, grade sheets will be issued to the students.The grade sheets will contain the following details:

a) The college in which the candidate has studied.
b) The list of courses enrolled during the semester and the grades scored.
c) The Grade Point Average (GPA) for the semester and t he Cumulative Grade Point Average (CGPA)of all enrolled subjects from first semester onwards.
d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding Grades Points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses.

$$\mathbf{GPA = \sum(C \times GP)/ \sum C}$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. F^R grades are to be excluded for calculating GPA and CGPA.

e) The conversion of CGPA into percentage marks is as follows

$$\% \text{ Mark} = (\text{CGPA} - 0.5) \times 10$$

9. Procedure for completing the B.Tech. course:

A candidate can join/rejoin the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire B.Tech. course should be completed within 7 years (14 semesters) and six years (12 semesters) for students admitted under lateral entry.

10. Award of Class and Rank in B.Tech. degree:

i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of B.Tech. degree.

ii) A candidate who qualifies for the award of the B.Tech. degree passing in all subjects pertaining to the semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

iii) A candidate who qualifies for the award of the B.Tech. degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

iv) All other candidates who qualify for the award of B.Tech. degree shall be declared to have passed the examination in **SECOND CLASS**.

v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from the 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from the1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

11. Provisions for Honors/Minor degree along with B.Tech. degree:

1. <u>B.Tech. with Honors Degree in the same Engineering discipline</u>

a. The student shall be given an option to earn a Honors degree in the same discipline of engineering at the end of first year based on his academic performance in the first year.

b. A student is eligible to exercise this option if he has passed all the subjects offered in the first year in the first attempt itself and has earned a CGPA of not less than 7.5.

c. Honors degree in a particular discipline of engineering shall be offered for a batch of

students if and only if a minimum of 5 eligible students opt for it.

d. The student is required to earn an additional 20 credits (over and above the prescribed maximum credits in the curriculum) starting from the third semester onwards to become eligible for the award of Honors degree. 20 credits shall be earned by the student by completing 5 additional courses of 4 credits each, one in each of the 5 semesters starting from the third to seventh semester. The syllabus of these 5 courses are framed so as to cover advanced topics in that discipline of engineering.

e. The students admitted in the second year through Lateral Entry Scheme will also be given a chance to opt for Honors degree. Eligibility to avail this option is CGPA of 7.5 and above with no arrears in the third Semester. The student will join the existing batch of students in the fourth semester and earn 16 credits by registering the prescribed courses offered up to the seventh semester. The respective BoS will decide on a suitable course in lieu of the course offered in the third semester to facilitate the student to earn the remaining 4 credits.

f. A student is eligible to get the Honors degree only on completing the programme in 'First Class with Distinction' class.

g. A student can exercise the option to withdraw from the Honors degree at any time after entry.

h. Details about the courses completed and credits earned for Honors degree will appear only in the 'Eighth Semester Grade Sheet' and 'Consolidated Grade Sheet'. These details will be listed under the heading 'Credits Earned for Honors degree'. In the case of students who have either withdrawn from Honors degree or become ineligible for Honors degree by not securing 'First Class with Distinction', the credits earned for the courses registered and successfully completed for Honors degree will be listed under the heading 'Additional Credits Earned'.

i. The CGPA will be calculated for all the courses credited by the students inclusive of major and honors courses

j. Nomenclature of Honors Degree is 'B.Tech.(Honors) in XXX ', where XXX is Discipline in which the student has enrolled.

2. <u>B.Tech. with Minor degree in another Engineering discipline</u>

a) The student shall be given an option to earn a minor degree in another discipline of engineering of his choice at the end of first year based on his academic performance in the first year.

b) A student is eligible to exercise this option if he has passed all the subjects offered in the first year in the first attempt itself and has earned a CGPA of not less than 7.5.

c) Minor degree in a particular discipline of engineering shall be offered for a batch of students if and only if a minimum of 5 eligible students opt for it.

d) The student is required to earn an additional 20 credits (over and above the prescribed maximum credits in the curriculum) starting from the third semester onwards to become eligible for the award of minor degree. 20 credits shall be earned by the student by completing 5 additional courses of 4 credits each, one in each of the 5 semesters starting from the third to seventh semester. The curricular content of these 5 courses are framed in such a way that that these courses will essentially cover the core minimum knowledge required to be fulfilled for award of degree in the discipline of engineering in which the student chooses to earn the minor degree.

e) The students admitted in the second year through Lateral Entry Scheme will also be given a chance to opt for Minor degree. Students with a CGPA of 7.5 and with no arrears in the third semester are eligible to avail this option. The student will join the existing batch of students in the fourth semester and earn 16 credits by registering for prescribed courses offered up to seventh semester. The respective BoS will decide on a suitable course in lieu of the course offered in the third semester to facilitate the student to earn the remaining 4 credits.

f) A student can exercise the option to withdraw from the Minor degree at any time after entry.

g) Details about the courses completed and credits earned for Minor degree will appear only in the 'Eighth Semester Grade Sheet' and 'Consolidated Grade Sheet'. These details will be listed under the heading 'Credits Earned for Minor degree'. In the case of students who have withdrawn from Minor degree, the credits earned for the courses registered and successfully completed for Minor degree will be listed under the heading 'Additional Credits Earned'.

h) Nomenclature of Minor Degree is 'B.Tech. in XXX with Minor in YYY', where XXX is Discipline in which the student is enrolled and YYY is Discipline which the student has opted as Minor.

i) The CGPA will be calculated for all the courses credited by the students inclusive of major and minor courses.

12. Provision for withdrawal:

Based on the recommendation of the Head of the Institution, a candidate with valid reasons may be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. A candidate who has withdrawn is also eligible to be awarded DISTINCTION provided he/she satisfies the other necessary conditions. But, they are not eligible to be awarded a rank.

13. Provisions for exit in B.Tech. course:

(For courses where AICTE specifies exit in the model curriculum)

The curriculum and the syllabus for all B.Tech programmes have been planned in compliance with the NEP guidelines proposed by AICTE. Accordingly, students joining B.Tech programmes shall have all benefits NEP offers in terms of exercising exit option during the course of study. Every B.Tech programme governed under this school board shall adopt the NEP guidelines, as and when proposed/amended by AICTE, and the following scheme will be applied for all such B.Tech programmes specified by AICTE.

NEP 2020 suggests that a student can exercise exits at multiple stages of the course of study. As per AICTE norms, a student can have two possible exits before the completion of the Full Engineering degree and may get a UG Diploma /Certificate or B.Sc. degree in the relevant discipline if he/she fulfils the following conditions: (Subject to change as per AICTE guidelines)

1. **UG Diploma/Certificate in the relevant branch of study**

   A student should be able to get a UG Diploma if he/she completes:

   a. 50% of the credits for B.Tech. (80-85 credits)

   b. 50% of the program core courses

   c. Students exiting the program after earning 50% credit requirements will be awarded a UG Diploma provided they secure an additional 6 credits through summer internships/apprenticeship of 2 months duration.

   d. Students admitted through lateral entry cannot exercise the exit option as he will not be able to meet out the 50% Credits for B.Tech. degree.

2 B.Sc. in the relevant branch of study

A student should be able to get a B.Sc. degree if he/she completes:

(i) 75% of the credits for B.Tech. (minimum 120 credits) and atleast 3 years in the program.

(ii) 100% of the core program courses.

(iii) Students exiting the program after earning 75% credit requirements will be awarded a B.Sc. provided they secure an additional 6 credits through 2 summer internships/apprenticeship for 2 months each.

(iv) With B.Sc. degree, the student is eligible for entry into programs which take B.Sc. degree as eligibility criteria.

2.1 Award of Class in B.Sc. degree

A candidate who satisfies the course requirements for all semesters and who passes all the examinations within a maximum period of 6 years (5 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of B.Sc. degree in the relevant discipline.

i) A candidate who qualifies for the award of the B.Sc. degree passing in all subjects pertaining to semesters the 3 to 6 in his/her first appearance within 4 consecutive semesters (2 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 6 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

ii) A candidate who qualifies for the award of the B.Sc. degree by passing in all subjects relating to semesters 3 to 6 within a maximum period of six semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS.**

iii) All other candidates who qualify for the award of B.Sc. degree shall be declared to have passed the examination in **SECOND CLASS**.

2. Re-entry to complete the program

A student exiting with B.Sc. should be entitled to re-enrol in the programme of the same Engineering discipline. Only students admitted to the B.Tech. programme and exercised an exit option are eligible for readmission to the B.Tech. programme under the same discipline. It is suggested that all credits will be transferred, if the student enrols back within a limited period (3 years) of exiting. In case a student enrols after that, then the decision on the transfer of credits should be based on the changes in the curriculum the student studied. A candidate after exit may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of

the B.Tech. course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

3. Completion Possibility in other Institutions

A student can earn B.Sc. in one institution (Engineering) and complete the degree program in another institution (same Engineering discipline only).

(Note: If these exit options are accepted for multipleB.Tech. programs, it is suggested that AICTE actively communicate these to the industry and other bodies, so they recognize these and accept them as bona-fide credentials for the purposes of recruitment and/or eligibility for admission to programs, appearing in competitive examinations, etc.)

14. Revision of Regulations and Curriculum:

The University may from time-to-time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 163 credits, the total number of credits proposed for the four-year B. Tech in Information Technology is kept as 169.

C. Structure of UG Program in Information Technology (IT): The structure of UG program in Information Technology (IT) shall have essentially the following categories of courses with the breakup of credits as given:

S.No.	Category	Credit Breakup	**Credit Breakup for IT students**
1	Humanities and Social Sciences including Management courses	16	**16**
2	Basic Science courses	23	**25**
3	Engineering Science courses including workshop, drawing, basics of electronics/electrical/mechanical/computer etc.	29	**24**
4	Professional core courses	59	**66**
5	Professional Elective courses relevant to chosen specialization/branch	12	**12**
6	Open subjects – Electives from other technical and /or emerging subjects	9	**9**
7	Project work, seminar and internship in industry or elsewhere	15	**17**
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)	(non-credit)
	Total	**163***	**169**

D. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
ITHS	Humanities and Social Sciences including Management courses
ITBS	Basic Science courses
ITES	Engineering Science courses
ITPC	Professional Core courses
ITPE	Professional Elective courses
ITOE	Open Elective courses
ITHL	Humanities and Social Sciences Lab
ITBL	Basic Science Lab
ITEL	Engineering Science Lab
ITPL	Professional Core Lab
ITAU	Audit Courses
ITMC	Mandatory Courses
ITH	Honor Courses
ITM	Minor Courses
ITPROJ	Mini Project, Seminar, Project I , Internship, Project II

E. Course level coding scheme: Three - digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix with the Course Code for identifying the level of the course. Digit at hundred's place signifies the year in which course is offered. e.g.

101, 102 … etc. for first year.

201, 202 …. Etc. for second year.

301, 302 … for third year.

F. Category-wise Courses

HUMANITIES & SOCIAL SCIENCES COURSES [HS]

(i) Number of Humanities & Social Science Courses: 6

(ii) Credits: 16

Sl. No	CourseCode	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITHL104	Design Thinking	I	0	0	2	1
2	ITHS201	English	II	2	0	2	3
3	ITHS204	Universal Human Values II	II	3	0	0	3
4	ITHS505	Principles of Management	V	3	0	0	3
5	ITHS604	Human Resource Management	VI	3	0	0	3
6	ITHS701	Organizational Behavior	VII	3	0	0	3
Total Credits							**16**

BASIC SCIENCE COURSE [BS] :

(i) Number of Basic Science Courses: 8

(ii) Credits: 25

Sl. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITBS101	Mathematics-I	I	3	1	0	4
2	ITBS102	Physics	I	3	0	0	3
3	ITBL101	Physics Lab	I	0	0	4	2
4	ITBS202	Mathematics-II	II	3	1	0	4
5	ITBS203	Chemistry	II	3	0	0	3
6	ITBL201	Chemistry Lab	II	0	0	4	2
7	ITBS301	Mathematics-III	III	3	0	0	3
8	ITBS401	Discrete Mathematics	IV	3	1	0	4
Total Credits							**25**

ENGINEERING SCIENCE COURSE [ES] :

(i) Number of Engineering Science Courses: 9

(ii) Credits: 24

Sl. No	CodeNo.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITES103	Basic Electronics Engineering	I	3	0	0	3
2	ITEL102	Basic Electronics Lab	I	0	0	4	2
3	ITEL103	Engineering Graphics and Design Lab	I	1	0	4	3
4	ITES204	Programming for Problem Solving	II	3	0	0	3
5	ITEL202	Programming for Problem Solving Lab	II	0	0	4	2
6	ITEL203	Workshop /Manufacturing Lab	II	1	0	4	3
7	ITES302	Digital Electronics and Systems	III	3	0	0	3
8	ITES305	Communication Engineering	III	3	0	0	3
9	ITEL303	Communication Engineering Lab	III	0	0	4	2
Total Credits							**24**

PROFESSIONAL CORE COURSES [PC] :

(i) Number of Professional Core Courses: 25

(ii) Credits: 66

S No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITPC303	Data Structures and Algorithms	III	3	0	0	3
2	ITPC304	Object Oriented Programming	III	3	0	0	3
3	ITPC306	Computer Organization and Architecture	III	3	0	0	3
4	ITPL301	Data Structures and Algorithms Lab	III	0	0	4	2
5	ITPL302	Object Oriented Programming Lab	III	0	0	4	2
6	ITPC401	Theory of Computation	IV	3	0	0	3
7	ITPC402	Information Coding Techniques	IV	3	0	0	3
8	ITPC403	Database Management Systems	IV	3	0	0	3
9	ITPC404	Web Technology	IV	3	0	0	3
10	ITPC405	Operating Systems	IV	3	0	0	3
11	ITPL401	Database Management Systems Lab	IV	0	0	4	2
12	ITPL402	Web Technology Lab	IV	0	0	4	2
13	ITPL403	Operating Systems Lab	IV	0	0	4	2
14	ITPC501	Computer Networks	V	3	0	0	3
15	ITPC502	Cloud Computing	V	3	0	0	3
16	ITPC503	Distributed Computing	V	3	0	0	3
17	ITPC504	Embedded Systems and IoT	V	3	0	0	3
18	ITPL501	Computer Networks Lab	V	0	0	4	2
19	ITPL502	Cloud Computing Lab	V	0	0	4	2
20	ITPL503	Embedded Systems and IoT Lab	V	0	0	4	2
21	ITPC601	Artificial Intelligence	VI	3	0	0	3
22	ITPC602	Software Engineering	VI	3	0	0	3
23	ITPC603	Compiler Design	VI	3	0	0	3
24	ITPL601	Artificial Intelligence Lab	VI	0	0	4	2
25	ITPC702	Cyber Security	VII	3	0	0	3
Total Credits							**66**

PROFESSIONAL ELECTIVE COURSES [PE] :

(i) Number of Professional Elective Courses: 4

(ii) Credits: 12

S. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITPEXXX	Professional Elective -I	VI	3	0	0	3
2	ITPEXXX	Professional Elective-II	VI	3	0	0	3
3	ITPEXXX	Professional Elective-III	VII	3	0	0	3
4	ITPEXXX	Professional Elective-IV	VII	3	0	0	3
Total Credits							**12**

OPEN ELECTIVE COURSES [OE] :

(i) Number of Open Elective Courses: 3

(ii) Credits: 9

S.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ITOEXXX	Open Elective – I	VIII	3	0	0	3
2	ITOEXXX	Open Elective-II	VIII	3	0	0	3
3	ITOEXXX	Open Elective-III	VIII	3	0	0	3
Total Credits							**9**

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY OR ELSEWHERE [PROJ] :

(i) Number of Project work Courses: 5

(ii) Credits: 17

Sl. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	**Tutorial**	**Practical**	
1	ITPROJ602	Mini Project	VI	0	0	6	3
2	ITPROJ701	Seminar	VII	0	0	2	1
3	ITPROJ702	Project I	VII	0	0	12	6
4	ITPROJ801	Internship	VIII	0	0	4	1
5	ITPROJ802	Project II	VIII	0	0	12	6
Total Credits							**17**

MANDATORY COURSES [MC] / AUDIT COURSE [AU] :

(i) Number of Mandatory Courses [MC] / Audit Course [AU] Courses: 5
(ii) Credits: 0

S. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	-	Induction Programme	I	3 weeks			0
2	ITAU105	IDEA Workshop Lab	I	2	0	4	0
3	ITAU204	Sports and Yoga	II	2	0	0	0
4	ITMC406	Environmental Science	IV	3	0	0	0
5	ITMC506	Constitution of India	V	3	0	0	0
Total Credits							0

INDUCTION PROGRAM

The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link:https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf).

Induction program (mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

Mandatory Visits/ Workshop/Expert Lectures:

a. It is mandatory to arrange one industrial visit every semester for the students of eachbranch.

b. It is mandatory to conduct a One-week workshop during the winter break after fifthsemester on professional/ industry/ entrepreneurial orientation.

c. It is mandatory to organize at least one expert lecture per semester for each branchby inviting resource persons from domain specific industry.

SUMMARY OF ALL COURSES

S.No	Course Category	I	II	III	IV	V	VI	VII	VIII	Total Credits
1	**HS**	**1**	**6**			**3**	**3**	**3**		**16**
2	**BS**	**9**	**9**	**3**	**4**					**25**
3	**ES**	**8**	**8**	**8**						**24**
4	**PC**			**13**	**21**	**18**	**11**	**3**		**66**
5	**PE**						**6**	**6**		**12**
6	**OE**								**9**	**9**
7	**PROJ**						**3**	**7**	**7**	**17**
8	**MC**	*			*	*				-
9	**AU**	*	*							-
Total		**18**	**23**	**24**	**25**	**21**	**23**	**19**	**16**	**169**

Curriculum

Semester I						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Induction Program			**3 weeks**			**0**
Theory						
1.	ITBS101	Mathematics-I	3	1	0	4
2.	ITBS102	Physics	3	0	0	3
3.	ITES103	Basic Electronics Engineering	3	0	0	3
Practical						
4.	ITBL101	Physics Lab	0	0	4	2
5.	ITEL102	Basic Electronics Lab	0	0	4	2
6.	ITEL103	Engineering Graphics and Design Lab	1	0	4	3
7.	ITHL104	Design Thinking	0	0	2	1
8.	ITAU105	IDEA Workshop Lab	2	0	4	0
Total			12	1	18	18
Semester II						
S.No	**Course Code**	**Course Title**	**Periods**			
			L	**T**	**P**	**Credits**
Theory						
1.	ITHS201	English	2	0	2	3
2.	ITBS202	Mathematics-II	3	1	0	4
3.	ITBS203	Chemistry	3	0	0	3
4.	ITES204	Programming for Problem Solving	3	0	0	3
5.	ITHS205	Universal Human Values II	2	1	0	3
Practical						
6.	ITBL201	Chemistry Lab	0	0	4	2
7.	ITEL202	Programming for Problem Solving Lab	0	0	4	2
8.	ITEL203	Workshop /Manufacturing Lab	1	0	4	3
9.	ITAU204	Sports and Yoga	2	0	0	0
Total			14	2	15	23

Semester III						
S.No	Course Code	Course Title	Periods			
			L	T	P	Credits
Theory						
1.	ITBS301	Mathematics-III	3	0	0	3
2.	ITES302	Digital Electronics and System	3	0	0	3
3.	ITPC303	Data Structures and Algorithms	3	0	0	3
4.	ITPC304	Object Oriented Programming	3	0	0	3
5.	ITES305	Communication Engineering	3	0	0	3
6.	ITPC306	Computer Organization and Architecture	3	0	0	3
Practical						
7.	ITPL301	Data Structures and Algorithms Lab	0	0	4	2
8.	ITPL302	Object Oriented Programming Lab	0	0	4	2
9.	ITEL303	Communication Engineering Lab	0	0	4	2
Total			18	0	12	24
Semester IV						
			Periods			
S.No	Course Code	Course Title	L	T	P	Credits
Theory						
1.	ITBS401	Discrete Mathematics	3	1	0	4
2.	ITPC402	Theory of Computation	3	0	0	3
3.	ITPC403	Information Coding Techniques	3	0	0	3
4.	ITPC404	Database Management Systems	3	0	0	3
5.	ITPC405	Web Technology	3	0	0	3
6.	ITPC406	Operating Systems	3	0	0	3
7.	ITMC407	Environmental Science	3	0	0	0
Practical						
8.	ITPL401	Database Management Systems Lab	0	0	4	2
9.	ITPL402	Web Technology Lab	0	0	4	2
10.	ITPL403	Operating Systems Lab	0	0	4	2
Total			21	1	12	25
Semester V						
			Periods			
S.No	Course Code	Course Title	L	T	P	Credits
Theory						
1.	ITPC501	Computer Networks	3	0	0	3
2.	ITPC502	Cloud Computing	3	0	0	3
3.	ITPC503	Distributed Computing	3	0	0	3
4.	ITPC504	Embedded Systems and IoT	3	0	0	3
5.	ITHS505	Principles of Management	3	0	0	3
6.	ITMC506	Constitution of India	3	0	0	0
Practical						
7.	ITPL501	Computer Networks Lab	0	0	4	2
8.	ITPL502	Cloud Computing Lab	0	0	4	2
9.	ITPL503	Embedded Systems and IoT Lab	0	0	4	2
Total			18	0	12	21

Semester VI						
			Periods			
S.No	Course Code	Course Title	L	T	P	Credits
Theory						
1.	ITPC601	Artificial Intelligence	3	0	0	3
2.	ITPC602	Software Engineering	3	0	0	3
3.	ITPC603	Compiler Design	3	0	0	3
4.	ITPEXXX	Professional Elective-I	3	0	0	3
5.	ITPEXXX	Professional Elective-II	3	0	0	3
6.	ITHS604	Human Resource Management	3	0	0	3
Practical						
7.	ITPL601	Artificial Intelligence Lab	0	0	4	2
8.	ITPROJ602	Mini Project	0	0	6	3
Total			18	0	10	23
Semester VII						
			Periods			
S.No	Course Code	Course Title	L	T	P	Credits
Theory						
1.	ITHS701	Organizational Behavior	3	0	0	3
2.	ITPC702	Cyber Security	3	0	0	3
3.	ITPEXXX	Professional Elective-III	3	0	0	3
4.	ITPEXXX	Professional Elective-IV	3	0	0	3
Practical						
5.	ITPROJ701	Seminar	0	0	2	1
6.	ITPROJ702	Project I	0	0	12	6
Total			12	0	14	19
Semester VIII						
			Periods			
S.No	Course Code	Course Title	L	T	P	Credits
Theory						
1.	ITOEXXX	Open Elective-I	3	0	0	3
2.	ITOEXXX	Open Elective-II	3	0	0	3
3.	ITOEXXX	Open Elective-III	3	0	0	3
Practical						
4.	ITPROJ801	Internship	0	0	4	1
5.	ITPROJ802	Project II	0	0	12	6
Total			9	0	16	16

HONOR COURSES						
SEM	**Course Code**	**Course Title**	**Periods**			
			L	**T**	**P**	**Credits**
Theory						
III	ITH01	Data Science	3	1	0	4
IV	ITH02	Drone Technologies	3	1	0	4
V	ITH03	3D Printing	3	1	0	4
VI	ITH04	Agile Methodologies	3	1	0	4
VII	ITH05	Biometrics	3	1	0	4

MINOR COURSES						
SEM	**Course Code**	**Course Title**	**Periods**			
			L	**T**	**P**	**Credits**
Theory						
III	ITM01	Essentials of Data Structures and Algorithms	3	1	0	4
IV	ITM02	Java and Internet Programming	3	1	0	4
V	ITM03	Data Communication and Computer Networks	3	1	0	4
VI	ITM04	Information Systems and Organization	3	1	0	4
VII	ITM05	IoT and Python Programming	3	1	0	4

LIST OF PROFESSIONAL ELECTIVE COURSES: VERTICALS

S.No	Course Code	Course Title	Periods			
			L	**T**	**P**	**Credits**
Vertical 1: Artificial Intelligence and Machine Learning						
1.	ITPE001	Exploratory Data Analysis	3	0	0	3
2.	ITPE002	Artificial Neural Networks	3	0	0	3
3.	ITPE003	Machine Learning	3	0	0	3
4.	ITPE004	Deep Learning Techniques	3	0	0	3
5.	ITPE005	Natural Language Processing	3	0	0	3
Vertical 2: Full Stack Development						
6.	ITPE006	Full Stack Web Development	3	0	0	3
7.	ITPE007	DevOps	3	0	0	3
8.	ITPE008	UI and UX Design	3	0	0	3
9.	ITPE009	Software Testing and Automation	3	0	0	3
10.	ITPE010	Robotic Process Automation	3	0	0	3

Vertical 3: Data Center Technologies						
11.	ITPE011	Data Mining and Warehousing	3	0	0	3
12.	ITPE012	Storage Technologies	3	0	0	3
13.	ITPE013	Virtualization	3	0	0	3
14.	ITPE014	Cloud Services Management	3	0	0	3
15.	ITPE015	Big Data Analytics	3	0	0	3
Vertical 4: Cyber Security						
16.	ITPE016	Cryptography and Network Security	3	0	0	3
17.	ITPE017	Database and Application Security	3	0	0	3
18.	ITPE018	Digital and Mobile Forensic	3	0	0	3
19.	ITPE019	Blockchain Technologies	3	0	0	3
20.	ITPE020	Ethical Hacking	3	0	0	3
Vertical 5: Advanced Networks						
21.	ITPE021	Mobile Computing	3	0	0	3
22.	ITPE022	Wireless Networks	3	0	0	3
23.	ITPE023	Software Defined Networks	3	0	0	3
24.	ITPE024	Mobile Application Development	3	0	0	3
25.	ITPE025	Advanced Mobile Communications	3	0	0	3
Vertical 6: Multimedia Technologies						
26.	ITPE026	Multimedia and Animation	3	0	0	3
27.	ITPE027	Human Computer Interaction	3	0	0	3
28.	ITPE028	Graphics and Image Processing	3	0	0	3
29.	ITPE029	Augmented Reality/Virtual Reality	3	0	0	3
30.	ITPE030	Computer Vision	3	0	0	3

OPEN ELECTIVE COURSES

S.No	Course Code	Course Title	Periods			Credits
			L	T	P	
1.	ITOE001	Python Programming	3	0	0	3
2.	ITOE002	Object Oriented Programming using C++	3	0	0	3
3.	ITOE003	Essentials of Mobile Application Development	3	0	0	3
4.	ITOE004	Bioinformatics	3	0	0	3
5.	ITOE005	Web Engineering	3	0	0	3

ITBS101 MATHEMATICS - I

L	T	P	C
3	1	0	4

Course Objective:

- To comprehend the mathematical concepts of matrices, ordinary differential equations, multivariable calculus and problem-solving.

Course Outcomes:

- To solve practical problems using Matrix algebra.
- To solve various types of ordinary differential equations, including higher-order linear equation.
- To compute partial derivatives, determine total derivatives, Jacobians, employ Taylor series, and find extremes of functions of two variables.
- To demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume.
- To apply Green's theorem, Stoke's theorem and Gauss divergence theorem.

UNIT I (12 Hrs)

LINEAR ALGEBRA(MATRICES): Rank of a matrix - Consistency of a system of linear equations - Characteristic equation of a matrix - Eigen values and Eigen vectors - Properties of Eigen values and Eigen vectors - Cayley-Hamilton theorem (excluding proof)- Verification- Application (Finding Inverse and Power of a matrix)- Diagonalization of a matrix by orthogonal and similarity transformation- Quadratic form – Nature of Quadratic Form- Orthogonal reduction of quadratic form to canonical form.

UNIT II (12 Hrs)

ORDINARY DIFFERENTIAL EQUATIONS: Differential Equations of First Order- Exact equations- Leibnitz's linear equations- Bernoulli's equation- Equations solvable for p- Clairaut's equation- Differential equations of Higher order- Linear differential equations of higher order with constant coefficients- Euler's linear equation of higher order with variable coefficients- Method of variation of parameters.

UNIT III (12 Hrs)

MULTIVARIABLE CALCULUS (DIFFERENTIATION): Partial differentiation- Partial derivatives of first order and higher order- Partial differentiation of implicit functions- Euler's theorem on homogeneous functions - Total derivative - Jacobian Properties - Taylor's series for functions of two variables- Maxima and minima of functions of two variables.

UNIT IV (12 Hrs)

MULTIVARIABLE CALCULUS (MULTIPLE INTEGRALS): Double integration (Cartesian form and Polar form)- constant limits- variable limits- over the region R- Change of variables in double integrals (Cartesian to polar)- Application of double integral- Area by double integration- Change of Order of Integration- Triple Integration (Cartesian- Spherical and Cylindrical)- constant limits- variable limits- over the region R- Application of triple integral- Volume by triple integration.

UNIT V (12 Hrs)

MULTIVARIABLE CALCULUS (VECTOR CALCULUS): Vector Differential Operator- Gradient - Properties - Directional derivative - Divergence and Curl Properties and relations- Solenoidal and Irrotational vector fields - Line integral and Surface integrals - Integral Theorems (excluding Proof) - Green's theorem - Stoke's theorem - Gauss divergence theorem.

Text Books:

1. Veerarajan T., "Engineering Mathematics - I & II ", Tata McGraw-Hill, New Delhi, 2014 & 2015.
2. Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

References:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
4. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Differential equations for engineers: https://nptel.ac.in/courses/111106100
2. Calculus of Several Real Variables: https://nptel.ac.in/courses/111104125
3. Engineering Mathematics - I: https://nptel.ac.in/courses/111105121
4. Matrix Analysis with Applications: https://nptel.ac.in/courses/111107112

ITBS102 PHYSICS

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental concepts of oscillations, waves, optics, applications of real life optical systems, communication and other applications.

Course Outcomes:

- To understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations.
- To gain knowledge on transverse and longitudinal waves in one dimension.
- To acquire skills to identify and apply formulas of optics and wave physics.
- To apply principles of interference, diffraction and polarization gain knowledge on interferometers.
- To gain knowledge on lasers to engineering situations.

UNIT I (9 Hrs)

SIMPLE HARMONIC MOTION - DAMPED AND FORCED SIMPLE HARMONIC OSCILLATOR: Mechanical and electrical simple harmonic oscillators - complex number notation and phasor representation of simple harmonic motion - damped harmonic oscillator – heavy - critical and light damping - energy decay in a damped harmonic oscillator - quality factor - forced mechanical and electrical oscillators - electrical and mechanical impedance - steady state motion of forced damped harmonic oscillator - power absorbed by oscillator.

UNIT II (9 Hrs)

NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION AND INTRODUCTION TO DISPERSION: Transverse wave on a string - the wave equation on a string - Harmonic waves - reflection and transmission of waves at a boundary - impedance matching - standing waves and their Eigen frequencies - longitudinal waves and the wave equation for them - acoustics waves and speed of sound - standing sound waves. Waves with dispersion - water waves - superposition of waves and Fourier method - wave groups and group velocity.

UNIT III (9 Hrs)

THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS: Fermat's principle of stationary time and its applications e.g. in explaining mirage effect -laws of reflection and refraction - Light as an electromagnetic wave and Fresnel equations - reflectance and transmittance - Brewster's angle - total internal reflection - evanescent wave. Mirrors and lenses and optical instruments based on them - transfer formula and the matrix method.

UNIT IV (9 Hrs)

WAVE OPTICS: Huygens' principle - superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment - Newton's rings - Michelson interferometer - Mach- Zehnder interferometer, Farunhofer diffraction from a single slit and a circular aperture - the Rayleigh criterion for limit of resolution and its application to vision, Diffraction gratings and their resolving power.

UNIT V (9 Hrs)

LASERS: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion - different types of lasers, gas lasers (He-Ne - CO_2) - solid-state lasers (ruby - Neodymium) - dye lasers,Properties of laser beams, mono-chromaticity - coherence - directionality and brightness - laser speckles - applications of lasers in science - engineering and medicine.

Text Books:

1. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", John Wiley & Sons Inc.USA 11th Edition, 2018.
2. Arthur Beiser, "Concepts of Modern Physics", Mc-Graw Hill Publications Private Limited, 7th Edition, 2017.
3. N.Subramanyam, "Waves and oscillations", Vikas Publishing house,2nd Edition, 2009.

References:

1. Renk, Karl.F, "Basics of laser physics", Springer international publishing, 2nd Edition, 2017.
2. H. J. Pain, Patricia Rankin, "Introduction to vibration and waves", Wiley, 1st Edition, 2015.
3. David Halliday, Robert Resnick and Jearl Walker, "Fundamentals of Physics", Wiley publications, 2013.

ONLINE/NPTEL Courses:

1. Engineering Physics I (Theory): https://nptel.ac.in/courses/122103011
2. Waves and Oscillations: https://nptel.ac.in/courses/115106119
3. Modern Optics: https://nptel.ac.in/courses/115105104

ITES103 BASIC ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objective:

- To learn the fundamental skills in construction of electronics circuit design and develop various electronic systems.

Course Outcomes:

- To understand the semiconductor physics of the intrinsic, p and n materials.
- To understand the function and operation of diodes, transistors and amplifiers.
- To analyze the performances of BJT & FETs and its uses in amplifiers and oscillators.
- To analyze and design the operational amplifiers circuits.
- To understand the architecture, functions & their applications of IC 741 OP-Amp.

UNIT I (9 Hrs)

SEMI CONDUCTORS AND DIODES: Conductors - Semiconductors - Intrinsic Semiconductors - Extrinsic Semi Conductors. Diode Theory, Basic Ideas - ideal Diode - Forward and Reverse Bias - Diode Equation - Volt-Ampere Characteristic- Special diodes, symbol of zener diode - operation - V-I characteristics - symbol of photo diode - working principle - LED symbol and principle.

UNIT II (9 Hrs)

RECTIFIERS: Half-wave Rectifier - Full-wave and Bridge Rectifier - derivation of Ripple factor - efficiency of Half-wave -Full-wave and Bridge rectifiers, Merits and demerits of Half-wave - Full-wave and Bridge rectifiers - Comparisons of rectifiers.

UNIT III (9 Hrs)

BIPOLAR JUNCTION &, FIELD-EFFECT TRANSISTORS: Symbols of PNP and NPN transistors and their working principles -Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier -Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT IV (9 Hrs)

DIGITAL CIRCUITS: Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem – Logic gates -Implementation of Boolean expressions - Flip flops - RS - JK - T and D Combinational logic - Half adder - Full adder and Subtractors, Sequential logic - Ripple counters and shift registers.

UNIT V (9 Hrs)

OPERATIONAL AMPLIFIERS: Characteristics of Op-Amps, Introduction to Op-amp - Op-amp Block Diagram - ideal and practical Op-Amps specifications - 741 Op-Amps & its features - Op-amp parameters & Measurement - Applications of Op-Amps: Inverting and Non-inverting amplifier - Integrator and differentiator - Comparators.

Text Books:

1. Albert Malvino and David J Bates, "Electronic Principles", Tata McGraw–Hill, 9th Edition, 2021. (Unit 1 & 2)
2. Boyelstad, "Electronic Devices and Circuits Theory", Pearson Education, 11th Edition, 2013.(Unit 1, 2 & 3)
3. Morris Mano, "Digital design", PHI Learning, 4thEdition, 2016. (Unit 4)
4. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI, 4th Edition, 2015. (Unit 5)
5. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International Pvt.Ltd., 5th Edition, 2018.(Unit 5)

References:

1. Robert L.Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson/PHI, 10th Edition, 2010.
2. David A.Bell, "Electronic Devices and Circuits", Oxford, 5th Edition, 2009.
3. S.Salivahanan, Kumar, Vallavaraj, "Electronic Devices and Circuits", TATA McGraw Hill, 2nd Edition, 2003.
4. David A, "Operational Amplifiers & Linear ICs", Oxford Uni. Press, 3rd Edition, 2005. (Unit 5)

ONLINE / NPTEL Courses:

1. Introduction to Basic Electronics: https://archive.nptel.ac.in/courses/122/106/122106025/
2. Basic Electronics: https://archive.nptel.ac.in/courses/108/101/108101091/

ITBL101 PHYSICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To understand the working principles of spectrometer, polarimeter, curvature of lens and determination of optical absorption.

Course Outcomes:

- To understand and experiment Newtons rings.
- To understand the principles, concepts abd comparison of results with theoretical calculations.
- To understand measurement technology, usage of new instruments and real time applications in engineering studies.
- To state various laws which they have studied through experiments.
- To describe principles of optical fibre communication.

LIST OF EXPERIMENTS

1. Radius of curvature of a Lens - Newton's rings.
2. Thickness of a thin object by air – wedge.
3. Spectrometer – resolving power of a prism.
4. Spectrometer - determination of wavelength using grating.
5. Spectrometer - ordinary and extraordinary rays by calcite prism.
6. Laurant's Half shade polarimeter – determination of specific rotatory power.
7. Determination of wavelength of a laser source using transmission grating, reflection grating vernier calipers and particle size determination.
8. Determination of numerical aperture and acceptance angle of an optical fiber.
9. Determination of optical absorption coefficient of materials using laser.
10. Compact disc - determination of width of the groove using laser.

(Total Periods:45)

ITEL102 BASIC ELECTRONICS LAB

L	T	P	C
0	0	4	2

Course Objective:

- To design and analyze electronic circuits such as diodes, rectifiers, Zener diode, BJT, FET. To verify the basic logic operations and simple arithmetic circuits using logic gates.

Course Outcomes:

- To understand the characteristics of basic electronic devices.
- To apply problem-solving skills, recognize and utilize the characteristics of diodes, rectifiers & transistors.
- To construct the adder, subtractor, multiplier circuits to verify their functionalities.
- To interpret the Op-Amp based inverting and non-inverting amplifier circuit.
- To integrate diverse applications of Op-Amp in differentiator, integrator, adder & subtractor circuits.

LIST OF EXPERIMENTS

1. Measurement of different signal parameters using oscilloscope.
2. V-I characteristics of ordinary p-n junction diode.
3. Full wave rectifier, with and without filter.
4. Zener diode as a voltage regulator.
5. Input and output characteristics of BJT.
6. Input and output characteristics of FET.
7. Realization of basic gates using Universal logic gates.
8. Construction of simple Decoder & Multiplexer circuits using logic gates.
9. Construction of simple arithmetic circuits-Adder, Subtractor.
10. Op-Amp based inverting and non-inverting amplifier.
11. Op-Amp based differentiator and integrator.
12. Op-Amp based adder and subtractor.

(Total Periods:45)

ITEL103 ENGINEERING GRAPHICS AND DESIGN LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide the basic knowledge about Engineering Drawing and learn the concepts of projections, technical drawing, dimensioning and specifications.

Course Outcomes:

- To understand the visual aspects of Engineering Design.
- To understand Engineering Graphics Standards.
- To illustrate Solid Modelling.
- To understand Computer-Aided geometric design
- To understand creation of design working drawings.
- To understand Engineering Communication inspect.

UNIT I

INTRODUCTION: Introduction, Conics and Special Curves.

UNIT II

PROJECTIONS: Projection of points, lines and planes.

UNIT III

SOLIDS: Projection of solids, section of solids, surface development in Engineering Design and Graphics Lab.

UNIT IV

ISOMETRIC: Isometric and Orthographic projections.

UNIT V

AUTOCAD: Introduction to computer aided drafting, hardware, overview of application software – 2D drafting commands (Auto CAD) for simple shapes – Dimensioning.

Text Books:

1. Bhatt N.D., Panchal V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House, 2014.
2. Lakhwinder Pal Singh and Harwinder Singh, "Engineering Drawing Principles and Applications", Cambridge University Press Education, 2021.
3. Agrawal B. and Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.
4. K. Venugopal, "Engineering Drawing and Graphics + Auto CAD", New Age International Publication Ltd., 4^{th} Edition, 2004.

References:

1. Narayana, K.L. and P Kannaiah, “Engineering Drawing”, Scitech Publishers, 2008.
2. CAD Software Theory and User Manuals.

(Total Periods:45)

ITHL104 DESIGN THINKING

L	T	P	C
0	0	2	1

Course Objective:

- To understand the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.

Course Outcomes:

- To compare and classify the various learning styles and memory techniques and apply them in their engineering education.
- To analyze emotional experience and inspect emotional expressions to better understand users while designing innovative products.
- To develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.
- To explore real-time innovative engineering product designs and choose appropriate frameworks, strategies,techniques during prototype development.
- To perceive individual differences, its impact on everyday decisions and create a better customer experience.

UNIT I (9 Hrs)

AN INSIGHT TO LEARNING: Understanding the Learning Process - Kolb's Learning Styles - Assessing and Interpreting - Remembering Memory:Understanding the Memory process, Problems in retention - Memory enhancement techniques - Emotions - Experience and Expression - Understanding Emotions - Experience and Expression -Assessing Empathy, Application with Peers.

UNIT II (9 Hrs)

BASICS OF DESIGN THINKING: Definition of Design Thinking - Need for Design Thinking - Objective of Design Thinking - Concepts and Brainstorming - Stages of Design Thinking Process (explain with examples) – Empathize - Define - Ideate - Prototype - Test. Being Ingenious and Fixing Problem - Understanding Creative thinking process - Understanding Problem Solving - Testing Creative Problem Solving.

UNIT III (9 Hrs)

PROCESS OF PRODUCT DESIGN: Process of Engineering Product Design - Design Thinking Approach - Stages of Product Design - Examples of best product designs and functions - Assignment – Engineering Product - Design Prototyping and Testing- Rapid Prototype Development process - Testing - Sample Example, Test Group Marketing.

UNIT IV (9 Hrs)

CELEBRATING THE DIFFERENCE: Understanding Individual differences and Uniqueness - Group Discus- sion and Activities to encourage the understanding - acceptance and appreciation of Individual differences. Design Thinking and Customer Centricity - Practical Examples of Customer Challenges - Use of Design Thinking to Enhance Customer Experience - Parameters of Product experience - Alignment of Customer Expectations with Product Design.

UNIT V (9 Hrs)

FEEDBACK, RE-DESIGN AND RE-CREATE: Feedback loop - Focus on User Experience - Address ergonomic challenges - user focused design - rapid prototyping and testing - final product - final Presentation - Solving Practical Engineering Problem through Innovative Product Design and Creative Solution.

Text Books:

1. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation", 5th Edition, McGraw Hill Publications, 2017.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, 2013.

References:

1. E Balaguruswamy, "Developing Thinking Skills (The way to Success)", Khanna Book Publishing Company, 2022.
2. Hasso Plattner, Christoph Meinel and Larry Leifer , "Design Thinking: Understand –Improve– Apply", Springer, 2011.
3. Jeanne Liedtka, Andrew King and Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works", Columbia Business School Publishing, 2013.

(Total Periods:45)

ITAU105 IDEA WORKSHOP LAB

L	T	P	C
2	0	4	0

Course Objective:

- To learn skill tools and inventory associated with the IDEA Lab. To build useful standalone system/ project with Mechanical and Electronic fabrication process.

Course Outcomes:

- To understand the working of tools and inventory associated with the IDEA lab
- To understand the working of mechanical and electronic fabrication processes and designing the standalone project and report preparation.

UNIT I

DESIGNING AND INTRODUCTION TO HAND AND POWER TOOLS: Electronic component familiarization, Electronic system design flow.Schematic design and PCB layout and Gerber creation using Eagle CAD. Documentation: Doxygen, Google Docs, Overleaf. Version control tools - GIT and GitHub. Basic 2D and 3D designing using CAD tools: FreeCAD, Sketchup, Prusa Slicer, FlatCAM, Inkspace, OpenBSP and VeriCUT. Introduction to basic hand tools: Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits.

UNIT II

CIRCUIT PROTOTYPING AND MECHANICAL CUTTING AND JOINING PROCESS: Familiarization and use of basic measurement instruments - DSO including various triggering modes, DSO probes, DMM, LCR bridge, Signal and function generator. Logic analyzer and MSO. Bench power supply (with 4-wire output) Circuit prototyping - breadboard, Zero PCB, Manhattan' style, custom PCB. Single, double and multilayer PCBs. Single and double-sided PCB prototype fabrication in the lab. Soldering using soldering iron/station. Soldering using a temperature controlled reflow oven. Automated circuit assembly and soldering using pick and place machines. Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc. Basic welding and brazing and other joining techniques for assembly. Concept of Lab aboard a Box.

UNIT III

ELECTRONIC CIRCUIT BUILDING AND 3D PRINTING: Electronic circuit building blocks including common sensors. Arduino and Raspberry Pi programming and use. Digital Input and output. Measuring time and events. PWM. Serial communication. Analog input. Interrupts programming. Power Supply design (Linear and Switching types), Wireless power supply, USB PD, Solar panels, Battery types and charging. 3D printing and prototyping technology – 3D printing using FDM, SLS and SLA. Basics of 3D scanning, point cloud data generation for reverse engineering. Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers. Basics of IPR and patents; Accessing and utilizing patent information in IDEA Lab.

UNIT IV

Discussion and implementation of a mini project.

UNIT V

Documentation of the mini project (Report and video).

Laboratory Activities:

List of Lab activities and experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as soft wood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter and engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.

Text Books:

1. Chris Hackett, Weldon Owen, "The Big Book of Maker Skills: Tools and Techniques for Building Great Tech Projects", 2018.
2. Sean Michael Ragan, Weldon Owen "The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product", 2017.
3. Paul Horowitz and Winfield Hill, "The Art of Electronics", Cambridge University Press, 3rd Edition.

References:

1. Paul Sherz and Simon Monk. "Practical Electronics for Inventors" McGraw Hill, 4th Edition, 2016.
2. Charles Platt, "Encyclopedia of Electronic Components (Volume 1,2 and 3)", Shroff Publishers, 2012.
3. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer, "Building Scientific Apparatus",Cambridge University Press, 4th Edition, 2009.
4. Simon Monk "Programming Arduino: Getting Started with Sketches", McGraw Hill, 2nd Edition, 2016.
5. Simon Monk and Duncan Amos, "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished-Boards", McGraw Hill Education, 2017.

ITHS201 ENGLISH

L	T	P	C
2	0	2	3

Course Objective:

- Build the competence in English grammar and vocabulary for effective communication by developing Reading, Writing, Listening and Speaking skills of students.

Course Outcomes:

- To enhance communication skills through formal and informal mode.
- To apply the technical writing and communication skills in their academic and professional life.
- To gain self-confidence with improved command over English.
- To understand the technical aspects of communication for better performance in extra curricular activities, recruitment process and prospective jobs.
- To develop and deliver professional presentations.

UNIT I (9 Hrs)

FUNDAMENTALS OF COMMUNICATION SKILLS: Importance of communication through English - Process of communication and factors that influence speaking - Importance of audience and purpose - Principles of communication - comparing general communication and business communication - Professional communication - barriers to communication - strategies to overcome communication barriers - formal and informal communication.

UNIT II (9 Hrs)

WRITING SKILLS: Basics of Grammar - Placing of Subject and Verb - Sentence Structures - Use of Phrases and Clauses in sentences - Importance of proper punctuation - Creating coherence - Techniques for writing precisely - Parts of Speech - Uses of Tenses - Active and Passive - Modes of Writing.

UNIT III (9 Hrs)

VOCABULARY BUILDING AND WRITING: The Concept of Word Formation - Root words from foreign languages and their use in English - Acquaintance with prefixes and suffixes - Synonyms & Antonyms -Words often confused - One-word substitutes - Idioms and Phrasal Verbs - Abbreviations of Scientific and Technical Words.

UNIT IV (9 Hrs)

SPEAKING SKILLS: Introduction to Phonetic Sounds & Articulation - Word Accent - Rhythm and Intonation - Interpersonal Communication - Oral Presentation - Body Language and Voice Modulation (Para linguistics and Non-Verbal) - Negotiation and Persuasion - Group Discussion - Interview Techniques (Telephonic and Video Conferencing).

UNIT V (9 Hrs)

TECHNICAL WRITING: Job Application - CV Writing - Business Letters - Memos - Minutes - Notices - Report Writing Structures - E-mail Etiquette - Blog Writing.

Text Books:

1. Ludlow R. and Panton F., "The Essence of Effective Communication", Prentice Hall, 2020.
2. Kul Bhushan Kumar & R. S. Salaria, "Effective Communication Skills", Khanna Publishing House, 2018.
3. Dr. Bikram K. Das et al., "An Introduction to Profession English and Soft Skills", Cambridge University Press, 2009.

References:

1. Michael Mccarthy and Felicity O Dell, "English Vocabulary in Use", McCarthy M, Cambridge University Press, 3rd Edition, 2017.
2. Raman M. Sharma S, "Technical Communication: Principles and Practice", Raman, Oxford University Press, 2nd Edition, 2012.

ONLINE/ NPTEL Courses:

1. English Language and Literature: https://nptel.ac.in/courses/109103020
2. Business English Communication: https://nptel.ac.in/courses/109106129
3. Technical English: https://nptel.ac.in/courses/109106066

ITBS202 MATHEMATICS-II

L	T	P	C
3	1	0	4

Course Objective:

- To formulate and solve partial differential equations, Laplace, Fourier transforms within the Engineering domain.

Course Outcomes:

- To formulate and solve various types of partial differential equations.
- To understand the Laplace transform and its properties.
- To apply Laplace transforms to solve ordinary differential equations with constant coefficients and simultaneous ordinary differential equations.
- To understand and apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity.
- To apply Fourier series and harmonic analysis, enabling them to analyze and synthesize periodic signals and functions in various engineering and mathematical applications.

UNIT I (12 Hrs)

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, Solutions of standard types of first order partial differential equations, Lagrange s linear equation, Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II (12 Hrs)

LAPLACE TRANSFORM: Existence conditions, Transforms of elementary functions , Properties, Transform of unit step function and unit impulse function , Transforms of derivatives and integrals , Transforms of Periodic Functions , Initial and final value theorems.

UNIT III (12 Hrs)

INVERSE LAPLACE TRANSFORM: Inverse Laplace Transforms Properties, Convolution theorem, Application - Solution of ordinary differential equations with constant coefficients - Solution of simultaneous ordinary differential equations.

UNIT IV (12 Hrs)

FOURIER TRANSFORM: Fourier Integral theorem (statement only) , Fourier transform and its inverse, Properties: Fourier sine and cosine transforms, Properties, Convolution and Parseval's identity.

UNIT V (12 Hrs)

FOURIER SERIES: Dirichlet s conditions , Expansion of periodic functions into Fourier series- Change of interval, Half-range Fourier series, Root mean square value - Parseval's theorem on Fourier coefficients, Harmonic analysis.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
2. Veerarajan T, "Transforms and Partial Differential Equations", Tata McGraw-Hill, New Delhi, 2012.

References:

1. Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

ONLINE / NPTEL Courses:

1. Laplace Transform: https://nptel.ac.in/courses/111106139
2. Partial Differential Equations: https://nptel.ac.in/courses/111101153
3. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119

ITBS203 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objective:

- To understand the concepts of atomic structures, spectroscopic techniques, chemical equilibrium, periodic properties and stereo chemistry.

Course Outcomes:

- To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- To rationalise bulk properties and processes using thermodynamic considerations.
- To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- To understand the major chemical reactions those are used in the synthesis of molecules.

UNIT I (9 Hrs)

ATOMIC AND MOLECULAR STRUCTURE: Schrodinger equation - Particle in a box solutions and their applications for conjugated molecules and nano particles - Forms of the hydrogen atom wave functions and the plots to explore their spatial variations - Molecular orbitals of diatomic molecules and plots of the multicentre orbitals - Pi-molecular orbitals of butadiene and aromaticity - Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties - Band structure and role of doping of solids.

UNIT II (9 Hrs)

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Principles of spectroscopy and selection rules - Electronic spectroscopy of Fluorescence and its applications in medicine - Applications of Vibrational and rotational spectroscopy of diatomic molecules - Nuclear magnetic resonance imaging and surface characterization techniques.

UNIT III (9 Hrs)

USE OF FREE ENERGY IN CHEMICAL EQUILIBRIUM: Thermodynamic functions-energy, entropy and free energy- Applications of Cell potentials - Nernst equation, acid-base, oxidation-reduction and solubility equilibrium - Use of free energy considerations in metallurgy through Ellingham diagrams. Inter molecular forces and poten- tial energy: surfaces- Ionic, dipolar and Van Der Waals interactions - Equations on state of real gases and critical phenomena.

UNIT IV (9 Hrs)

PERIODIC PROPERTIES: Effective nuclear charge - variations of s, p, d and f orbital and energies of atoms in the periodic table, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability and molecular geometries.

UNIT V (9 Hrs)

STEREO CHEMISTRY: Representations of 3 dimensional structures - structural isomers and stereoisomers, symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis- Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation and reduction - Synthesis of a commonly used drug molecule.

Text Books:

1. Manisha Agrawal, "Chemistry-I", Khanna Book Publishing Co., 1st Edition, 2021.
2. P.W.Atkins, Julio de Paula and James Keeler, "Physical Chemistry", Oxford University, 11th Edition, 2018.
3. B. H. Mahan, "University chemistry", Pearson Education, 4th Edition, 2013.
4. C.N.Banwell, "Fundamentals of Molecular Spectroscopy", 3rd Edition, 2008.

References:

1. K.P.C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function", 5th Edition, 2022.

ONLINE/ NPTEL Courses:

1. Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries: https://nptel.ac.in/courses/104102113
2. Engineering Chemistry I: https://archive.nptel.ac.in/courses/122/106/122106028
3. Quantum Chemistry of Atoms and Molecules: https://nptel.ac.in/courses/104101124

ITES204 PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Course Objective:

- To acquire the knowledge of programming in Python. To learn the concepts, principles, functions and develop an application.

Course Outcomes:

- To understand the basic concepts and working principles of Python Programming.
- To develop algorithmic solutions to simple computational problems.
- To understand the structure of solving problems using programming.
- To explore the concepts of compound data using Python lists, tuples, dictionaries.
- To explore the various multimedia features using python.

UNIT I (9 Hrs)

INTRODUCTION: History - Features - Working with Python - Installing Python - basic syntax - Data types - variables - Manipulating Numbers - Text Manipulations - Python Build in Functions.

UNIT II (9 Hrs)

COMPONENTS OF PYTHON PROGRAMMING: Python objects and other languages - operator Basics - Numbers - String - List - Tuples - Dictionaries - Files - Object Storage - Type Conversion - Type Comparison - Statements - Assignments - Control Statements.

UNIT III (9 Hrs)

FUNCTIONS AND MODULES: Functions Definition and Execution - Arguments - Return Values - Advanced Function Calling - Modules - Importing modules - Packages - Creating a module.

UNIT IV (9 Hrs)

OBJECT ORIENTED AND EXCEPTION HANDLING: Classes and Objects - creating a class - class methods - class inheritance. Exceptions Handling-Build in Exceptions- Files, File operations, reading a file content, writing a file, change position, controlling file I/O, Manipulating file paths.

UNIT V (9 Hrs)

APPLICATIONS: Working with PDF and Word Documents - Working with CSV Files and JSON Data - Sending Email and Text Messages - Manipulating Images - Using Python for Multimedia.

Text Books:

1. Allen B.Downey, "Think Python: How to Think Like a Computer Scientist", Shroff O Reilly Publishers, 2nd Edition, 2016.
2. Guido Van Rossum and Fred L. Drake Jr, "An Introduction to Python", Network Theory Ltd., 2011.
3. Martin C.Brown, "The Complete reference - Python", Tata McGraw Hill Indian Edition, 2010.

References:

1. Eric Matthes, “A Hands-On, Project-Based Introduction To Programming”, 2nd Edition, 2019.
2. Budd T A, “Exploring Python”, Tata McGraw Hill Education, 2011.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms using Python: https://nptel.ac.in/courses/106106145
2. The Joy of Computing using Python: https://nptel.ac.in/courses/106106182
3. Python for Data Science: https://nptel.ac.in/courses/106106212

ITHS205 UNIVERSAL HUMAN VALUES II

L	T	P	C
2	1	0	3

Course Objective:

- To highlight the plausible implications of such a holistic understanding in terms of ethical human conduct, trustful, mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- To have a holistic vision of life.
- To enhance a socially responsible behavior.
- To understand the responsibility of an environmental work.
- To understand the Competence and Capabilities for Maintaining Health and Hygiene.
- To appreciate the aspiration for excellence (merit) and gratitude for all.

UNIT I (9 Hrs)

INTRODUCTION TO VALUE EDUCATION: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity the Basic Human Aspirations, Happiness and Prosperity Current Scenario, Method to Fulfil the Basic Human Aspirations.

UNIT II (9 Hrs)

HARMONY IN THE HUMAN BEING: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III (9 Hrs)

HARMONY IN THE FAMILY AND SOCIETY: Harmony in the Family, the Basic Unit of Human Interaction, Trust, Foundational Value in Relationship, Respect, Right Evaluation, Other Feelings, Justice in Human to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

UNIT IV (9 Hrs)

HARMONY IN THE NATURE/EXISTENCE: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion.

UNIT V (9 Hrs)

IMPLICATIONS OF THE HOLISTIC UNDERSTANDING: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. Premvir Kapoor, "Professional Ethics and Human Values", Khanna Book Publishing Company, New Delhi, 2022.
2. R R Gaur,R Asthana, G P Bagaria, "The Textbook - A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
3. RR Gaur, R Asthana, G P Bagaria, "The Teacher's Manual- Teachers Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, 2019.

References:

1. Annie Leonard, "The Story of Stuff", 2011.
2. A.N. Tripathi,"Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", FP classic, 2009.
4. A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "VanVidya: EkParichaya", 1999.

ITBL201 CHEMISTRY LAB

L	T	P	C
0	0	4	2

Course Objective:

- To experiment various methods of volumetric analysis - Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample..

Course Outcomes:

- To illustrate the principles of physical chemistry relevant to the study of rate of reactions.
- To estimate rate constants of reactions from concentration of reactants/products as a function of time.
- To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- To understand the changes in matter and acquire scientific skills in the laboratory.
- To synthesize a small drug molecule and analyze a salt sample.

LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Determination of cell constant and conductance of solutions.
6. Potentiometry - determination of redox potentials and emfs.
7. Synthesis of a polymer/drug.
8. Determination of the partition coefficient of a substance between two immiscible liquids.
9. Saponification/acid value of an oil.
10. Chemical analysis of a salt.
11. Lattice structures and packing of spheres.
12. Determination of the rate constant of a reaction.
13. Colligative properties using freezing point depression.
14. Models of potential energy surfaces.
15. Chemical oscillations- Iodine clock reaction.
16. Adsorption of acetic acid by charcoal.
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

(Total Periods : 45)

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/ physical- which has to be broken of_ Organic_Solvents/
2	Ion exchange column for removal of hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis _Determination _of_Chemical_Parameters/
3	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs dev/labs/nitk_labs/Environmental _Engineering_1/ experiments/determination-of-chloride-nitk/simulation.html
4	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/ physical- chemistry/Cryoscopy/
5	Determination of the rate constant of a reaction.n.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF _Measurement/
6	Determination of cell constant and conductance of solutions.	http://icv-au.vlabs.ac.in/ inorganic- chemistry/ Water_Analysis_Determinatio _of_Physical_Parameters/
7	Potentiometry - determination of redox potentials and emfs.	http://pcv-au.vlabs.ac.in/ physical- chemistry/EMF_Measurement/
8	Saponification/acid value of an oil	http://biotech01.vlabs.ac.in/bio chemistry/ Estimation_of _ Saponificatio n_Value of Fats_or_Oils/
9	Lattice structures and packing of spheres.	https://vlab.amrita.edu/ ?sub=1&brch=2 82&sim=370&cnt=1

ITEL202 PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language

Course Objective:

- To develop a application using python libraries and packages.

Course Outcomes:

- To develop a application for simple real life problems.
- To write programs using python statements and expressions.
- To write programs by implementing functions and strings in python.
- To demonstrate a application by dealing with an exceptions
- To explore Pygame tool by developing a gaming application.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems. (Electricity Billing, Retail shop billing, Sin series etc).
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, Scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter s age validity, student mark range validation)
11. Exploring Pygame tool.Developing a game activity using Pygame like bouncing ball, car race etc.

(Total Periods:45)

ITEL203 WORKSHOP/MANUFACTURING LAB

L	T	P	C
1	0	4	3

Course Objective:

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

Course Outcomes:

- To fabricate components with their own hands.
- To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- To design small devices of their interest by assembling different components.
- To practice Arc Welding and Gas Welding.
- To develop a casted products.

Course Content:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.
2. CNC machining, Additive manufacturing.
3. Fitting operations & power tools.
4. Electrical & Electronics.
5. Carpentry.
6. Plastic moulding, glass cutting.
7. Metal casting.
8. Welding (arc welding & gas welding), brazing.

Practicals:

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding).	http://mm- coep.vlabs.ac.in/ LaserSpotWelding/Theory.html? domain=Mechanical%20Engineering &lab=Welcome %20to %20Micromachining %20laboratory
2	Casting	http://fab- coep.vlabs.ac.in/exp7/Theory.html? domain=Mechanical %20Engineering&lab=Welcome%20tO %20FAB%20laboratory

(Total Periods:45)

ITAU204 SPORTS AND YOGA

L	T	P	C
2	0	0	0

Course Objective:

- To expose the students in variety of physical, yogic activities and stimulating their continued inquiry about Yoga, physical education, health and fitness.

Course Outcomes:

- To practice physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- To learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- To learn breathing exercises and healthy fitness activities.
- To understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- To perform yoga movements in various combination and forms.

UNIT I

Introduction to Physical Education - Olympic Movement - Physical Fitness - Wellness and Lifestyle.

UNIT II

Fundamentals of Anatomy & Physiology in Physical Education - Sports and Yoga - Kinesiology - Biomechanics & Sports

UNIT III

Postures - Yoga - Yoga & Lifestyle

UNIT IV

Training and Planning in Sports - Psychology & Sports - Doping

UNIT V

Sports Medicine - Sports/Games

References:

1. Dr. Sudhakara.G, “Modern Trends in Physical Education, Sports and Yogic Science”, 2020.
2. Swami Vivekananda, “PatanjaliÆs Yoga Sutras”, paperback, 2019.
3. B.K.S. Iyengar, “Light On Yoga”, 2006.
4. Health and Physical Education NCERT (11^{th} and 12^{th}Classes)

SEMESTER III

ITBS301 MATHEMATICS - III

L	T	P	C
3	0	0	3

Pre-requisite:

- Basic Knowledge in Maths & Statistics

Course Objective:

- To learn the foundations of probabilistic and statistical methods in engineering field.

Course Outcomes:

- To understand the fundamental concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- To understand and apply measures of central tendency, dispersion, moments, skewness, kurtosis, correlation, regression, and rank correlation for effective data analysis and interpretation.
- To attain proficiency in curve fitting techniques and conduct significance tests for large samples.
- To perform t-tests for means, correlation tests, F - test, and Chi-square tests for goodness of fit and independence of attributes.
- To apply the fundamental principles of experimental design classifications in the field of engineering.

UNIT I (9 Hrs)

BASIC PROBABILITY: Sample Space and Events, Axioms of Probability, Conditional Probability, Bayes' Theorem, Independent Events, Random Variables, Discrete and Continuous Random Variables – Probability Mass Function - Probability Density Function – Cumulative Distribution Function - Expectation and Variance, Standard Probabil- ity Distributions (Problems only): Bernoulli, Binomial, Poisson, Geometric, Multinomial, Uniform , Exponential, Gamma, Erlang and Normal Distribution.

UNIT II (9 Hrs)

BASIC STATISTICS: Measures of Central tendency – Mean – Median – Mode; Measure of Dispersion – Range – Variance – Standard Deviation; Moments, Skewness and Kurtosis, Correlation and regression, Rank Correlation.

UNIT III (9 Hrs)

APPLIED STATISTICS (LARGE SAMPLES): Curve Fitting by the Method of Least Squares- Fitting of straight lines, second degree parabolas and more general curves. **Test of Significance:** Large Sample Test for Single Proportion, Difference of Proportions, Single Mean, Difference of Means and Difference of Standard Deviations.

UNIT IV (9 Hrs)

APPLIED STATISTICS (SMALL SAMPLES): Student's' t-Tests - Test for Single Mean, Difference of Means and Correlation Coefficients, Test for ratio of variances (F - Test), Chi-square Test for goodness of fit and Independence of Attributes.

UNIT IV (9 Hrs)

DESIGN OF EXPERIMENTS: One-Way and Two-way Classifications- Completely randomized design- Randomized block design- Latin square design -2 factorial designs.

Text Books:

1. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
2. S. Ross, "A First Course in Probability", Pearson Education India,9th Edition, 2013.

References:

1. Bali N.P and Manish Goyal, "A Textbook Of Engineering Mathematics", Laxmi Publications(P) Ltd, 10th Edition, 2019.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2018.
3. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2017.
4. William Feller, "An Introduction to Probability Theory and its Applications", (WSE) Vol. 1, 3rd Edition, 2013.

ONLINE/ NPTEL Courses:

1. Probability and Statistics: https://nptel.ac.in/courses/111105090
2. Advanced Engineering Mathematics: https://nptel.ac.in/courses/111107119
3. Introduction to Probability Theory and Statistics: https://nptel.ac.in/courses/111102160

ITES302 DIGITAL ELECTRONICS AND SYSTEM

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To design combinational logic circuits and Sequential logic circuits, including multiplexers, decoders, encoders, adders, subtractors, Flip Flops and Latches. To learn the basics of IoT devices and types of boards.

Course Outcomes:

- To understand various combinational digital circuits using logic gates.
- To understand sequential circuits and analyze the design procedures.
- To understand Verilog HDL and hierarchial modeling concepts.
- To understand various protocols of IoT using various sensors and actuators.
- To design and develop system using Rasperry Pi/Arduino.

UNIT I (9 Hrs)

COMBINATIONAL LOGIC: Combinational Circuits – Karnaugh Map, Analysis and Design Procedures of combinational circuit, Magnitude Comparator, Parity generator/checker, Decoder, Encoder, Implementation of combinational logic using Multiplexers, Demultiplexers.

UNIT II (9 Hrs)

SYNCHRONOUS SEQUENTIAL LOGIC: Introduction to Sequential Circuits – Flip-Flops, operation and excitation tables, Triggering of Flip Flop, Analysis and design of clocked sequential circuits – Design of Moore/Mealy models, state minimization, state assignment, circuit implementation- Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL.

UNIT III (9 Hrs)

DIGITAL DESIGN WITH VERILOG HDL: Modules – instances – Data types – Arrays – System tasks – directives – Modules and Ports – Gate-Level Modeling – Dataflow Modeling – Behavioral Modeling - Design of Multiplexers, counters and full adders – Introduction to - Hierarchical Modeling concepts – 4-bit ripple carry counter.

UNIT IV (9 Hrs)

SENSORS AND ACTUATORS: Introduction to the Concept of IoT Devices – IoT Devices Versus Computers, IoT Configurations, IoT Basic Components, IoT Architecture - State of the Art,Functional View, Information View, Deployment and Operational View, Integration of Sensors and Actuators with Arduino.

UNIT V (9 Hrs)

DESIGN AND DEVELOPMENT: Introduction to Arduino – Arduino Board, Arduino types - Micro, UNO, NANO, Modules - WiFi, Bluetooth Node ESP, Raspberry: Raspberry Pi Board Types, IDE programming - Interfaces and Raspberry Pi with Python Programming.

Text Books:

1. A. P. Godse and D. A. Godse, "Digital Principles and System Design", Technical Publications, 4th Edition, 2021.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson Education, 6th Edition, 2018.
3. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

References:

1. Charles H. Roth, Larry L. Kinney and Raghunandan G. H, "Fundamentals of Logic Design", Cengage India Private Limited, 1st Edition, 2019.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities Press, 2015.
3. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand and David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

ONLINE/ NPTEL Courses:

1. Digital Circuits: https://onlinecourses.nptel.ac.in/noc23_ee115/preview
2. Digital Circuits Design: https://onlinecourses.nptel.ac.in/noc22_ee110/preview
3. Microelectronics: Devices To Circuits: https://nptel.ac.in/courses/108107142

ITPC303 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

Course Objective:

- To impart knowledge about the importance of data structures in programming and to familiarise basic searching and sorting algorithms.

Course Outcomes:

- To comprehend the basics of algorithms and understand the operations performed using arrays.
- To understand the linear data structures and its applications.
- To realize the properties of tree data structure and its importance in searching large database.
- To understand graph data structure and its applications.
- To know the need for hash tables.

UNIT I (9 Hrs)

INTRODUCTION: Data structures: Definition, Types - Algorithm: Definition, Properties, Analyzing algorithms: Space and Time Complexity-Arrays: One dimensional array, multidimensional array, Applications. Searching Algorithms: Linear search, Binary Search, Fibonacci search. Sorting Algorithms: Selection Sort, Bubble Sort, Quick Sort, Insertion sort, Heap Sort and Merge Sort.

UNIT II (9 Hrs)

STACK,QUEUE AND LINKED LISTS: Stacks: Definition – Operations - Applications of stack. Queues: Definition - Operations - Priority queues – De-queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, Linked stacks, Linked queues, Applications of Linked List – Dynamic storage management.

UNIT III (9 Hrs)

TREE: Definition - Binary tree – Terminology – Representation – Operations - Applications – Binary search tree – AVL tree. B Trees: B Tree indexing - Operations on a B Tree - B + Tree Indexing. Trie - Trie operations.

UNIT IV (9 Hrs)

GRAPH: Definition – Terminology – Representation - Traversals – Applications - Spanning tree, Shortest path and Transitive closure, Topological sort. Set: Definition - Representation - Operations on sets – Applications

UNIT V (9 Hrs)

HASH TABLE: Tables: Rectangular tables - Jagged tables – Inverted tables - Symbol tables – Static tree tables - Dynamic tree tables - Hash tables-Overflow handling- Files: Sequential organization – Indexed organization.

Text Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Pvt. Ltd., 2004.
2. D. Samanta, Classic Data Structures, 2nd, Prentice-Hall of India, Pvt. Ltd., India, 2012.

References:

1. Thomas Cormen, Charles Lieserson, Ronald L Rive stand Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.
2. John Canning, Alan Broder, Robert Lafore, "Data Structures & Algorithms in Python", Addison-Wesley Professional,1st Edition, 2022.

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac. in/noc23 cs95
2. Introduction to Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac.in/noc23_cs15
3. Programming, Data Structures and Algorithms using Python for beginners: https: //nptel.ac.in /courses/106106145

ITPC304 OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in C programming language.

Course Objectives:

- To familarize the concept of object-oriented programming (OOP) and basics of Java programming concepts, packages, inheritance, interfaces, exception handling, event handling and multithreading. To understand and implement the JavaFX event handling and controls.

Course Outcomes:

- To apply the concepts of classes and objects to solve simple problems.
- To write programs using inheritance, packages and interfaces.
- To make use of exception handling mechanisms and multithreaded model to solve real world problems.
- To build Java applications with I/O packages, string classes, collections and generics concepts.
- To integrate the concepts of event handling, JavaFX components and controls for developing GUI based applications.

UNIT I (9 Hrs)

INTRODUCTION TO OOP AND JAVA : Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors - Methods - Access specifiers - Static members - JavaDoc comments

UNIT II (9 Hrs)

INHERITANCE, PACKAGES AND INTERFACES : Overloading Methods – Objects as Parameters – Returning Objects – Static - Nested and Inner Classes - Inheritance - Basics – Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance - Packages and Interfaces - Packages – Packages and Member Access – Importing Packages – Interfaces.

UNIT III (9 Hrs)

EXCEPTION HANDLING AND MULTITHREADING : Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java Built-in Exceptions – User defined Exception - Multithreaded Programming - Java Thread Model – Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication - Suspending – Resuming and Stopping Threads – Multithreading.

UNIT IV (9 Hrs)

I/O, GENERICS, STRING HANDLING : I/O Basics – Reading and Writing Console I/O – Reading and Writing Files - Generics - Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations - Strings - Basic String class, methods and String Buffer Class.

UNIT V (9 Hrs)

JAVAFX EVENT HANDLING AND CONTROLS : JAVAFX Events and Controls - Event Basics – Handling Key and Mouse Events - Controls,Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane - Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

Text Books:

1. Herbert Schildt, Java, "The Complete Reference", McGraw Hill Education, New Delhi, 11th Edition, 2019.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", McGraw Hill Education, New Delhi, 1st Edition, 2015.

References:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, Prentice Hall, 11th Edition, 2018.

ONLINE/NPTEL Courses:

1. Object Oriented Programming: https://nptel.ac.in/courses/106105151

ITES305 COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Understanding in Electronics and Communication.

Course Objectives:

- To familiarize with the analog, pulse, digital modulation system and able to learn the cellular mobile communication & satellite communication systems.

Course Outcomes:

- To explain various fundamental aspects of the analog modulation systems.
- To understand various pulse modulation techniques used in communication systems.
- To understand various digital modulation techniques and understand the concept of spread spectrum technologies.
- To understand the wireless standard, networking, GSM architecture and mobile radio propagation in cellular communication system.
- To describe the basic components of satellite communication system and fundamental concepts of optical communication system.

UNIT I (9 Hrs)

ANALOG COMMUNICATION : Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of DSBFC, DSBSC & SSBSC Techniques – Theory of Frequency and Phase Modulation –Super heterodyne AM - FM Transmitter and Receiver.

UNIT II (9 Hrs)

PULSE MODULATION : Principles of pulse modulation – sampling theorem, Generation and demodulation of PAM – PWM – PPM—Principles of Pulse Code Modulation- Theory of DPCM, DM,ADM and ADPCM.

UNIT III (9 Hrs)

DIGITAL MODULATION AND MULTIPLE ACCESS : Principle of ASK - Transmitter and receiver for coherent BFSK, BPSK, QPSK - Basic principles of M-ary PSK and M-ary FSK - PN sequence – Spread spectrum techniques and its types (DSSS & FHSS), Multiple access techniques (TDMA, FDMA & CDMA).

UNIT IV (9 Hrs)

CELLULAR AND MOBILE COMMUNICATION STANDARDS : Basic cellular concept - frequency reuse - Elements of cellular mobile radio - Handoff - Frequency management and channel assignment - concepts of cell splitting and cell sectoring - Principles of Global System for Mobile Communications (GSM) and its evolution (GPRS, EDGE, UMTS & LTE)- Principles of CDMA techniques.

UNIT V (9 Hrs)

SATELLITE AND OPTICAL COMMUNICATION: Introduction to Satellite Orbits and look angles - satellite link model and link budget calculations - satellites used for mobile networks and personal communication systems - GPS services - Need for fiber optics - fiber characteristics and classification, various fiber losses– LED, ILD and photodetectors - Power budget analysis for an optical link.

Text Books:

1. George Kennedy and Bernard Davis, "Electronic Communication Systems ", Tata Mc Graw Hill, 6th Edition, 2017.
2. S. Haykin, "Digital Communication ", John Wiley 2013.
3. William C.Y. Lee, " Wireless and Cellular Telecommunications ", McGraw Hill, 3rd Edition, 2006.
4. D.Roddy , " Satellite Communications ", Tata Mc Graw Hill , 4th Edition, 2009.
5. GerdKeiser, " Optical fiber Communications ", McGraw Hill , 5th Edition, 2013.

References:

1. Wayne Tomasi, "Electronics Communication systems ", Pearson Education, 5th Edition, 2008.
2. Simon Haykin and Wiley," Communication Systems", 4th Edition, 2013.
3. T.S. Rappaport, " Wireless Communication ", Pearson education, 2nd Edition, 2010.

ONLINE/NPTEL Courses:

1. Communication Engineering: https://nptel.ac.in/courses/117102059

CSPC306 COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Problem solving and programming

Course Objective:

- To learn the basic components of computer, instruction set architecture, memory hierarchy, super scalar processor and multicore systems.

Course Outcomes:

- To understand the components of a basic computer.
- To understand the key components of a CPU and how the instructions are executed.
- To analyze the execution time taken in a pipelined processor.
- To understand the need of memory hierarchy and efficiency achieved due to the use of cache.
- To interpret how the data is stored and input-output is performed in computers.

UNIT I (9 Hrs)

INTRODUCTION: Role of abstraction, Basic functional units of a computer, Von-Neumann model of computation, Moore's law, form Notion and perance- Data representation and basic operations.

UNIT II (9 Hrs)

INSTRUCTION SET ARCHITECTURE (RISC-V): CPU registers, Instruction format and Encoding, addressing modes, Instruction set, Instruction types, Instruction Decoding and Execution, Basic Instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC), RISC-V instructions - X86 Instruction set.

UNIT III (9 Hrs)

PROCESSOR: Revisiting clocking methodology, Amdahl's law, Building a data path and control, single cycle processor, multi-cycle processor, instruction pipelining, Notion of ILP, data and control hazards and mitigations - Limits of ILP.

UNIT IV (9 Hrs)

MEMORY HIERARCHY: SRAM/DRAM, Locality of reference, Caching - different indexing mechanisms, trade-offs related to block size, associativity, cache size, processor, cache interactions for a read/write request, basic optimizations - write through/writeback caches, average memory access time, cache replacement policies, memory interleaving.

UNIT V (9 Hrs)

STORAGE AND I/O: Introduction to magnetic disks, flash memory- I/O mapped I/O and memory mapped I/O - I/O data transfer techniques - programmed I/O, Interrupt-driven I/O and DMA.

Text Books:

1. Carl Hamacher, ”Computer Organization and Embedded Systems”, McGrawHill Higher Education, 6th Edition, 2022.
2. David A. Patterson and John L. Hennessy, ”Computer Organization and Design: The Hardware/Software Interface”, Elsevier, 5th Edition, 2014.

References:

1. Vincent P. Heuring and Harry F. Jordan, ”Computer System Design and Architecture”, Pearson Education, 2nd Edition, 2016.
2. Smruti Ranjan Sarangi, ”Computer Organisation & Architecture”, McGraw Hill, 2014.
3. Mano M. Morris, ”Computer System Architecture”, Pearson, 2007.

Online Simulators and Tools:

1. RIPES: https://freesoft.dev/program/108505982
2. GEM5:https://www.gem5.org/documentation/learning_gem5/introduction

ONLINE/NPTEL Courses:

1. Introduction to computer System and its submodules: https://nptel.ac.in/courses/106103068
2. Computer Organization and Architecture: https://nptel.ac.in/courses/106106166
3. Computer Organization and Architecture A Pedagogical Aspect:https://nptel.ac.in/courses/106103180

ITPL301 DATA STRUCTURES AND ALGORITHMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic knowledge in programming

Course Objective:

- To enable students write programs using various data structures, analyse and understand the benefits of choosing the right data structure.

Course Outcomes:

- To write programs for search and sorting algorithms.
- To write programs for implementing stacks, queues and linked list.
- To write programs for searching using tree data structure.
- To write programs for identifying shortest path in a network.
- To write programs that implements hash tables.

LIST OF EXPERIMENTS

1. Searching Algorithms (With the Number of Key Comparisons) - Sequential, Binary and Fibonacci Search Algorithms on an Ordered List
2. Sorting Algorithms: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Heap Sort and Merge Sort.
3. Implementation of Stack and Its Operations.
4. Application of Stack for Converting an Arithmetic Expression into Postfix Form and Evaluation of Postfix Expression.
5. Implementation of Queue, Circular Queue, Priority Queue, Dequeue and Their Operations.
6. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List.
7. Implementation of Binary Tree and Binary Traversal Techniques.
8. Implementation of Graph Traversal Techniques.
9. Implement Dijkstra's Algorithm to Obtain the Shortest Paths.
10. Implementation of Hash Tables and its Operations.

(Total Periods:45)

ITPL302 OBJECT ORIENTED PROGRAMMING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic knowledge in programming

Course Objectives:

- To understand and implement the concepts of classes, packages, interfaces, inheritance, exception handling, event handling, file processing and develop applications using generic programming.
- To provide software development skills using java programming for real-world applications.

Course Outcomes:

- To design and develop java programs using object oriented programming concepts.
- To develop simple applications using object oriented concepts such as package, exceptions.
- To implement multithreading and generics concepts.
- To create GUIs and event driven programming applications for real world problems.
- To implement and deploy web applications using Java.

LIST OF EXPERIMENTS

1. Develop a java application with an Employee class with Empname, Empid, Address, Mailid, Mobileno as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
2. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
3. Solve the above problem using an interface.
4. Implement exception handling and creation of user defined exceptions.
5. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
6. Write a program to perform file operations.
7. Develop applications to demonstrate the features of generics classes
8. Develop applications using JavaFX controls, layouts and menus.
9. Develop a mini project for any application using Java concepts.

(Total Periods: 45)

ITEL303 COMMUNICATION ENGINEERING LAB

L	T	P	C
0	0	4	2

Course Objectives:

- To understand the concepts of analogue and digital communication systems. To enhance technical skills through analyzing the wave forms obtained at various stages of the experiment.
- To verify the experimentally obtained and simulated outputs and knowing the reason for the deviation.

Course Outcomes:

- To develop practical knowledge about theories of AM analog communication.
- To evaluate analog FM modulated waveform and the FM modulation index.
- To demonstrate various pulse modulation techniques.
- To develop understanding about performances of various digital communication systems.
- To develop practical knowledge about MATLAB simulation software to apply theoretical concepts in practice.

LIST OF EXPERIMENTS

1. Amplitude modulation and demodulation.
2. Frequency modulation and demodulation.
3. Pulse modulation – PAM, PWM, PPM.
4. Pulse Code Modulation.
5. Generation of ASK, FSK and PSK.
6. Simulation of Satellite link budget analysis.
7. Simulation analysis of Handoff performance in Cellular Mobile systems.
8. Simulation of fiber Optic link budget analysis.
9. Simulation of Amplitude Modulation and Demodulation.
10. Simulation of Frequency Modulation and Demodulation.
11. Simulation of Antenna radiation Pattern (Horn, Parabolic reflector).
12. Simulation of various propagation models.

(Total Periods: 45)

SEMESTER IV

ITBS401 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

Course Pre-requisite:

- Mathematics I, II

Course Objectives:

- To learn the fundamentals of set operations, Cartesian products, binary equivalence relations, functions, and their properties.
- To learn the fundamental concepts of Combinatorics and Graph theory.

Course Outcomes:

- To analyse and comprehend Cantor's diagonal argument and understand the Power Set theorem.
- To apply the Chinese Remainder Theorem to solve systems of congruences and real-world problems.
- To solve the problems on combinatorial concepts such as permutations, combinations and matching algorithms to graph theory problems.
- To interpret and evaluate formulas using interpretations in first-order logic.
- To analyse the homomorphism and isomorphism between algebraic structures and Calculate expectations, variances, probabilities in Bernoulli trials and conditional probability scenarios using Bayes' Theorem.

UNIT I (12 Hrs)

SET, RELATIONS, FUNCTIONS: Operations and Laws of Sets, Cartesian Products,Binary Relation and functions, Partial Ordering Relation - Equivalence Relation - Image and Size of a Set - Sum and Product of Functions - Bijective functions - Inverse and Composite Function - Finite and infinite Sets - Countable and uncountable Sets-Cantor's diagonal argument and The Power Set theorem.

UNIT II (12 Hrs)

PROOF STRATEGIES AND MODULAR ARITHMETIC: Proof Methods and Strategies- Forward Proof - Proof by Contradiction - Proof by Contraposition - Proof of Necessity and Sufficiency - Case analysis - Induction -Extended Euclid's Greatest Common Divisor algorithm - The Fundamental Theorem of Arithmetic - Modular arithmetic - Co-primality (or Euler's totient function)- Chinese Remainder Theorem.

UNIT III (12 Hrs)

COMBINATORICS AND GRAPHS: Permutation and Combination - Inclusion-Exclusion - pigeon-hole principle -generating functions - Recurrence - Connected components - Paths - Cycles - Trees - Hamiltonian/Eulerian Walks - Coloring - Planarity - Matching.

UNIT IV (12 Hrs)

LOGIC: Languages of Propositional logic and First-order logic - expressing natural language sentences in languages of propositional and first-order logic - expressing natural language predicates in the language of first-order logic. Semantics of First-order logic- interpretation and its use in evaluating a formula.

UNIT V (12 Hrs)

ALGEBRA: Group, Permutation Groups, Cosets, Normal Subgroups, Ring, Field, Finite fields, Fermat's little theorem, Homomorphisms, Isomorphisms.

Text Books:

1. Rosen, K. H, "Discrete Mathematics and Its Applications", 8th Edition, 2019.
2. Liu, C.L. and Mohapatra, D.P., "Elements of Discrete Mathematics", Tata McGraw-Hill, 2008.
3. Huth, M.and Ryan M., "Logic in Computer Science: Modelling and Reasoning about Systems", Cambridge University Press, 2nd Edition, 2004.

References:

1. Mitzenmacher.M, and Upfal.E, "Probability and computing: Randomization and probabilistic techniques in algorithms and data analysis", Cambridge University Press, 2017.
2. Shoup.V, "A computational introduction to number theory and algebra", Cambridge University Press, 2009.
3. Bo´na.M, "A Walk Through Combinatorics: An Introduction to Enumeration and Graph Theory", 2006.
4. Herstein.I.N, "Topics in algebra", John Wiley and Sons, 2006.

ONLINE/NPTEL Courses:

1. Discrete Mathematics: https://nptel.ac.in/courses/106103205
2. Introduction-Discrete Mathematics: https://nptel.ac.in/courses/106108227
3. Discrete Mathematics: https://nptel.ac.in/courses/111106086

ITPC402 THEORY OF COMPUTATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Discrete Mathematics, and Programming skills

Course Objectives:

- To understand the foundations of computation with Finite Automata(FA) theory, Push Down Automata(PDA) and Turing Machine(TM). To construct the Regular and Context Free Language(CFL) for Automata models as well as exploration into un-decidability and NP-class problems.

Course Outcomes:

- To understand and construct automata theory using Finite Automata.
- To write regular expressions for all the patterns.
- To gain knowledge on Context Free Grammar(CFG) and Push Down Automata.
- To design Turing Machine and Push Down Automata(PDA) for computational functions.
- To explore the un-decidability and NP-class problems.

UNIT I (9 Hrs)

AUTOMATA AND REGULAR EXPRESSIONS : Need for automata theory - Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – Finite Automata with Epsilon transitions – Equivalence of NFA and DFA- Equivalence of NFAs with and without $\epsilon - moves - Conversionof\ NFAintoDFA – Minimizationof\ DFAs.$

UNIT II (9 Hrs)

REGULAR EXPRESSIONS AND LANGUAGES : Regular expression – Regular Languages- Equivalence of Finite Automata and regular expressions – Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages.

UNIT III (9 Hrs)

CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA : Types of Grammar - Chomsky‘s hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of push-down automata – Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG – Deterministic Pushdown Automata.

UNIT IV (9 Hrs)

NORMAL FORMS AND TURING MACHINES : Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) - Pumping lemma for CFL – Closure properties of Context Free Languages – Turing Machine : Basic model – definition and representation – Instantaneous Description – Language acceptance by TM – TM as Computer of Integer functions – Programming techniques for Turing machines (subroutines).

UNIT V (9 Hrs)

UNDECIDABILITY : Unsolvable Problems and Computable Functions –PCP-MPCP- Recursive and recursively enumerable languages – Properties - Universal Turing machine -Tractable and Intractable problems - P and NP completeness – Kruskal's algorithm – Travelling Salesman Problem- 3-CNF SAT problems.

Text Books:

1. Hopcroft J.E, Motwani R and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 3rd Edition, 2011.
2. John C Martin ,"Introduction to Languages and the Theory of Computation", Tata McGraw Hill, 4th Edition, 2011.
3. Vivek Kulkarni, "Theory of Computation", Oxford University Press, 2013.

References:

1. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", Prentice Hall of India, 2nd Edition, 2015.
2. Peter Linz, "An Introduction to Formal Language and Automata", Jones & Bartlett, 6th Edition, 2016.
3. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science", Automata Languages and Computation , Prentice Hall of India, 3rd Edition, 2006.

ONLINE/NPTEL Courses:

1. Theory of Computations: https://nptel.ac.in/courses/106104148

ITPC403 INFORMATION CODING TECHNIQUES

L	T	P	C
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Course Objectives:

- To understand the fundamental concepts of concepts of information, entropy, probability, encoding techniques, representation of image, audio, vedio data and error control coding techniques.

Course Outcomes:

- To understand the relation among information, entropy and probability.
- To understand the basic lossless encoding techniques.
- To explain the image and audio representation, coding and applications in standards.
- To describe the basics of video representation, coding and applications in standards.
- To understand various error control coding techniques.

UNIT I (9 Hrs)

INTRODUCTION: Information – Entropy - Properties of Information and Entropy- Relation between Information and Probability- Mutual and Self-Information - Coding theory- Code Efficiency and Redundancy-Shannon's theorem – Construction of basic codes.

UNIT II (9 Hrs)

DATA CODING: Shannon and Fano coding - Huffman coding– Arithmetic coding - Predictive coding - Run-length Encoding - Ziv-Lempel Coding – Predictive Coding.

UNIT III (9 Hrs)

IMAGE AND AUDIO CODING: Image representation - Transformation – Quantization – Image Coding Standards - JPEG and JPEG 2000. Audio Coding - types – Linear Predictive Coding (LPC) – Code Excited LPC – Perceptual Coding - MPEG Audio Coding.

UNIT IV (9 Hrs)

VIDEO CODING: Video Coding - Motion Estimation and Compensation – Types of Frames – Encoding and Decoding of Frames – Video Coding Standards, H.261, H.263, MPEG-1, MPEG-2, MPEG-4.

UNIT V (9 Hrs)

ERROR CONTROL CODING: Linear Block Codes – Cyclic Codes – BCH Codes - Convolutional Codes.

Text Books:

1. Ze-Nian Li, Mark S. Drew and Jiang Chuan Liu, "Fundamentals of Multimedia ", Springer Edition, 2014.
2. Ranjan Bose, " Information theory, coding and cryptography ", Tata McGraw Hill, 3rd Edition, 2016.
3. Andrew J. Viterbi, "Information Theory and Coding", McGraw Hill, 1982.
4. Dr. Chitode J S, "Information Theory and Coding Techniques", Technical Publications , 2019.

ONLINE/NPTEL Courses:

Information Coding Techniques: https://nptel.ac.in/courses/117101053

ITPC404 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Data Structures and Algorithms, Programming skills

Course Objectives:

- To understand the concepts of Database Management System(DBMS), relational model, SQL quries, database storage structure, transaction processing and concurrency control.

Course Outcomes:

- To explain the basics of DBMS and design of database using ER model.
- To understand the relational model and SQL queries.
- To understand the authorization, security in database and normalization concepts.
- To understand the various storage components of a database and file organization techniques.
- To understand the concepts of ACID, concurrent transaction processing and recovery systems.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Database Systems: Overview – Data Models – Database System Architecture – History of Database Systems. Entity-Relationship Model: Basic Concepts – Constraints – Keys – Design Issues – Entity Relationship Diagram – Weak Entity Sets – Extended E-R Features – Design of an E-R Database Schema.

UNIT II (9 Hrs)

Relational Model: Structure of Relational Databases – Relational Algebra – Extended - Relational Algebra Operations – Modification of Database – Views – Tuple Relational - Calculus – Domain Relational Calculus. SQL: Background – Basic Structure – Set - Operations – Aggregate Functions – Null Values – Nested Sub-queries – Views – Complex Queries – Modification of the database –Joined Relations – Data-Definition Language.

UNIT III (9 Hrs)

Integrity and Security: Domain Constraints, Referential Integrity, Assertions, Triggers, Security and Authorization,Authorization in SQL. Relational-Database Design: Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form.

UNIT IV (9 Hrs)

Storage and File Structures: Overview of Physical Storage Media – Magnetic Disks – RAID – Tertiary Storage – Storage Access – File Organization. Indexing and Hashing: Basic Concepts –Static Hashing – Dynamic Hashing.

UNIT V (9 Hrs)

Transactions: Transaction concept – Transaction State – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Testing for Serializability. Concurrency Control: Lock-Based Protocols – Timestamp-Based Protocols. Recovery System: Failure Classification – Storage Structure – Recovery and Atomicity – Log-Based Recovery – Shadow Paging.

Text Books:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", McGraw-Hill Higher Education, 7th Edition, 2021.

References:

1. Fred R McFadden, Jeffery A Hoffer and Mary B. Prescott, "Modern Database Management", Addison Wesley, 7th Edition, 2004.
2. Elmasri and Navathe, "Fundamentals of database Systems", Addison Wesley, 6th Edition, 2010.
3. Jefrey D.Ulman and Jenifer Widom, "A First Course in Database Systems", Pearson Education Asia, 2001.
4. Bipin C Desai, "An Introduction to Database Systems", Galgotia Publications Pvt Limited, 2003.

ONLINE/NPTEL Courses:

1. Database Management System: https://nptel.ac.in/courses/106105175

ITPC405 WEB TECHNOLOGY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Copmuter Programming Language.

Course Objectives:

- To familiarize the basic concepts of web programming, web designing, client side, server side processing and scripting. To learn the creation of web sites and database applications.

Course Outcomes:

- To understand basic concept of web programming and working principles of web site.
- To apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites.
- To understand the client-side processing and scripting.
- To understand the server-side processing and scripting.
- To understand the servelet and database connectivity.

UNIT I (9 Hrs)

WEB ESSENTIALS : Internet Overview - Fundamental computer network concepts - Web Protocols - URL – Domain Name- Web Browsers and Web Servers- Working principle of a Website –Creating a Website - Client-side and server-side scripting

UNIT II (9 Hrs)

WEB DESIGNING : HTML – Form Elements - Input types and Media elements - CSS3 - Selectors, Box Model, Backgrounds and Borders, Text Effects, Animations, Multiple Column Layout, User Interface.

UNIT III (9 Hrs)

CLIENT-SIDE PROCESSING AND SCRIPTING : JavaScript Introduction – Variables and Data Types-Statements – Operators - Literals-Functions- Objects-Arrays - Built - in Objects - Regular Expression, Exceptions, Event handling, Validation - JavaScript Debuggers.

UNIT IV (9 Hrs)

SERVER SIDE PROCESSING AND SCRIPTING – PHP : PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - File Uploading – Email Basics - Email with attachments - PHP and HTML - Simple PHP scripts - Databases with PHP

UNIT V (9 Hrs)

SERVLETS AND DATABASE CONNECTIVITY : Servlets: Java Servlet Architecture – Servlet Life cycle- Form GET and POST actions -Sessions – Cookies – Database connectivity - JDBC Creation of simple interactive applications - Simple database applications

Text Books:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5", O'Reilly Publishers, 3rd Edition, 2014.
2. Deitel , Harvey Deitel and Abbey Deitel, Internet & World Wide Web , "How to Program" , Pearson Education, 5th Edition, 2012.
3. Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective" , Pearson Education, 2006.

References:

1. James F. Kurose "Computer Networking, A Top-Down Approach" , Pearson Education, 6th Edition, 2012.
2. Steven Holzener , "PHP – The Complete Reference", Mc-Graw Hill, 1st Edition, 2017.
3. Fritz Schneider and Thomas Powell , "JavaScript – The Complete Reference", McGraw Hill Publishers, 3rd Edition, 2017.
4. Bates, "Developing Web Applications" , Wiley Publishers, 2006.

ONLINE/NPTEL Courses:

1. Web Technology: https://nptel.ac.in/courses/106105084

ITPC406 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer Programming and Data Structures

Course Objectives:

- To understand the functions of operating systems, processes, threads, analyze the scheduling algorithms, process synchronization, deadlocks and various memory management schemes. To familiarize with the basics of virtual machines and Mobile OS like iOS & Android.

Course Outcomes:

- To understand the funtions of Operating System, System call, design & implementation.
- To understand and analyze various scheduling algorithms, process synchronization, process management, deadlock prevention and avoidance algorithms.
- To compare and contrast various memory management schemes.
- To explain the functionality of file systems and I/O systems.
- To understand the Virtualization concept and compare iOS and Android Operating Systems.

UNIT I (9 Hrs)

INTRODUCTION: Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring Methods.

UNIT II (9 Hrs)

PROCESS MANAGEMENT: Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-Process Communication; CPU Scheduling - Scheduling Criteria - Scheduling Algorithms: Threads - Multithread Models – Threading Issues; Process Synchronization - The Critical-Section Problem - Synchronization Hardware – Semaphores – Mutex - Classical Problems of Synchronization - Monitors; Deadlock - Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT III (9 Hrs)

MEMORY MANAGEMENT: Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT IV (9 Hrs)

STORAGE MANAGEMENT: Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File Concept - Access Methods - Directory Structure - Directory Organization - File System Mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory Implementation - Allocation Methods - Free Space Management - I/O Systems – I/O Hardware, Application I/O Interface, Kernel I/O subsystem.

UNIT V (9 Hrs)

VIRTUAL MACHINES AND MOBILE OS: Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and Implementations, Virtualization and Operating-System Components - Mobile OS - iOS and Android.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley and Sons Inc., 10th Edition, 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems" , Pearson, New Delhi, 5th Edition, 2022.

References:

1. Ramaz Elmasri, A. Gil Carrick and David Levine, "Operating Systems – A Spiral Approach" , Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems - Internals and Design Principles" , Prentice Hall, 7th Edition, 2018.
3. Achyut S.Godbole and Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.

ONLINE/NPTEL Courses:

1. Operating Sytems: https://nptel.ac.in/courses/106106144
2. https://nptel.ac.in/courses/106105214

ITMC407 ENVIRONMENTAL SCIENCE

L	T	P	C
3	0	0	0

Course Pre-requisite:

- Basic Science Courses

Course Objective:

- To work and produce most efficient, economical, eco-friendly finished products, to solve various engineering problems applying ecosystem to produce eco–friendly products.

Course Outcomes:

- To understand the basic concepts of industrial management.
- To understand the importance of air and noise pollution.
- To analyze the importance of solid and water pollution.
- To understand the importance of renewable sources of solar energy.
- To understand the environmental management in fabrication industry and solid waste management.

UNIT I (9 Hrs)

ECOSYSTEM: Structure of ecosystem-Biotic & Abiotic components- Food chain and food web- Aquatic (Lentic and Lotic) and terrestrial ecosystem- Carbon, Nitrogen, Sulphur, Phosphorus cycle- Global warming, Causes, effects, process, Green House Effect, Ozone depletion.

UNIT II (9 Hrs)

AIR AND, NOISE POLLUTION: Definition of pollution and pollutant-Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)- Air Pollutants: Types, Particulate Pollutants- Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)- Gaseous Pollution Control, Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler- Noise pollution, sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

UNIT III (9 Hrs)

WATER AND SOIL POLLUTION : Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD- Definition, calculation- Waste Water Treatment, Primary methods, sedimentation, froth flotation, Secondary methods- Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method- Membrane separation technology, RO (reverse osmosis).

UNIT IV (9 Hrs)

RENEWABLE SOURCES OF ENERGY SOLAR ENERGY: Basics of Solar energy- Flat plate collector (Liquid & Air). Theory of flat plate collector- Importance of coating- Advanced collector- Solar pond- Solar water heater, solar dryer- Solar stills- Biomass: Overview of biomass as energy source- Thermal characteristics of biomass as fuel- Anaerobic digestion- Biogas production mechanism- Utilization and storage of biogas- New Energy Sources, Need of new sources- Different types new energy sources- Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy.

UNIT V (9 Hrs)

SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT: Solid waste generation- Sources and characteristics of Municipal solid waste, E- waste, Biomedical waste- Air quality act 2004, air pollution control act 1981 and Water Pollution and Control Act 1996- Structure and role of Central and state pollution Control Board- Concept of Carbon Credit, Carbon Footprint- Environmental management in fabrication industry- ISO14000: Implementation in industries, Benefits.

Text Books:

1. S.C. Sharma & M.P. Poonia, "Environmental Studies", Khanna Publishing House, New Delhi, 2021.
2. Arceivala, Soli Asolekar, Shyam, "Waste Water Treatment for Pollution Control and Reuse", Mc-Graw Hill Education India Pvt. Ltd., New York, 2007.
3. Nazaroff, William, Cohen, Lisa, "Environmental Engineering Science", Willy, New York, 2000.
4. O.P. Gupta, "Elements of Environmental Pollution Control", Khanna Publishing House, New Delhi.

References:

1. Aldo Vieira, Da Rosa, "Fundamentals of renewable energy processes", Academic Press Oxford, 2013.
2. Patvardhan, A.D, "Industrial Solid Waste", Teri Press, 2013.
3. Metcalf and Eddy, "Waste Water Engineering", Mc-Graw Hill, 2013.
4. Keshav Kant, "Air Pollution & Control", Khanna Publishing House, 2018.

ONLINE/NPTEL Courses:

1. Introduction to Environmental Engineering: https://nptel.ac.in/courses/103107084
2. Environmental Quality Monitoring & Analysis: https://nptel.ac.in/courses/103106162
3. Basic Environmental Engineering and Pollution Abatement: https://nptel.ac.in/courses/103107215
4. Environmental Air Pollution: https://nptel.ac.in/courses/105104099

ITPL401 DATABASE MANAGEMENT SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Data Structures and Algorithms, Programming Skills

Course Objectives:

- To understand SQL,JDBC and ODBC connectivity. To design and develop databases for real-time applications.

Course Outcomes:

- To analyze database needs, functions and to create data models.
- To create Entity-Relationship (E-R)diagrams.
- To design and implement databases using database technology.
- To use normalization rules and principles to create normalized databases.
- To develop real-time database applications.

LIST OF EXPERIMENTS

1. Study of Database Concepts
2. Implementation of BASIC commands
3. Implementation of DDL commands
4. Implementation of DML commands
5. Implementation of DQL commands
6. Implementation of DCL commands
7. Implementation of TCL commands
8. Implementation of Built in functions
9. Implementation of Aggricate functions
10. Implementation of set operations, joins, nested sub quries
11. Create a set of tables, add foreign key constraints and incorporate referential integrity.
12. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
13. Write user defined functions and stored procedures in SQL.
14. Write SQL Triggers for insert, delete, and update operations in a database table.
15. Create View and index for database tables with a large number of records.
16. Design and develop any three real life database applications from the following list
    (a) Library Information System
    (b) Logistics Management System
    (c) Students’ Information System

(d) Ticket Reservation System

(e) Hospital Management System

(f) Inventory Management for a Grocery Shop

(g) Employee Information System

(h) Property Management system

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
- Apply Normalization rules in designing the tables in scope.
- Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
- Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
- Ability to showcase ACID Properties with sample queries with appropriate settings.

(Total Periods: 45)

ITPL402 WEB TECHNOLOGY LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basics in Programming

Course Objectives:

- To implement the basic of web programming, simple scripts for the creation of web sites and database applications.

Course Outcomes:

- To apply JavaScript, HTML and CSS effectively to create interactive and dynamic websites.
- To create simple PHP scripts.
- To design and deploy simple web-applications.
- To implement multimedia components.
- To create simple database applications.

LIST OF EXPERIMENTS

1. Creation of interactive web sites - Design using HTML and authoring tools.
2. Working with Client Side Scripting - JavaScript.
3. Form validation using JavaScript.
4. Creation of simple PHP scripts.
5. Implement to handle multimedia content in web sites.
6. Write programs using Servlets: i. To invoke servlets from HTML forms. ii. Session tracking using hidden form fields and session tracking for a hit count.
7. Creation of information retrieval system using web, PHP, and MySQL.
8. Creation of personal information system.

(Total Periods: 45)

ITPL403 OPERATING SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Computer Programming and Data Structures

Course Objectives:

- To install UNIX & Windows operating system, implement the various CPU scheduling algorithms, deadlock avoidance, deadlock detection algorithms, paging, file organisation techniques and disk scheduling algorithms.

Course Outcomes:

- To define and implement UNIX commands.
- To compare the performance of various CPU scheduling algorithms
- To compare and contrast various Memory allocation methods.
- To implement file organization and file allocation strategies
- To implement various disk scheduling algorithms.

LIST OF EXPERIMENTS

1. Installation of windows/UNIX operating system.
2. Illustrate UNIX commands and Shell Programming.
3. Implement the following Process Management System Calls: Fork, Exit, Getpid, Wait, Close.
4. Write programs to implement the various CPU scheduling algorithms.
5. Illustrate the Inter Process Communication(IPC) strategy.
6. Implement mutual exclusion by Semaphore.
7. Write a programs to avoid Deadlock using Banker's Algorithm.
8. Write a program to Implement Deadlock Detection Algorithm.
9. Write a program to implement Threading.
10. Implement the paging Techniques.
11. Write program to implement the following memory allocation methods. a. First Fit b. Worst Fit c. Best Fit
12. Write a program to implement the various page replacement algorithms.
13. Write a program to implement the various file organization techniques.
14. Implement the following File allocation strategies a. Sequential b. Indexed c. Linked
15. Write a program for the implementation of various disk scheduling algorithms.
16. Install any guest operating system like Linux using VMware.

(Total Periods: 45)

SEMESTER V

ITPC501 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer Organization, Operating Systems

Course Objectives:

- To understand the fundamental principles of computer networks, routing algorithms and various functions of networks.

Course Outcomes:

- To understand the basic concepts of computer networks and application layer protocol.
- To understand the concepts of transport layer protocols and Quality of Serives.
- To understand the network layer protocols.
- To analyze the routing algorithms.
- To understand data link layer functionality and transmission media.

UNIT I (10 Hrs)

INTRODUCTION TO NETWORKS AND APPLICATION LAYER: Scope and Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets - Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP.

UNIT II (9 Hrs)

TRANSPORT LAYER: Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service.

UNIT III (7 Hrs)

NETWORK LAYER: Switching : Packet Switching - Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP

UNIT IV (7 Hrs)

ROUTING: Routing and protocols: Unicast routing - Distance Vector Routing - RIP - Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM

UNIT V (12 Hrs)

DATA LINK AND PHYSICAL LAYERS: Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.

Text Books:

1. Behrouz and A. Forouzan, "Data Communications & Networking with TCP/IP Protocol Suite", 6th Edition TMH, 2022.
2. F. Kurose and Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Pearson Education, 8th Edition, 2021.

References:

1. Nader F. Mir, "Computer and Communication Networks", Prentice Hall, 2014.
2. William Stallings, "Data and Computer Communications", Pearson Education, 10th Edition, 2013.
3. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers Inc., 5th Edition, 2012.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks - An Open Source Approach", McGraw Hill, 2012

ONLINE/NPTEL Courses:

1. Computer Networks: https://nptel.ac.in/courses/106105183

ITPC502 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- knowledge in Computer Organization and Operating systems.

Course Objectives:

- To familiarize the core concepts of cloud computing, including its characteristics, service and deployment models.
- To design, deploy and manage virtualized resources in cloud environments including virtual machines, storage, and networking components.
- To comprehend secure and perform identity management in the cloud and popular Cloud Service Providers.

Course Outcomes:

- To impart the principles and paradigm of Cloud Computing and understand the Service Model with reference to Cloud Computing.
- To understand the Cloud Computing architecture and implementation.
- To realize the role of Virtualization Technologies and acquire knowledge of how hypervisors are used in Virtual Machines.
- To comprehend Secure and perform identity management in the Cloud and to access and use the services in the Cloud.
- To understand the popular Cloud Service Providers.

UNIT I (9 Hrs)

INTRODUCTION TO CLOUD COMPUTING : Overview, Roots of Cloud Computing - Layers and Types of Cloud - Desired Features of a Cloud - Benefits and Disadvantages of Cloud Computing - Cloud Infrastructure Management: Infrastructure as a Service Providers, Platform as a Service Providers - Challenges and Risk - Assessing the role of Open Standards.

UNIT II (9 Hrs)

CLOUD ARCHITECTURE, SERVICES AND APPLICATIONS : Exploring the Cloud Computing Stack - connecting to the Cloud - Infrastructure as a Service - Platform as a Service - SaaS Vs. PaaS, Using PaaS Application Frameworks - Software as a Service - Identity as a Service - Compliance as a Service.

UNIT III (9 Hrs)

ABSTRACTION AND VIRTUALIZATION : Introduction to Virtualization Technologies - Load Balancing and Virtualization - Understanding Hyper visors - Understanding Machine Imaging - Porting Applications - Virtual Machines Provisioning and Manageability Virtual Machine Migration Services - Virtual Machine Provisioning and Migration in Action - Provisioning in the Cloud Context.

UNIT IV (9 Hrs)

MANAGING & SECURING THE CLOUD : Administrating the Clouds - Cloud Management Products - Emerging Cloud Management Standards - Securing the Cloud - Securing Data - Establishing Identity and Presence.

UNIT V (9 Hrs)

CASE STUDIES : Using Google Web Services - Using Amazon Web Services - Using Microsoft Cloud Services.

Text Books:

1. Buyya R., Broberg J. and Goscinski A., "Cloud Computing- Principles and Paradigm", John Wiley & Sons, 1st Edition, 2013.
2. Sosinsky B., "Cloud Computing Bible", Wiley Edition, 1st Edition, 2011.
3. Miller Michael, "Cloud Computing- Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India.

References:

1. Smooth S.and Tan N., "Private Cloud Computing", Morgan Kauffman , 1st Edition, 2011.
2. Linthicium D., "Cloud Computing and SOA Convergence in Enterprise", Pearson Education India.

ONLINE/NPTEL Courses:

1. Cloud Computing: https://nptel.ac.in/courses/106105167

ITPC503 DISTRIBUTED COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Operating System.

Course Objectives:

- The aim is to introduce the concepts of communication models in distributed system,issues of synchronization, distributed mutual exclusion and dead lock detection.
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems and to understand the basic cloud computing concepts.

Course Outcomes:

- To explain the foundations of distributed systems
- To solve synchronization and state consistency problems
- To understand resource sharing techniques and deadlock detection in distributed systems
- To understand recovery in distributed systems
- To explain the fundamentals of cloud computing

UNIT I (8 Hrs)

INTRODUCTION: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges - A Model of Distributed Computations - A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

UNIT II (10 Hrs)

LOGICAL TIME AND GLOBAL STATE: Logical Time: Physical Clock Synchronization: NTP – Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication - Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III (10 Hrs)

DISTRIBUTED MUTEX AND DEADLOCK: Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

UNIT IV (10 Hrs)

CONSENSUS AND RECOVERY: Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures - Checkpointing and Rollback Recovery - Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm - Asynchronous Checkpointing Algorithm and Recovery.

UNIT V (7 Hrs)

CLOUD COMPUTING: Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms - Compute Services – Storage Services – Application Services

Text Books:

1. Kshemkalyani Ajay D and Mukesh Singhal, "Distributed Computing - Principles, Algorithms and Systems" , Cambridge Press, 2011.
2. Arshdeep Bagga and Vijay Madisetti, "Cloud Computing - A Hands On Approach", Universities Press, 2014.

References:

1. George Coulouris, Jean Dollimore and Time Kindberg, "Distributed Systems Concepts and Design", Pearson Education, 5th Edition, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems - Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A S and Van Steen M, "Distributed Systems - Principles and Paradigms", Pearson Education, 2007.
4. Liu M L, "Distributed Computing" - Principles and Applications, Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
6. Mukesh Singhal and Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc- Graw Hill Publishers, 2017.

ONLINE/NPTEL Courses:

1. Distributed Computing: https://nptel.ac.in/courses/106106168
2. https://nptel.ac.in/courses/106102237

ITPC504 EMBEDDED SYSTEMS AND IoT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer Organization and Architechture.

Course Objectives:

- To learn the concepts of embedded systems & Internet of Things (IoT) using their architectures, components, and applications in various domains.
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform and to apply in real world scenario.

Course Outcomes:

- To explain the architecture of embedded processors.
- To write embedded C programs.
- To design simple embedded applications.
- To compare the communication models in IOT
- To design IoT applications using Arduino/Raspberry Pi /open platform

UNIT I (9 Hrs)

EMBEDDED PROCESSOR: 8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II (9 Hrs)

EMBEDDED C PROGRAMMING: Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III (9 Hrs)

IOT AND ARDUINO PROGRAMMING: Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV (9 Hrs)

IOT COMMUNICATION AND OPEN PLATFORMS: IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V (9 Hrs)

APPLICATIONS DEVELOPMENT: Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2nd Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry and Gonzalo Salgueiro, "IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

References:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Elsevier, 2006.
3. Andrew N Sloss, D. Symes and C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

ONLINE/NPTEL Courses:

1. Embedded Systems and IoT: https://nptel.ac.in/courses/106105166

ITHS505 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Course Objective:

- To provide a foundational understanding of Management principles and practices. To introduce the field of management, its historical development and its importance in organizations.

Course Outcomes:

- To understand the introductory management concepts.
- To understand the basic knowledge on international aspect of management.
- To understand the organization structure and Human resource management.
- To understand motivation theories leadership and communication process.
- To understand the controlling concept of management.

UNIT I (9 Hrs)

INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS: Definition of Management - Science or Art, Manager Vs Entrepreneur, types of managers managerial roles and skills, Evolution of Management - Scientific, human relations, system and contingency approaches, Types of Business organization - Sole proprietorship, partnership, company, public and private sector enterprises, Organization culture and Environment - Current trends and issues in Management.

UNIT II (9 Hrs)

PLANNING: Nature and purpose of planning - Planning process, Types of planning, Objectives - Setting objec- tives, Policies, Planning premises, Strategic Management, Planning Tools and Techniques, Decision making steps and process - types of decisions and decision making conditions, Decision making styles, Effective decision making.

UNIT III (9 Hrs)

ORGANISING: Nature and purpose - Formal and informal organization, Organization chart, Organization structure, Types, Line and staff authority - Departmentalization, delegation of authority, Centralization and decentralization, Job Design, Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV (9 Hrs)

LEADING: Foundations of individual and group behaviour - Motivation, Motivation theories, Motivational techniques, Job satisfaction - Job enrichment, Leadership, types and theories of leadership, Communication - Process of communication, Barrier in communication, Effective communication, Communication and IT.

UNIT V (9 Hrs)

CONTROLLING: System and process of controlling - Budgetary and non, Budgetary control techniques, Use of computers and IT in Management control, Productivity problems and management, Control and performance, Direct and preventive control, Reporting.

Text Books:

1. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 11th Edition, 2019.
2. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall India Pvt. Ltd., 13th Edition, 2017.

References:

1. PC Tripathy, PN Reddy and Ashish Bajpai, "Principles of Management", Tata Mcgraw Hill, 7thEdition, 2021.
2. Harold Koontz and Heinz Weihrich, "Essentials of management", Tata McGraw Hill, 11thEdition, 2020.
3. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.

ONLINE/ NPTEL Courses:

1. Management Information System: https://onlinecourses.nptel.ac.in/noc23_mg87
2. Management Information System: https://nptel.ac.in/courses/110105148

ITMC506 CONSTITUTION OF INDIA

L	T	P	C
3	0	0	0

Pre-requisite:

- Basic Knowledge of Indian History

Course Objective:

- To learn about the Constitution of India and the structure.

Course Outcomes:

- To create the awareness of The Constitution.
- To understand the structures, roles and functions of the Union Government.
- To understand the structures, roles and functions of the State Government.
- To understand the structures, roles and functions of the Local Administration.
- To understand about the Election Commission.

UNIT I

THE CONSTITUTION - INTRODUCTION: The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation- State Policy Principles.

UNIT II

UNION GOVERNMENT: Structure of the Indian Union-President, Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

UNIT III

STATE GOVERNMENT: Governor, Role and Power, Chief Minister and Council of Ministers, State Secretariat.

UNIT IV

LOCAL ADMINISTRATION: District Administration, Municipal Corporation, Zila Panchayat.

UNIT V

ELECTION COMMISSION: Role and Functioning, Chief Election Commissioner, State Election Commission.

Text Books:

1. Dr. B. Mahadevan, Chinmaya Vishwa Vidyapeeth, Dr. Vinayak Rajat Bhat, Dr. Nagendra Pavana R.N., Chinmaya Vishwa Vidyapeeth, Dr. Anil Sahasrabudhe, Subhash Kak, Dr. S. Sadagopan, "Introduction to Indian Knowledge System: Concepts and Applications", IIIT Bangalore, 2022.

References:

1. DD Basu Lexis Nexis, "Introduction to the Constitution of India", 23rd Edition, 2018.
2. B.L. Fadia Sahitya Bhawan, "The Constitution of India", New Edition, 2017.
3. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, 2008.

ITPL501 COMPUTER NETWORKS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basics in Programming

Course Objectives:

- To configure and setting up networking components.
- To implement socket programming and various layer protocols using simulation tool.
- To understand the network layer, various routing protocols and error correction code using simulation tool.

Course Outcomes:

- To configure and implement networking components.
- To implement socket programming and various layer protocol using stimulation tool.
- To analyze routing algorithms using stimulation tool.
- To implement the error correction code using simulation tool.

LIST OF EXPERIMENTS

1. Assign IP numbers to the computer using static and dynamic mode.
2. Check the connectivity of a computer using the ping command.
3. Print the computers that are forwarding the packets from your computer to the server using the command tracer-oute.
4. Mount the volume of a remote computer using the “net use” command.
5. Examine the packets in the network using Wireshark application.
6. Send messages from one machine to another machine using Socket.
7. Simulate a chatting application using Socket.
8. Implement File Transfer Protocol in Java language.
9. Examine the log files of a web server and find the frequently visited websites.
10. Analyse the Distance Vector Routing protocol in NS2.
11. Analyse the Link State Routing protocol in NS2.

(Total periods: 45)

ITPL502 CLOUD COMPUTING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Operating System and Programming

Course Objectives:

- To develop web applications in cloud and to design and develop the process involved in creating a cloud-based applications with parallel programming using Hadoop.

Course Outcomes:

- To configure various virtualization tools such as Virtual Box, VMware workstation.
- To design and deploy a web application in a PaaS environment.
- To use the cloud environment simulation to implement new schedulers.
- To install and use a generic cloud environment that can be used as a private cloud.
- To manipulate large data sets in a parallel environment.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub.

(Total periods: 45)

ITPL503 EMBEDDED SYSTEMS AND IoT LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basics in C Programming

Course Objectives:

- To design and implement the internal architecture and programming of an embedded processor and to understand the interfacing I/O devices to the processor and evolution of IoT.
- To build a small low cost IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

Course Outcomes:

- To explain the architecture of embedded processors.
- To write embedded C programs.
- To design simple embedded applications.
- To compare the communication models in IoT.
- To design and develop real world IoT application.

LIST OF EXPERIMENTS

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write a basic and arithmetic Programs Using Embedded C.
5. Write a basic program using Arduino platform and programming.
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
7. Write sample program using Raspberry PI platform and python programming.
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium.
10. Setup a cloud platform to log the data
11. Log Data using Raspberry PI and upload to the cloud platform.
12. Design an IOT based system.

(Total Periods: 45)

SEMESTER VI

ITPC601 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in programming and logics.

Course Objectives:

- To apply heuristic concepts to design efficient algorithms and knowledge representation schemes for typical AI problems.

Course Outcomes:

- To understand AI & its types, Problem space, its searching and implement heuristic concepts in real time applications.
- To familiarize with knowledge representation schemes for typical AI problems.
- To understand the concept of basics of reasoning under uncertainty, rule based system and fuzzy logic.
- To understand the concepts of learning and planning.
- To implement a typical AI applications using LISP & Prolog.

UNIT I (9 Hrs)

INTRODUCTION: Overview of AI, Problems, Problem space and searching techniques, Definition production system, Control strategies, Heuristic search techniques - Game Playing - Minmax search procedure-Adding alpha-beta cutoff Intelligent agents - Agents and environment – structure of agents and its functions - simple reflex agent- goal based agent – utility based agent – learning agents, Knowledge Based Agent.

UNIT II (9 Hrs)

KNOWLEDGE REPRESENTATION: Approaches and issues in knowledge representation, Predicate logic, propositional logic, Forward and backward reasoning - Unification- Resolution- Weak slot-filler structure – Strong slot-filler structure.

UNIT III (9 Hrs)

REASONING UNDER UNCERTAINTY: Logics of non-monotonic reasoning-Implementation- Basic probability notation - Bayes rule – Certainty factors and rule based systems-Bayesian networks – Dempster - Shafer Theory - Fuzzy Logic.

UNIT IV (9 Hrs)

PLANNING AND LEARNING: Planning with state space search -partial order planning - planning graphs - conditional planning-continuous planning - Multi - Agent planning - Forms of learning- Learning from observation - Inductive learning – Decision trees –Explanation based learning – Statistical Learning methods - Reinforcement Learning - Neural Net learning and Genetic learning.

UNIT V (9 Hrs)

EXPERT SYSTEM & DECLARATIVE LANGUAGES: Expert System - Representation - Expert System shells - Knowledge Acquisition - AI Languages - Introduction to LISP, expressions, functions, Recursion - Introduction to Prolog - Knowledge representation and reasoning using Prolog.

Text Books:

1. Elaine Rich, Kevin Knight, Shivashankar and B. Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Edition, 2017.
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, 4th Edition, 2022.
3. I. Bratko, "Prolog: Programming for Artificial Intelligence", Addison-Wesley Educational Publishers Inc., 4th Edition, 2011.

References:

1. Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlett Publishers, 1st Edition, 2004.
2. N.P. Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2nd Edition, 2005.
3. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.

ONLINE/NPTEL Courses:

1. Artificial Intellegence: https://nptel.ac.in/courses/106106184
2. https://nptel.ac.in/courses/106105216

ITPC602 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Computer programming.

Course Objectives:

- To learn, practice and apply the software engineering industry practices.
- To acquire knowledge on the various techniques, tools and models for each of the phases of software development.

Course Outcomes:

- To understand the process of software life cycle models.
- To describe the concept of Software Project management and Requirement Analysis.
- To understand the software design and function oriented software design.
- To understand the coding and testing.
- To understand the software reliability and software maintenance models.

UNIT I (9 Hrs)

INTRODUCTION TO SOFTWARE ENGINEERING: Software Engineering Discipline – Evolution and Impact – Software Development projects – Emergence of Software Engineering – Computer System Engineering Software Life Cycle Models: classic Waterfall model – Iterative Lifecycle model – prototyping model – Evolutionary model – spiral model – Comparison of Life cycle models.

UNIT II (9 Hrs)

SOFTWARE PROJECT MANAGEMENT AND REQUIREMENTS ANALYSIS: Responsibilities of a Software Project Manager – Project Planning – Metrics for Project Size Estimation – Empirical Estimation Techniques – COCOMO – Halstead's Software Science – Staffing Level Estimation – Scheduling – Organization and Team structures – Staffing – Risk Management – Software Configuration Management - Requirements Analysis and Specification - Requirements Gathering and Analysis – Software Requirements specification – Formal System Specification – Axiomatic Specification - Algebraic Specification – 4GL.

UNIT III (9 Hrs)

SOFTWARE DESIGN: Outcome of a Design Process – Characteristics of a Good Software Design – Coupling and Cohesion – Approaches to Software Design – Object Oriented Vs Function Oriented Software Design approaches Function Oriented Software Design: Structured Analysis – Data Flow Diagrams – Applying DFD to Real time systems – Structured and Detailed Design.

UNIT IV (9 Hrs)

CODING AND TESTING: Coding – Software Documentation – Testing – Unit Testing – Black Box testing – White Box testing – Debugging – Program Analysis tools – Integration testing – Testing Object Oriented programs – System Testing – Issues.

UNIT V (9 Hrs)

SOFTWARE RELIABILITY AND QUALITY: Software Reliability – Software Quality – ISO 9000 – SEI CMM – Six Sigma - CASE and Software Maintenance - CASE environment – CASE support in Software Life cycle – Characteristics of CASE tools – characteristics of software maintenance – software reverse engineering – software maintenance process models.

Text Books:

1. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning, 5th Edition,2018.

References:

1. Roger S.Pressman, "Software Engineering:A Prac",McGraw-Hill International Edition, 7th Edition,2009.
2. S.L.Pfleeger and J.M.Atlee, "Software Engineering Theory and Practice",Pearson Education, 4th Edition,2012.
3. Pankaj Jalote, "An Integrated Approach to Software Engineering",Narosa, 3rd Edition,2008.
4. Ian Sommerville, "Software Engineering",Pearson Education, 10th Edition,2015.

ONLINE/NPTEL Courses:

1. Software Engineering: https://nptel.ac.in/courses/106105182

ITPC603 COMPILER DESIGN

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Programming Languages, Formal Languages and Automata theory

Course Objectives:

- To learn the process involved in functionality, translation and interpretation modules of a compiler.

Course Outcomes:

- To understand the basic components of a compiler and the role of Lexical Analyzer and parser.
- To understand different parsing techniques.
- To demonstrate the use of SDT in code generation.
- To apply code optimization techniques.
- To design and develop a simple code generator.

UNIT I (9 Hrs)

INTRODUCTION TO COMPILERS: Compiler - Interpreter - Phases of Compilation, Bootstrapping, Cross-Compilation, The role of lexical analysis - Regular Expressions (RE), Deterministic Finite Automata (DFA) - Traversing a DFA for Recognizing tokens - Generating a Lexical Analyzer using LEX/Flex - Parsing - Concept of Parsing, CFG, Derivation, Parse Tree, Ambiguity.

UNIT II (9 Hrs)

PARSING TECHNIQUES: Overview of top-down and bottom-up parsing, Handles and pruning - Introduction to shift reduce parsing - Constructing SLR parsing tables, SLR, CLR, LALR, Top-down parsing -Left factoring - Elimination of Left-recursion - Backtracking - predictive parsing - recursive descent parsing - LL(1) parsing - Generating a parser using a parser generator such as ANTLR, JavaCC, YACC/BISON.

UNIT III (9 Hrs)

SYNTAX DIRECTED TRANSLATION: Syntax trees, S,L attributes definition - the need of semantic analysis - syntax directed translation schemes (SDTS) - Intermediate Code generation - Intermediate forms - Polish notation & 3AC - types - translation of assignment - Boolean expression & Flow of control statements.

UNIT IV (9 Hrs)

CODE OPTIMIZATION: Organization of code Optimizer - basic blocks - flow graphs - optimization of basic blocks - sources of optimization - DAG - representation of Basic blocks- global data flow analysis.

UNIT V (9 Hrs)

CODE GENERATION: Machine dependent code generation - The target machine - Simple code generator - Register allocation and assignment - Peephole Optimization.

Text Books:

1. Alfred V.Aho, Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Addison-Wesley, 2nd Edition, 2006.

References:

1. Andrew Appel and Jens Palsberg, "Modern Compiler Implementation in Java", 2nd Edition, Cambridge University Press, 2002.

ONLINE/NPTEL Courses:

1. Overview of Compiler: https://nptel.ac.in/courses/106108113
2. Compiler Design: https://nptel.ac.in/courses/106105190

ITHS604 HUMAN RESOURCE MANAGEMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in Principles of Management

Course Objectives:

- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.

Course Outcomes:

- To gain knowledge on the various aspects of human resource management.
- To learn the knowledge needed for success as a human resource professional.
- To develop the skills needed for a successful HR manager.
- To implement the concepts learned in the workplace.
- To understand emerging concepts in the field of HRM.

UNIT I (9 Hrs)

PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT: Evolution of human resource management – The importance of the human capital – Role of human resource manager –Challenges for human resource managers - trends in Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

UNIT II (9 Hrs)

HUMAN RESOURCE PLANNING AND RECRUITMENT: Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources- Organizational Attraction-. Recruitment, Selection, Induction and Socialization- Theories, Methods and Process.

UNIT III (9 Hrs)

TRAINING AND DEVELOPMENT: Types of training methods –purpose- benefits- resistance. Executive development programme – Common practices - Benefits – Self development – Knowledge management.

UNIT IV (9 Hrs)

EMPLOYEE ENGAGEMENT: Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Mentoring - Development of mentor – Prote´ge´ relationships- Job Satisfaction, Employee Engagement, Organizational Citizenship Behavior: Theories, Models.

UNIT V (9 Hrs)

PERFORMANCE EVALUATION AND CONTROL: Method of performance evaluation – Feedback – Industry practices. Promotion, Demotion, Transfer and Separation – Implication of job change. The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

Text Books:

1. Gary Dessler and Biju Varkkey, "Human Resource Management", Pearson Education Limited, 14th Edition , 2015.
2. David A. Decenzo, Stephen.P.Robbins and Susan L. Verhulst, "Human Resource Management", Wiley, International Student Edition, 11th Edition, 2014.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy, "Managing Human Resource", PHI Learning, 2012

References:

1. Bernadin, "Human Resource Management",Tata Mcgraw Hill ,8th edition, 2012.
2. Wayne Cascio, "Managing Human Resource", McGraw Hill, 2015.
3. Ivancevich, ""Human Resource Management", McGraw Hill, 2012.
4. Uday Kumar Haldar and Juthika Sarkar., "Human Resource management", Oxford, 2012.

ONLINE/NPTEL Courses:

Human Resource management: https://nptel.ac.in/courses/109105121

ITPL601 ARTIFICIAL INTELLIGENCE LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Data Structures, Knowledge in programming

Course Objectives:

- To apply the heuristic concepts and to design efficient algorithms using Python. To develop expert system using Python and AI problems using LISP.

Course Outcomes:

- To apply heuristic concepts to design efficient algorithms using Python.
- To implement game playing algorithms in Python.
- To develop Expert system using Python.
- To design and develop intelligent application using python & lisp.
- To develop expert system using lisp and prolog.

LIST OF EXPERIMENTS

1. Implement Breadth First Search (for 8 puzzle problem).
2. Implement Depth First Search (for Water Jug problem).
3. Implement $A*$ algorithm.
4. Implement $AO*$ Algorithms.
5. Implement Single Player Game (Using Heuristic Function).
6. Implement Two Player Game (Using Heuristic Function).
7. Implement Constraint Satisfaction Problem.
8. Implement Certainty Factor problem.
9. Implement Proportional Model for checking the english sentences.
10. Develop an Expert system for Medical diagnosis.
11. Develop any Rule based system for an application of your choice.

    To design and develop programs in LISP
12. Knight's tour problem.
13. Crossword puzzle.

    Problems in Prolog
14. Resolution in Propositional Logic.
15. Resolution in Predicate Logic.

(Total periods: 45)

ITPROJ602 MINI PROJECT

L	T	P	C
0	0	6	3

Course Pre-requisite:

- Knowledge in Software Engineering and Programming.

Course Objectives:

- To design and develop software application using software engineering principles.

Course Outcomes:

- To expertise software development lifecycle Models.
- To develop the software requirements specification for the project.
- To use UML diagrams for analysis and design.
- To use the suitable architectural styles and design patterns.
- To develop the test cases and deploy the software.

SUGGESTED APPLICATIONS FOR MINI-PROJECT

1. Passport automation system.
2. Book bank system.
3. Exam registration system.
4. Stock maintenance system.
5. Online course reservation system.
6. Airline/Railway reservation system.
7. Software personnel management system.
8. Credit card processing.
9. Recruitment system.
10. Foreign trading system.
11. Conference management system.
12. BPO management system.
13. Library management system.
14. Student information system.
15. Quiz App.
16. Restaurant Website Application.

MINI PROJECT GUIDELINES

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios
11. Preparation of Project Report.

SEMESTER VII

ITHS701 ORGANIZATIONAL BEHAVIOUR

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in organization and management

Course Objectives:

- To learn organizational behaviour,management practices and solving organizational challenges to understand the important issues pertaining to individual.

Course Outcomes:

- To analyze the inter personnel communication process to increase their effectiveness
- To evaluate the development of basic conflict resolutions
- To examine what makes an organization, how organization evolve and what makes them effective
- To appraise their ability to manage, lead and work with other people in an organizational setting
- To understand the organizational behaviour in dynamics.

UNIT I (9 Hrs)

FOCUS AND PURPOSE: Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

UNIT II (9 Hrs)

INDIVIDUAL BEHAVIOUR: Personality, types, Factors influencing personality, Theories – Learning,Types of learners,The learning process, Learning theories – Organizational behavior modification, Misbehaviour, Types, Management Intervention- Emotions Emotional Labour, Emotional Intelligence, Theories- Attitudes, Characteristics, Components, Formation, Measurement Values- Perceptions, Importance, Factors influencing perception, Interpersonal perception, Impression Management Motivation,importance,Types – Effects on work behavior.

UNIT III (9 Hrs)

GROUP BEHAVIOUR: Organization structure – Formation – Groups in organizations, Influence, Group dynamics – Emergence of informal leaders and working norms, Group decision making techniques, Team building, Interpersonal relations, Communication – Control.

UNIT IV (9 Hrs)

LEADERSHIP AND POWER: Meaning, Importance, Leadership styles – Theories, Leaders Vs Managers – Sources of power, Power centers – Power and Politics.

UNIT V (9 Hrs)

DYNAMICS OF ORGANIZATIONAL BEHAVIOUR: Organizational culture and climate, Factors affecting organizational climate, Importance- Job satisfaction, Determinants, Measurements, Influence on behavior- Organizational change, Importance, Stability Vs Change , Proactive Vs Reaction change, the change process, Resistance to change, Managing change- Stress, Work Stressors, Prevention and Management of stress, Balancing work and Life- Organizational development, Characteristics,objectives.

Text Books:

(a) Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, "Essentials of Organizational Behaviour", Pearson, 2019.

References:

(a) K. Aswathappa, "Organizational Behavior", Himalaya Publishing House, 2018.

(b) Richard L, "Organization Theory and Design", South Western College Publishing, 11^{th} Edition, 2012.

(c) S.TrevisCerto, "Modern Management Concepts and Skills", Pearson Education, 2018.

ONLINE/NPTEL Courses:

(a) Understanding Organizational Behaviour: https://nptel.ac.in/courses/110105033

(b) Organizational Behaviour: https://nptel.ac.in/courses/110106145

(c) Organizational Behaviour - II: https://nptel.ac.in/courses/110105154

ITPC702 CYBER SECURITY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Programming Language, Computer Networks

Course Objective:

- To learn the importance of cyber security and various attacks on digital systems.To explore various vulnerabilities in web applications, networks and Internet Infrastructure.

Course Outcomes:

- To understand the importance of cyber security.
- To understand the concepts of authentication, authorization and privileges of Cyber security.
- To acquire knowledge about security in application layer and its mitigation techniques.
- To understand perimeter protection and Intrusion detection system.
- To explore various malware and its analysis.

UNIT I (9 Hrs)

INTRODUCTION TO CYBER SECURITY: Introduction and basic Terminology Cyber Security and CIA Triad, Cyber Threats to CIA, Cyber-Attack surfaces, Recent Cyber- Security incidents and high-level analysis - Basic Cryptography - Role of Cryptography in ensuring confidentiality for data at rest, data in motion, and data in process - Symmetric and Asymmetric Cryptography, Needs, Symmetric and Asymmetric algorithm outlines (RSA, DH, DES, AES) - Role of cryptography in Data Integrity, non-repudiation Hashing and Digital Signature - hash function (MD5, SHA-256), Understanding digital signature and its role, Digital Certificate and PKI - Importance of the role of a proper Pseudo Random Number Generator.

UNIT II (5 Hrs)

AUTHENTICATION, AUTHORIZATION AND PRIVILEGE: Importance of strong Authentication – distinction between authorization and authorization - importance of authorization-access control – Mandatory and Discretionary Access control - role based authorization – privilege and privilege escalation.

UNIT III (13 Hrs)

APPLICATION SECURITY: Application Security- Basic application vulnerabilities (Buffer overflow, Integer Overflow, format string vulnerability) – Basic mitigations of buffer overflow – platform bases – compiler based, secure programming practice - Web Client Security, Same Origin Principle – DOM, Java Script Vulnerability – Cookies and Cookie Attributes Secure, http only–Concept of session and session ID– Session hijacking vulnerability–http vs. https and SSL/TLS and version issue - Web Server Security – XSS, CSRF, SQL Injection, Command Injection concepts.

UNIT IV (9 Hrs)

PERIMETER PROTECTION AND INTRUSION DETECTION: Vulnerabilities in DNS, Routing and IP protocols especially in IPv4 and suggested remedies with DNSSEC, S-BGP, and IPSec - Perimeter Protection And Intrusion Detection- Host Intrusion Detection techniques, To look for and how an SIEM tool can consolidate such indicators into a management console- Network Intrusion Detection – signature based vs. behavior based, Snort, Intrusion Detection System.

UNIT V (9 Hrs)

BASIC MALWARE ANALYSIS: Firewall vs. Intrusion detection tool – Firewall rules and customization techniques. Basic Malware Analysis- Various malware classes and their characteristics - Difference between static analysis and dynamic analysis - Signature vs. behavioral detection techniques.

Text Books:

(a) Debtoru Chatterjee, "Cyber Crime and its Prevention in Easy Steps", Khanna Publishing House, 2022.

(b) Debtoru Chatterjee, "Cyber Attacks and Counter-Measures Made Simple", Khanna Publishing House, 2022.

(c) Ross J. Anderson, "Security Engineering", Wiley, 3rd Edition, 2020.

(d) William Stallings, "Cryptography and Network Security", Pearson Education, 7th Edition, 2017.

References:

(a) D Stuttard and M Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley publisher, 2011.

(b) Peter Kim, "The Hacker Playbook: Practical Guide to Penetration Testing (vol. 1 and 2)", Createspace Independent Pub, 2015.

(c) Jeeva Jose, "Introduction to Security of Cyber-Physical Systems", Khanna Publishing, 1st Edition, 2022.

(d) Er.Harsh Bothra, "Mastering Hacking The Art of Information Gathering & Scanning", Khanna Book Publishing House, 1st Edition, 2019.

ITPROJ701 SEMINAR

L	T	P	C
0	0	2	1

Course Objectives:

- To work independently and get exposure in latest technologies.
- The seminar topic shall be chosen in consultation with a faculty member who would be the guide.
- Each student has to make a critical review of literature and prepare a report.
- The student has to present a seminar on latest technologies.

Course Outcomes:

- To work independently and get exposure in latest technologies.
- To make a critical review of literature and prepare a report.
- To present a seminar.

ITPROJ702 PROJECT I

L	T	P	C
0	0	12	6

Course Pre-requisite:

- Mini Project, Programming skills

Course Objectives:

- To enable the students to design and develop a software for real world application using latest techniques.

Course Outcomes:

- To gain domain knowledge and technical skill set required for solving industry / research problems.
- To gather system requirements and design suitable software solutions and test and evaluate them.
- To provide solution architecture, module level designs, algorithms.
- To implement, test and deploy the solution for the target platform.
- To prepare detailed technical report, demonstrate and present the work.

Project Guidelines:

The students shall individually / or as group work(3 to 4 members) on business/research domains and related problems approved by the Department / organization that offered the project. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work, methodology for carrying out the work, design and implement, the solution, tabulated test results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

SEMESTER VIII

ITPROJ801 INTERNSHIP

L	T	P	C
0	0	4	1

Course Objectives:

- To understand the operation of an Industry / Research / Human Interaction.

Course Outcomes:

- To understand the impact of engineering solutions in a global, economic, environmental and societal context.
- To understand the operations of an industry.
- To develop the ability to engage in research and to involve in life-long learning.

Guidelines:

(a) Four weeks of work at industry site from 2nd Semester onwards during the summer.

(b) Supervised by an expert at the industry.

(c) The student should submit a report on completion.

ITPROJ802 PROJECT II

L	T	P	C
0	0	12	6

Course Objectives:

- To enable the students to design and develop a software for real world application using latest techniques.

Course Outcomes:

- To gain domain knowledge and technical skill set required for solving industry / research problems.
- To gather system requirements and design suitable software solutions and test and evaluate them.
- To provide solution architecture, module level designs, algorithms.
- To implement, test and deploy the solution for the target platform.
- To prepare detailed technical report, demonstrate and present the work.

Project Guidelines:

The students shall individually / or as group work(3 to 4 members) on business/research domains and related problems approved by the Department / organization that offered the project. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work, methodology for carrying out the work, design and implement, the solution, tabulated test results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

HONOR COURSES

ITH01 DATA SCIENCE

L	T	P	C
3	1	0	4

Course Objectives:

- To gain knowledge in the basic concepts of data analysis, data preparatory and preprocessing, tools and packages in python for data science.

Course Outcomes:

- To perform exploratory data analysis.
- To understand data dependencies.
- To perform array process.
- To understand regression analysis.
- To understand and apply the knowledge of data visualization using matplotlib.

UNIT I (12 Hrs)

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

UNIT II (12 Hrs)

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

UNIT III (12 Hrs)

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 (12 Hrs)

DATA ANALYSIS: 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 (12 Hrs)

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

Text Books:

1. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, "Introducing Data Science Big Data, Machine Learning, and More, using Python Tools", Manning Publications Co., 1st Edition 2016.
2. Steven S. Skiena, "The Data Science Design Manual", Springer, 2017.
3. Joel Grus, "Data Science from Scratch", O'Reilly Media, 2nd Edition 2019.

Text Books:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2nd Edition, 2012.
2. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India, 1st Edition, 2013.

ONLINE/NPTEL Courses:

1. Data Science: https://onlinecourses.nptel.ac.in/noc21_cs69

ITH02 DRONE TECHNOLOGIES

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the basics of drone concepts, design, fabrication and programming of drone.
- To impart the knowledge of an flying and operation of drone, applications of drone, safety risks and guidelines of fly safely.

Course Outcomes:

- To understand a various type of drone technology, drone fabrication and programming.
- To understand and design drones.
- To select appropriate sensors and actuators for drones.
- To develop a drone mechanism for specific applications.
- To create the programs for various drones.

UNIT I (12 Hrs)

INTRODUCTION TO DRONE TECHNOLOGY: Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses - Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

UNIT II (12 Hrs)

DRONE DESIGN, FABRICATION AND PROGRAMMING: Classifications of the UAV - Overview of the main drone parts - Technical characteristics of the parts - Function of the component parts - Assembling a drone - The energy sources - Level of autonomy - Drones configurations - The methods of programming drone - Install program on computer - Running Programs - Multi rotor stabilization - Flight modes - Wi-Fi connection.

UNIT III (12 Hrs)

DRONE FLYING AND OPERATION: Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications.

UNIT IV (12 Hrs)

INTRODUCTION TO DRONE TECHNOLOGY: Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V (12 Hrs)

FUTURE DRONES AND SAFETY: Safety risks- Guidelines to fly safely -Specific aviation regulation and standardization Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.

Text Books:

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, Inc, 1st Edition 2021.
2. Terry Kilby and Belinda Kilby, "Make:Getting Started with Drones",Maker Media, Inc, 1st Edition 2016.

References:

1. John Baichtal, "Building Your Own Drones: A Beginner's Guide to Drones, UAVs, and ROVs", Que Publishing, 1st Edition 2016.
2. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

ITH03 3D PRINTING

L	T	P	C
3	1	0	4

Course Objectives:

- To discuss on basics of 3D printing, principles of 3D printing technique, inkjet technology, laser technology and the applications of 3D printing.

Course Outcomes:

- To outline and examine the basic concepts of 3D printing technology.
- To understand 3D printing workflow.
- To understand the concepts and working principles of 3D printing using inkjet technique.
- To explain and categorise the working principles of 3D printing using laser technique.
- To explain various method for designing and modeling for industrial applications.

UNIT I (12 Hrs)

INTRODUCTION: Introduction - Design considerations – Material, Size, Resolution, Process - Modelling and viewing - 3D - Scanning; Model preparation – Digital - Slicing - Software - File formats.

UNIT II (12 Hrs)

PRINCIPLE: Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation - Materials - Paper, Plas- tics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene - Material Selection - Processes, applications, limitations.

UNIT III (12 Hrs)

INKJET TECHNOLOGY: Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control - Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand - Material Formulation for jetting; Liquid based fabrication – Continous jet, Mulitjet - Powder based fabrication – Colourjet.

UNIT IV (12 Hrs)

LASER TECHNOLOGY: Light Sources – Types, Characteristics - Optics – Deflection, Modulation - Material feeding and flow – Liquid, powder - Printing machines – Types, Working Principle, Build Platform, Print bed Movement, Support structures.

UNIT V (12 Hrs)

INDUSTRIAL APPLICATIONS: Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends.

Text Books:

1. Christopher Barnatt, “3D Printing: The Next Industrial Revolution”, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, “Inkjet Technology for Digital Fabrication”, John Wiley& Sons, 2013.

References:

1. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", 2nd edition, World Scientific Publishers, 2010.
2. Ibrahim Zeid, "Mastering CAD CAM", Tata McGraw-Hill Publishing Co., 2nd Edition 2007.
3. Joan Horvath, "Mastering 3D Printing", APress, 1st Edition 2014.

ITH04 AGILE METHODOLOGIES

L	T	P	C
3	1	0	4

Course Objectives:

- To provide with a theoretical as well as practical understanding of agile software development, software design and a set of software technologies.

Course Outcomes:

- To realize the importance of interacting with business stakeholders in determining the requirements for a software system
- To perform iterative software development processes and to impact of social aspects on software development success.
- To develop techniques and tools for improving team collaboration and software quality.
- To perform Software process improvement as an ongoing task for development teams.
- To practice Agile approaches.

UNIT I (12 Hrs)

AGILE METHODOLOGY: Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

UNIT II (12 Hrs)

AGILE PROCESSES: Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III (12 Hrs)

AGILITY AND DECISION MAKING: Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story Cards – Story-Card Maturity Model (SMM).

UNIT IV (12 Hrs)

AGILITY AND REQUIREMENTS ENGINEERING: Impact of Agile Processes in RE – Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V (12 Hrs)

AGILITY AND QUALITY ASSURANCE: Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

Text Books:

1. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

References:

1. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Addison-Wesley, 2004.
2. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 1st Edition 2007.

ITH05 BIOMETRICS

L	T	P	C
3	1	0	4

Course Objectives:

- To familiarize with biometric traits and its processing & applications, physiological biometric traits and its operations.
- To acquire knowledge in multi-biometrics, levels of fusion and real time applications.

Course Outcomes:

- To get an introduction to Biometric traits, its processing and their applications.
- To know the importance of physiological biometric traits and its operations.
- To know more about behavioral and soft biometric traits and its operations.
- To acquire knowledge in multi-biometrics and levels of fusion.
- To apply the multi-biometric traits in real time applications.

UNIT I (12 Hrs)

INTRODUCTION: Introduction to Biometrics: Operation of a Biometric System – verification vs. identification – performance of a biometric system – biometrics characteristics –biometrics traits - application of biometrics.

UNIT II (12 Hrs)

PHYSIOLOGICAL TRAITS: Fingerprint – Face – Iris – Hand geometry – Ear – palm print – knuckle print – Hand vascular – DNA traits – sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications.

UNIT III (12 Hrs)

BEHAVIOURAL AND SOFT TRAITS: Key stroke – Signature – Voice – Gait – Driving Style – ECG – EEG - sensor models of every trait – feature extraction techniques – matching – performance evaluation – test databases – applications.

UNIT IV (12 Hrs)

MULTI-BIOMETRICS: Limitations of Biometric System - Multi-biometrics System Design - Level of Fusion: Sensor Level - Feature Level - Rank Level - Decision Level.

UNIT V (12 Hrs)

APPLICATIONS: National ID Card (UID), Voter Registration, Welfare Disbursement, Border Crossing. Forensic: Corpse Identification, Criminal Investigation, Parenthood Determination. Commercial: ATM, Access Control, Mobile Phone, Banking, E-Commerce, Smart Card.

Text Books:

1. Anil K. Jain, Patrick Flynn and Arun A. Ross, "Handbook of Biometrics", Springer, 2008.
2. Arun A. Ross, Karthik Nandakumar and Anil K. Jain, "Handbook of Multibiometrics", Springer, 2008.
3. Davide Maltoni, Dario Maio, Anil K. Jain and SalilPrabhakar, "Handbook of Fingerprint Recognition", 2nd Edition, Springer, 2009.
4. M.J. Burge and K.W. Bowyer, "Handbook of Iris Recognition", Springer, 2013.

References:

1. Stan Z. Li and Anil K. Jain, "Encyclopedia of Biometrics", Springer, 2009.
2. Ruud M. Bolle, Sharath Pankanti, Nalini K. Ratha, Andrew W. Senior and Jonathan H. Connell, "Guide to Biometrics", Springer, 2009.

ONLINE/NPTEL Courses:

Biometrics: https://nptel.ac.in/courses/106104119

MINOR COURSES

ITM01 ESSENTIALS OF DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the sorting, searching techniques, stacks, queues, trees and graphs. To analysis the algorithm design.

Course Outcomes:

- To understand sorting and searching algorithms and applying them in applications.
- To design and implement linear data structures using C.
- To design and implement non - linear data structures using C.
- To understand about the analysis of algorithm.
- To understand the algorithm design methods.

UNIT I (12 Hrs)

SORTING AND SEARCHING TECHNIQUES: Sorting algorithms – Insertion sort- selection sort – shell sort – bubble sort – quick sort – heap sort-merge sort – radix sort – searching – linear search – binary search.

UNIT II (12 Hrs)

STACKS AND QUEUES: Stack ADT – operations - implementation – application: expression evaluation.Queue ADT – operations – implementation – application – priority queue.

UNIT III (12 Hrs)

TREES AND GRAPHS : Binary tree – traversal methods – application – binary search tree. Graph – traversal methods – Dijkstra's algorithm - application.

UNIT IV (12 Hrs)

ALGORITHM ANALYSIS: Introduction: Algorithm – efficiency of algorithms – best, worst and average case analysis – the order of – asymptotic notations –solving recurrences – homogeneous recurrences – inhomogeneous recurrences.

UNIT V (12 Hrs)

ALGORITHM DESIGN: Strassen's Matrix multiplication –Greedy Knapsack problem solution – N queen's problem – all pairs shortest path algorithm.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008.
2. Richard Gilberg, Behrouz and A.Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, India Edition, 2005.

3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2010.
4. Venkatesan R and Lovelyn Rose S, “Data Structures”, Wiley India Pvt Ltd, New Delhi, 2015.

References:

1. Salaria R S, “Data Structures and Algorithms using C”, 5th Edition, Khanna Book Publishing, New Delhi, 2012.
2. Vijayalakshmipai G.A, “Data Structures and Algorithms: Concepts Techniques and Applications”, McGraw Hill, 2009.

ONLINE/NPTEL Courses:

Essentials of Data Structures and Algorithms: https://nptel.ac.in/courses/106102064

ITM02 JAVA AND INTERNET PROGRAMMING

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the concepts of object oriented programming, applets, foundations for internet programming dynamic HTML, servlets, session tracking and JDBC connectivity.

Course Outcomes:

- To understand the java fundamentals.
- To understand the applets concepts and implement.
- To implement the HTML programming.
- To understand DHTM, XML and active-X controls.
- To implement the servlet concepts.

UNIT I (12 Hrs)

INTRODUCTION: Introduction to Object Oriented Programming – Java on the Internet – Multithreading and Persistence – Java keywords and flow control – Garbage collection – packages- Final declaration – Interfaces and inner classes – Java I/O classes – Run time type identification.

UNIT II (12 Hrs)

APPLETS: Introduction to Applets – How it differs from application –building applet code and Execution – Life cycle – Applet Tag – Adding Applet to HTML file – Passing Parameters to Applet – Displaying Numerical Values – Getting Input from the User – Debugging.

UNIT III (12 Hrs)

INTERNET PROGRAMMING: Foundations for Internet Programming: An overview of Internet Programming - WWW -HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions – arrays – objects – simple web applications.

UNIT IV (12 Hrs)

DYNAMIC HTML AND ACTIVE X: Dynamic HTML – introduction – cascading style sheets – object model and collections – event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data - XML.

UNIT V (12 Hrs)

SERVLETS: Servlets communication – Interactive Java Servlets – Deployment of simple servlets – web server (Java web server / Tomcat / Web logic) – HTTP GET and POST requests – session tracking – cookies – JDBC – simple web applications – multi-tier applications.

Text Books:

1. Deitel, Deitel and Nieto, “Internet and World Wide Web, How to program”, Pearson Education Publishers, 2000.
2. E. Balagurusamy, “Programming with Java” – A Primer – 3rd Edition, Tata McGraw Hill, 2006.
3. R. Krishnamoorthy and S. Prabhu, “Internet and Java Programming” , New Age International Publishers, 2004.

Text Books:

1. Thomno A. Powell, “The Complete Reference HTML and XHTML”, 4th Edition, Tata McGraw Hill, 2003.
2. Naughton, “The Complete Reference – Java2”, Tata McGraw-Hill, 3rd Edition, 1999.

ONLINE/NPTEL Courses:

Java and Internet Programming: https://onlinecourses.nptel.ac.in/noc22_cs47

ITM03 DATA COMMUNICATION AND COMPUTER NETWORKS

L	T	P	C
3	1	0	4

Course Objectives:

- To understand the basic layers and its functions of computer networks. To understand the data flows from one node to another in networks. To analyse the routing algorithms.

Course Outcomes:

- To understand the functions of computer networks and physical layer.
- To understand the data link layer functionality and media access.
- To understand the internet protocols and analyze routing algorithms.
- To understand the function of transport layer protocols.
- To understand the working of various application layer protocols.

UNIT I (12 Hrs)

INTRODUCTION AND PHYSICAL LAYER: Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II (12 Hrs)

DATA LINK LAYER AND MEDIA ACCESS: Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

UNIT III (12 Hrs)

NETWORK LAYER: Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT IV (12 Hrs)

TRANSPORT LAYER: Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

UNIT V (12 Hrs)

APPLICATION LAYER: WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition TMH, 2013.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.
4. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.

References:

1. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
2. James F. Kurose and Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2013.

ONLINE/NPTEL Courses:

Data Communication and Computer network: https://nptel.ac.in/courses/106105082

ITM04 INFORMATION SYSTEMS AND ORGANIZATION

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the concepts of information systems and organization, importance of decision making and concepts of Management Information System(MIS).

Course Outcomes:

- To understand the concepts of information systems and organization.
- To understand the importance of decision making.
- To understand the fundamental concepts MIS.
- To impart the knowledge of MIS.
- To understand the security issues of MIS.

UNIT I (12 Hrs)

CONCEPTUAL FOUNDATIONS: Introduction to Basic Systems Concepts-Elements of System- Characteristics of System-Types of Systems- System Approach to Problem Solving - Information Systems: Definition and Characteristics-Types of Information Role of Information in Decision Making.

UNIT II (12 Hrs)

DECISION MAKING: Simon's Model of Decision Making- Concepts of Management Organization and Hierarchy of Management Activity- Structured Vs Unstructured Decisions- Formal Vs Informal Systems- Levels of Management - Kinds of Information Systems.

UNIT III (12 Hrs)

MANAGEMENT INFORMATION SYSTEM: Definition and Characteristics- History of MIS Components of MIS-Frame Work for Understanding MIS-Hardware Support for MIS- Structure of Management Information System.

UNIT IV (12 Hrs)

DEVELOPING INFORMATION SYSTEMS: Analysis and Design of Information Systems: Evaluation- Pitfalls in MIS Development. Functional MIS: A Study of Marketing- Personnel- Financial and Production MIS.

UNIT V (12 Hrs)

SECURITY AND ETHICAL ISSUES: Introduction- Control Issues in Management Information Systems- Security Hazards- Ethical Issues - Technical Solutions for Privacy Protection.

Text Books:

1. C. Laudon Kenneth and P. Laudon Jane, "Management Information System", Pearson Education; 5th Edition, 2018.
2. James A. O'Brien, George M. Marakas and Ramesh Behl, "Management Information Systems", McGraw Hill Education, 10th Edition, 2017.
3. Parminder Kaur Seema Gupta, "Principles of Management Information System", Mewar University Press, 1st Edition, 2015.

ONLINE/NPTEL Courses:

Information System and and Organization: https://nptel.ac.in/courses/122105022

ITM05 IOT AND PYTHON PROGRAMMING

L	T	P	C
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Course Objectives:

- This course helps to familiarize with Internet of Things(IoT) applications, protocol standardization for IoT, basics of python and advanced constructs.

Course Outcomes:

- To understand the fundamental requirements, architecture of IoT and middleware for IoT.
- To understand the need for IoT protocol standards and applications.
- To understand the concept of web of things.
- To understand the basic python programming concepts.
- To understand the compound data using python lists, tuples, dictionaries, files and exception.

UNIT I (12 Hrs)

INTRODUCTION TO IOT: Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.

UNIT II (12 Hrs)

IOT PROTOCOLS AND APPLICATIONS: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture - Applications - Smart Grid – Electrical Vehicle Charging.

UNIT III (12 Hrs)

WEB of THINGS: Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence - Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems - The Cloud of Things Architecture.

UNIT IV (12 Hrs)

INTRODUCTION TO PYTHON: Data types- variables, expressions, statements, tuple assignment, precedence of operators - Conditionals - Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else) - Iteration - state, while, for, break, continue, pass - Fruitful functions - return values, parameters, local and global scope, function composition, recursion - Strings - string slices, immutability, string functions and methods, string module; Lists as arrays.

UNIT V (12 Hrs)

ADVANCED CONSTRUCTS: Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters - Tuples - tuple assignment, tuple as return value - Dictionaries - operations and methods - advanced list processing - list comprehension; Files and exception - text files, reading and writing files, format operator - command line arguments, errors and exceptions, handling exceptions, modules, packages.

Text Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Dieter Uckelmann and Mark Harrison, " Architecting the Internet of Things", Florian Michahelles- (Eds.), Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.

Text Books:

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
2. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

ONLINE/NPTEL Courses:

IoT and Python Programming: https://onlinecourses.nptel.ac.in/noc20_cs22

PROFESSIONAL ELECTIVES

VERTICAL 1 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

ITPE001 EXPLORATORY DATA ANALYSIS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Python programming

Course Objectives:

- To understand the concept of exploratory data analysis. To apply univariate & bivariate data exploration and analysis.

Course Outcomes:

- To understand the fundamentals of exploratory data analysis.
- To implement the data visualization using Matplotlib.
- To apply univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use data exploration and visualization techniques for multivariate and time series data.

UNIT I (9 Hrs)

EXPLORATORY DATA ANALYSIS: EDA fundamentals - Understanding data science - Significance of EDA - Making sense of data - Comparing EDA with classical and Bayesian analysis - Software tools for EDA - Visual Aids for EDA - Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II (9 Hrs)

EDA USING PYTHON: Data Manipulation using Pandas - Pandas Objects - Data Indexing and Selection - Operating on Data - Handling Missing Data - Hierarchical Indexing - Combining datasets - Concat, Append, Merge and Join - Aggregation and grouping - Pivot Tables - Vectorized String Operations.

UNIT III (9 Hrs)

UNIVARIATE ANALYSIS: Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing - Inequality.

UNIT IV (9 Hrs)

BIVARIATE ANALYSIS: Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.

UNIT V (9 Hrs)

MULTIVARIATE AND TIME SERIES ANALYSIS: Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Fundamentals of TSA - Characteristics of time series data - Data Cleaning - Time-based indexing - Visualizing - Grouping - Resampling.

LIST OF EXPERIMENTS

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Working with Pandas data frames.
3. To build basic plots using Matplotlib.
4. Perform Time Series Analysis and apply the various visualization techniques.
5. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
6. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
7. Perform EDA on open source Data Set.
8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

Text Books:

1. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", O Reilly, 1st Edition, 2017.
3. Catherine Marsh and Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.

References:

1. Eric Pimpler, "Data Visualization and Exploration with R", GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, and Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", CRC press, 2nd Edition, 2015.

ITPE002 ARTIFICIAL NEURAL NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Artificial Intelligence

Course Objectives:

- To understand the basics of artificial neural networks and provide knowledge on supervised and unsupervised learning using neural networks. To learn attractor neural networks and self-organization Feature Map.

Course Outcomes:

- To understand role of neural networks in engineering, artificial intelligence, and cognitive modeling.
- To understand the concepts and techniques of neural networks through the study of the most important neural network models.
- To understand support vector machines and radial basis function.
- To understand Attractor neural network.
- To apply neural networks to particular applications.

UNIT I (9 Hrs)

INTRODUCTI0N: Biological Neuron - Artificial Neural Model - Types of activation functions - Architecture: Feed forward and Feedback - Convex Sets - Convex Hull and Linear Separability - Non-Linear Separable Problem. XOR Problem - Multilayer Networks. **Learning:** Learning Algorithms - Error correction and Gradient Descent Rules - Learning objective of TLNs - Perceptron Learning Algorithm - Perceptron Convergence Theorem.

UNIT II (9 Hrs)

SUPERVISED LEARNING: Perceptron learning and Non Separable sets - -Least Mean Square Learning - MSE Error surface, Steepest Descent Search - μ-LMS approximate to gradient descent - Application of LMS to Noise Cancelling - Multi-layered Network Architecture - Back propagation Learning Algorithm - Practical consideration of BP algorithm.

UNIT III (9 Hrs)

SUPPORT VECTOR MACHINES AND RADIAL BASIS FUNCTION: Learning from Examples - Statistical Learning Theory - Support Vector Machines - SVM application to Image Classification - Radial Basis Function Regularization theory - Generalized RBF Networks - Learning in RBFNs - RBF application to face recognition.

UNIT IV (9 Hrs)

ATTRACTOR NEURAL NETWORKS: Associative Learning Attractor Associative Memory - Linear Associative memory - Hopfield Network - application of Hopfield Network - Brain State in a Box neural Network - Simulated Annealing - Boltzmann Machine - Bidirectional Associative Memory.

UNIT V (9 Hrs)

SELF-ORGANIZATION FEATURE MAP: Maximal Eigenvector Filtering - Extracting Principal Components Generalized Learning Lawsm - Vector Quantization Self-organization FeatureMaps - Application of SOM - Growing Neural Gas.

LIST OF EXPERIMENTS

1. Solving XOR problem using Multilayer perceptron.
2. Implement character and Digit Recognition using ANN.
3. Implement simple vector addition in TensorFlow.
4. Implement the SVM application to image classification.
5. Implement a perceptron in TensorFlow/Keras Environment.
6. Implement a Feed-Forward Network in TensorFlow/Keras.
7. Implement RBF application for face recognision.
8. Program to calculate output in a multi-layer feed forward network.

Text Books:

1. Satish Kumar, “Neural Networks A Classroom Approach”, McGraw Hill Education (India) Pvt. Ltd, 2010.

References:

1. J.M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publications, 1994.
2. B. Yegnanaray, “Artificial Neural Networks”, PHI, New Delhi, 2004.

ONLINE/NPTEL Courses:

1. https://nptel.ac.in/courses/117105084
2. Fuzzy Logic and Neural Networks : https://nptel.ac.in/courses/127105006
3. Neural Networks for Signal Processing :https://nptel.ac.in/courses/108108148

ITPE003 MACHINE LEARNING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Artificial Intelligence, Python Programming.

Course Objectives:

- To understand the basic concepts of machine learning, probability theory, supervised & unsupervised learning techniques, probabilistic graphical models and advanced machine learning techniques.

Course Outcomes:

- To elucidate the basic concepts of machine learning and probability theory.
- To use supervised learning techniques for different types of applications.
- To design and implement unsupervised learning algorithms.
- To apply appropriate graph models for any real time application.
- To explain advanced learning techniques.

UNIT I (9 Hrs)

INTRODUCTION: Machine Learning - Types of Machine Learning - Basic Concepts of Machine Learning - Machine Learning Process - Weight Space - Testing Machine Learning Algorithms - Turning Data into Probabilitie - The Bias-Variance Trade off - Concept Learning and General-to-Specific Ordering.

UNIT II (9 Hrs)

SUPERVISED LEARNING : Linear Discriminants - Perceptron - Linear Separability - Linear Regression - Multi Layer Perceptron - Going Forward - Going Backward - Support Vector Machine Algorithm - Decision Tree Learning - Random Forest Model.

UNIT III (9 Hrs)

UNSUPERVISED LEARNING : K-means Algorithm, Hierarchical clustering - EM algorithm - Dimensionality Reduction Techniques - Vector Quantization - Self Organising Feature Map.

UNIT IV (9 Hrs)

GRAPHICAL MODELS : Bayesian Networks - Conditional Independence - Markov Random Fields - Naive Bayes Classifier - Hidden Markov Model - Tracking Methods.

UNIT V (9 Hrs)

ADVANCED LEARNING : Reinforcement Learning - The Learning Task - Q Learning - Temporal Difference Learning - Generalization - Relationship to Dynamic Programming - Ensemble Learning - Boosting - Bagging - Deep Learning. Case studies on Machine learning.

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. 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.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets
5. Write a program to implement the na¨ıve Bayesian classifier for a sample training data set stored as a .CSV file.
6. Assuming a set of documents that need to be classified, use the na¨ıve 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.
7. 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. You can use Java/Python ML library classes/API
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

Text Books:

1. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman & Hall, 2nd Edition, 2014.
2. Chapman ,"Machine Learning and Pattern Recognition Series", 2014.
3. Tom M Mitchell, "Machine Learning", McGraw Hill Education, 1st Edition, 2013.

References:

1. Ethem Alpaydin, "Introduction to Machine Learning 3E (Adaptive Computation and Machine Learning Series)", MIT Press, 3rd Edition, 2014.
2. Miroslav Kubat, "An Introduction to Machine Learning", Springer Publications, 2nd Edition, 2017.
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 1st Edition, 2012.
4. Jason Bell, "Machine learning–Hands on for Developers and Technical Professionals", Wiley, 1st Edition, 2014.

ONLINE/NPTEL Courses:

1. Machine Learning : https://nptel.ac.in/courses/106105152

ITPE004 DEEP LEARNING TECHNIQUES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Machine Learning

Course Objectives:

- To understand the basics of Neural Network, Convolutional Neural Networks, Recurrent Neural Network, Boltzmann Machine Spin Glass Model and Deep Belief Networks.To learn various applications of Deep Learning.

Course Outcomes:

- To discuss the basics of Neural Network and its types.
- To describe Convolutional Neural Networks and its architecture.
- To implement Recurrent Neural Network.
- To describe the Boltzmann Machine and Deep Belief Networks.
- To apply Deep Learning Techniques.

UNIT I (9 Hrs)

INTRODUCTION TO NEURAL NETWORK(NN): Introduction to NN - Neural Networks and types - Gradient descent - Training Neural Networks - Backpropagation - Deep Learning With Pytorch.

UNIT II (9 Hrs)

CONVOLUTIONAL NEURAL NETWORK(CNN): Convolutional Neural Network - CNNs Architectures - Weight Initialization - Autoencoders - Transfer Learning in PyTorch - Deep Learning for Cancer Detection.

UNIT III (9 Hrs)

RECURRENT NEURAL NETWORK(RNN): Recurrent Neural Network - Long & Short-Term Memory Network - Implementation of RNN & LSTM - Hyperparameters - Embeddings & Word2vec - Sentiment Prediction RNN.

UNIT IV (9 Hrs)

BOLTZMANN MACHINES: Introduction to Boltzmann Machine - Energy-Based Models - Restricted Boltzmann Machine - Contrastive Divergence - Deep Belief Networks - Deep Boltzmann Machine.

UNIT V (9 Hrs)

DEEP LEARNING APPLICATIONS: Image Processing - Natural Language Processing - Speech Recognition - Video Analytics.

LIST OF EXPERIMENTS

1. Implement the analysis of X-ray image using auto encoders.
2. Develop a code to design object detection and classification for traffic analysis using CNN.
3. Implement Sentiment Analysis using LSTM.
4. Implement online fraud detection of share market data using any one of the data analytics tools.
5. Implement RNN for video processing.
6. Implement Image classification using CNN.

Text Books:

1. 1.Aston Zhang, Zack C. Lipton, Mu Li and Alex J. Smola, “Dive into Deep Learning”, Amazon Science, 2018.
2. Ian J. Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, MIT Press, 2017.
3. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.

References:

1. Ragav Venkatesan and Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018.
2. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
3. Joshua F. Wiley, “R Deep Learning Essentials”, Packt Publications, 2016.

ONLINE/NPTEL Courses:

1. Deep Learning: https://nptel.ac.in/courses/106105215

ITPE005 NATURAL LANGUAGE PROCESSING

L	T	P	C
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Course Pre-requisite:

- Artificial Intelligence, Machine Learning

Course Objectives:

- To learn the fundamentals of natural language processing, the use of CFG & PCFG in NLP, the role of semantics of sentences and pragmatics. To apply the NLP techniques.

Course Outcomes:

- To tag a given text with basic Language features.
- To design an innovative application using NLP components.
- To implement a rule based system to tackle morphology/syntax of a language.
- To design a tag set to be used for statistical processing for real-time applications.
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I (9 Hrs)

INTRODUCTION: Origins and challenges of NLP - Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata - English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II (9 Hrs)

WORD LEVEL ANALYSIS Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff - Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging - Hidden Markov and Maximum Entropy models.

UNIT III (9 Hrs)

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar - Dependency Grammar - Syntactic Parsing, Ambiguity, Dynamic Programming parsing, Shallow parsing, Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV (9 Hrs)

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics - Syntax-Driven Semantic analysis, Semantic attachments - Word Senses, Relations between Senses, Thematic Roles, selectional restrictions - Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods - Word Similarity using Thesaurus and Distributional methods.

UNIT V (9 Hrs)

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

LIST OF EXPERIMENTS

1. Implement Speech recognision for NLP.
2. Implement word analysis and word generation.
3. Create Regular expressions in Python for detecting word patterns and tokenizing text
4. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
5. Accessing Text Corpora using NLTK in Python
6. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
7. Implement the Word2Vec model
8. Use a transformer for implementing classification
9. Design a chatbot with a simple dialog system
10. Convert text to speech and find accuracy

Text Books:

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

References:

1. Gros, Jones and Webber, "Readings in Natural Language Processing", MorganKonfmann publishers, 1986.
2. Popov, "Talking with computers in Natural Language", Springer Verlag, 1986.
3. E.Reiter and Robert Date, "Building Natural Language Generation Systems", Cambridge University Press, 2000.

ONLINE/NPTEL Courses:

1. Natural Language Processing: https://nptel.ac.in/courses/106105158

VERTICAL 2 FULL STACK DEVELOPMENT

ITPE006 FULL STACK WEB DEVELOPMENT

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Course Pre-requisite:

- Web Technology.

Course Objectives:

- To understand the concept of full stack web development and Node.js. To familiarize with MongoDB and develop simple web applications using React.

Course Outcomes:

- To understand the various stacks available for web application development.
- To use Node.js for application development.
- To develop applications with MongoDB.
- To use the features of Angular and Express.
- To develop React applications.

UNIT I (9 Hrs)

BASICS OF FULL STACK: Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React.

UNIT II (9 Hrs)

NODE JS: Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js.

UNIT III (9 Hrs)

MONGO DB: Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Ac- cess control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications.

UNIT IV (9 Hrs)

EXPRESS AND ANGULAR: Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives.

UNIT V (9 Hrs)

REACT: MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering.

LIST OF EXPERIMENTS

1. Develop a portfolio website for yourself which gives details about yourself for a potential recruiter.
2. Create a web application to manage the TO-DO list of users, where users can login and manage their to-do items
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4. Create a food delivery website where users can order food from a particular restaurant listed in the website.
5. Develop a classifieds web application to buy and sell used products.
6. Develop a leave management system for an organization where users can apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, InProgress or Completed.
8. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.

Text Books:

1. Brad Dayley, Brendan Dayley and Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Addison-Wesley, 2nd Edition, 2018
2. Vasan Subramanian, "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node", A"press, 2nd Edition, 2019.

References:

1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress, 1st Edition, 2018.
2. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, 2nd Edition, 2018.

ITPE007 DevOps

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering, Agile Methodologies

Course Objectives:

- To understand the agile development environment, the need for Minimum viable product led development using Sprints, the fundamental knowledge of CI/CD and CAMS and various aspects of DevOps Ecosystem.

Course Outcomes:

- To learn traditional software development methodologies like waterfall.
- To apply the Agile Methodology and comparing various other software development models with agile.
- To understand implementing Continuous Integration and Continuous Delivery.
- To create quick MVP prototypes for modules and functionalities.
- To understand CAMS (Culture, Automation, Measurement and Sharing) for DevOps.

UNIT I (9 Hrs)

TRADITIONAL SOFTWARE DEVELOPMENT: The Advent of Software Engineering - Software Process, Perspective and Specialized Process Models – Software Project Management: Estimation - Developers vs IT Operations conflict.

UNIT II (9 Hrs)

RISE OF AGILE METHODOLOGIES: Agile movement in 2000 - Agile Vs Waterfall Method - Iterative Agile Software Development - Individualand team interactions over processes and tools - Working software over comprehensive documentation - Customer collaboration over contract negotiation - Responding to change over following a plan.

UNIT III (9 Hrs)

INTRODUCTION DEVOPS: Introduction to DevOps - Version control - Automated testing - Continuous integration - Continuousdelivery - Deployment pipeline - Infrastructure management – Databases.

UNIT IV (9 Hrs)

PURPOSE OF DEVOPS: Minimum Viable Product- Application Deployment- Continuous Integration- Continuous Delivery.

UNIT V (9 Hrs)

CAMS (CULTURE, AUTOMATION, MEASUREMENT AND SHARING): CAMS – Culture, CAMS – Automation, CAMS – Measurement, CAMS – Sharing, Test-Driven Development, Configuration Management-Infrastructure Automation- Root Cause Analysis- Blamelessness- Organizational Learning.

LIST OF EXPERIMENTS

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud
4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle
8. Install Ansible and configure ansible roles and to write playbooks

Text Books:

1. GrigGheorghiu, Alfredo Deza, Kennedy Behrman and Noah Gift, "Python for DevOps", 2019.
2. Len Bass, Ingo Weber and Liming Zhu, "DevOps - A Software Architect's Perspective", Pearson Education, 2015.

References:

1. Deepak Gaikwad and Viral Thakkar, "DevOps Tools: from practioner's point of view", Wiley, 1st Edition, 2019.
2. Gene Kim, Jez Humble, Patrick Debois, and Willis, "The DevOps Handbook", IT Revolution Press, 2016.
3. JoakimVerona, "Practical DevOps", O'Reilly, 2016.

ITPE008 UI AND UX DESIGN

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Knowledge in user interface design

Course Objectives:

- To provide a sound knowledge in UI & UX, to understand the need for UI & UX and the various Research Methods used in Design.
- To explore the various Tools used in UI & UX and Creating a wireframe and prototype.

Course Outcomes:

- To build UI for user Applications.
- To evaluate UX design of any product or application.
- To demonstrate UX Skills in product development.
- To implement Sketching principles.
- To create Wireframe and Prototype.

UNIT I (9 Hrs)

FOUNDATIONS OF DESIGN: UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II (9 Hrs)

FOUNDATIONS OF UI DESIGN: Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

UNIT III (9 Hrs)

FOUNDATIONS OF UX DESIGN: Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV (9 Hrs)

WIREFRAMING, PROTOTYPING AND TESTING: Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods -Synthesizing Test Findings - Prototype Iteration.

UNIT V (9 Hrs)

RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE: Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

LIST OF EXPERIMENTS

1. Designing a Responsive layout for an societal application.
2. Exploring various UI Interaction Patterns.
3. Developing an interface with proper UI Style Guides.
4. Developing Wireflow diagram for application using open source software.
5. Exploring various open source collaborative interface Platform.
6. Hands on Design Thinking Process for a new product.
7. Brainstorming feature for proposed product.
8. Defining the Look and Feel of the new Project.
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles).
10. Identify a customer problem to solve.
11. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping.
12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.

Text Books:

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", O'Reilly, 2021.

References:

1. Jenifer Tidwell, Charles Brewer and Aynne Valencia, "Designing Interface", 3rd Edition, O'Reilly, 2020.
2. Steve Schoger and Adam Wathan, "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", 3rd Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature

ONLINE/NPTEL Courses:

1. UI & UX Design https://onlinecourses.nptel.ac.in/noc21 ar05
2. User Inteface Designhttps://archive.nptel.ac.in/courses/124/107/124107008/

ITPE009 SOFTWARE TESTING AND AUTOMATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering

Course Objectives:

- To understand the basics of software testing, testing and planning, build test cases and execute.To learn advanced testing concepts and tools used for test automation.

Course Outcomes:

- To understand the basic concepts of software testing and the need for software testing.
- To design Test planning and different activities involved in test planning.
- To design effective test cases that can uncover critical defects in the application.
- To carry out advanced types of testing.
- To automate the software testing using Selenium and TestNG.

UNIT I (9 Hrs)

FOUNDATIONS OF SOFTWARE TESTING: Why do we test Software? - Black-Box Testing and White-Box Testing - Software Testing Life Cycle - V-model of Software Testing - Program Correctness and Verification - Reliability versus Safety - Failures, Errors and Faults (Defects) - Software Testing Principles - Program Inspections - Stages of Testing: Unit Testing, Integration Testing, System Testing.

UNIT II (9 Hrs)

TEST PLANNING: The Goal of Test Planning - High Level Expectations - Intergroup Responsibilities - Test Phases - Test Strategy - Resource Requirements - Tester Assignments - Test Schedule - Test Cases - Bug Reporting - Metrics and Statistics.

UNIT III (9 Hrs)

TEST DESIGN AND EXECUTION: Test Objective Identification - Test Design Factors - Requirement identification - Testable Requirements - Modeling a Test Design Process - Modeling Test Results - Boundary Value Testing - Equivalence Class Testing - Path Testing - Data Flow Testing - Test Design Preparedness Metrics - Test Case Design Effectiveness - Model-Driven Test Design - Test Procedures - Test Case Organization and Tracking - Bug Reporting - Bug Life Cycle.

UNIT IV (9 Hrs)

ADVANCED TESTING CONCEPTS: Performance Testing: Load Testing - Stress Testing - Volume Testing - Fail-Over Testing - Recovery Testing - Configuration Testing - Compatibility Testing, Usability Testing - Testing the Documentation, Security testing - Testing in the Agile Environment - Testing Web and Mobile Applications.

UNIT V (9 Hrs)

TEST AUTOMATION AND TOOLS: Automated Software Testing - Automate Testing of Web Applications - Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events - Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

LIST OF EXPERIMENTS

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application.
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.
9. Mini Project:
   (a) Build a data-driven framework using Selenium and TestNG.
   (b) Build Page object Model using Selenium and TestNG.
   (c) Build BDD framework with Selenium, TestNG and Cucumber.

Text Books:

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
2. Unmesh Gundecha and Satya Avasarala, "Selenium WebDriver 3 Practical Guide", 2nd Edition, 2018.

References:

1. Glenford J. Myers, Corey Sandler and Tom Badgett, "The Art of Software Testing", John Wiley & Sons, Inc., 3rd Edition, 2012.
2. Ron Patton, "Software testing", Sams Publishing, 2nd Edition, 2006.
3. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Taylor& Francis Group, 4th Edition, 2014.
4. Carl Cocchiaro, "Selenium Framework Design in Data-Driven Testing", PacktPublishing, 2018.
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, "Implementing Automated Software Testing", Pearson Education, Inc., 2009.
6. Satya Avasarala, "Selenium WebDriver Practical Guide",Packt Publishing, 2014.
7. Varun Menon, "TestNg Beginner's Guide", Packt Publishing, 2013.

ONLINE/NPTEL Courses:

1. Software Testing: https://nptel.ac.in/courses/106101163

ITPE010 ROBOTIC PROCESS AUTOMATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering, Programming Skills

Course Objectives:

- To familiarize about the basic concepts of Robotic Process Automation and to expose to the key RPA design and development strategies and methodologies. They should learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA and to deploy and Maintain the software bot.

Course Outcomes:

- To enunciate the key distinctions between RPA and existing automation techniques and platforms.
- To use UiPath to design control flows and work flows for the target process.
- To implement recording, web scraping andprocess mining by automation.
- To use uiPath Studio to detect, and handle exceptions in automation processes.
- To use and implement Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

UNIT I (9 Hrs)

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Emergence of Robotic Process Automation (RPA) - Evolution of RPA - Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II (9 Hrs)

AUTOMATION PROCESS ACTIVITIES: Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events.

UNIT III (9 Hrs)

APP INTEGRATION, RECORDING AND SCRAPING: App Integration - Recording - Scraping - Selector - Workflow Activities. Recording mouse and keyboard actions to perform operation - Scraping data from website and writing to CSV. Process Mining.

UNIT IV (9 Hrs)

EXCEPTION HANDLING AND CODE MANAGEMENT: Exception handling - Common exceptions - Logging-Debugging techniques - Collecting crash dumps - Error reporting. Code management and maintenance: Project organization - Nesting workflows - Reusability - Templates - Commenting techniques - State Machine.

UNIT V (9 Hrs)

DEPLOYMENT AND MAINTENANCE: Publishing using publish utility - Orchestration Server - Control bots - Orchestration Server to deploy bots - License management - Publishing and managing updates. RPA Vendors - Open Source RPA - Future of RPA.

LIST OF EXPERIMENTS

Setup and Configure a RPA tool and understand the user interface of the tool:

1. Create a Sequence to obtain user inputs display them using a message box.
2. Create a Flowchart to navigate to a desired page based on a condition;
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments.
6. Also implement Automation using System Trigger
7. Automate login to (web)Email account.
8. Recording mouse and keyboard actions.
9. Scraping data from website and writing to CSV
10. Implement Error Handling in RPA platform.
11. Web Scraping.
12. Email Query Processing.

Text Books:

1. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool", UiPath, Packt Publishing, 2018.
2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

References:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author) and Lauren Livingston (Author), "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, "Robotic Process Automation: Guide To Building Software Robots", Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide", 2020.

VERTICAL 3 DATA CENTER TECHNOLOGY

ITPE011 DATA MINING AND WAREHOUSING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System

Course Objectives:

- To learn the concepts of data mining, warehousing, the tools & techniques used for mining, classification and cluster analysis.

Course Outcomes:

- To understand the insight concepts of data mining.
- To understand multidimensional data and data warehouse.
- To able to clean and pre-process data and Query with multidimensional data.
- To apply various data mining techniques for projects.
- To apply web mining for real-time projects.

UNIT I (9 Hrs)

INTRODUCTION TO DATA MINING: Definition of data mining - data mining vs query tools - machine learning - taxonomy of data mining tasks - steps in data mining process - overview of data mining techniques.

UNIT II (9 Hrs)

DATA WAREHOUSING: Definition - Multidimensional Data Model - Data Cube - Dimension Modelling - OLAP Operations - Warehouse Schema - Data Warehouse Architecture - Data Mart, Meta Data, Types of Meta Data - Data Warehouse Backend Process –Development Life Cycle.

UNIT III (9 Hrs)

DATA CLEANING AND PRE-PROCESSING: Data Cleaning - Pre-Processing techniques - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation - Query Language - Generalization - Summarization.

UNIT IV (9 Hrs)

ASSOCIATION RULE AND CLASSIFICATION: Association Rule - Mining Multi-Dimensional data from Transactional Database and Relational Database. Classification, Decision Tree Induction - Bayesian Classification - Prediction - Back Propagation.

UNIT V (9 Hrs)

CLUSTER ANALYSIS: Cluster Analysis - Types of Clustering-Hierarchical Method - Partitioning methods - Density Based Method - Grid Based Method - Outlier Analysis. Advanced topics: Web Mining - Difference between data mining and Web Mining - Web Content Mining - Structure and Usage Mining - Spatial Mining - Sequence Mining. Applications : Case studies in Data Mining and web mining applications.

LIST OF EXPERIMENTS

1. Implement the Bayes classification techniques.
2. Implement web mining.
3. Implement Text mining.
4. Write the query for schema definition.
5. Design data ware house for real time applications.
6. Analyse the dimensional Modeling.
7. Case study using OLAP and OTLP.
8. Implementation of warehouse testing.

Text Books:

1. Paulraj Ponnaiah, "Data Warehousing Fundamentals", Wiley Publishers, 2001.
2. Jiawei Han and MichelineKamber, "Data Mining: Concepts and Techniques", Morgan Kaufman Publishers, 2011.
3. Hand, Mannila and Smyth, "Principles of Data Mining", Prentice Hall of India, New Delhi 2009.

References:

1. UsamaM.Fayyad, Gregory Piatetsky Shapiro, Padhrai Smyth and RamasamyUthurusamy, "Advances in Knowledge Discover and Data Mining", TheM.I.T.Press, 2012.
2. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit", John Wiley and Sons Inc., 3rd Edition, 2019.
3. Alex Berson, Stephen Smith and Kurt Thearling, "Building Data Mining Applications for CRM", Tata McGraw Hill, 2009.
4. Daniel T. Larose and Hoboken, "Discovering Knowledge in Data: An Introduction to Data mining", John Wiley & Sons, New Jersey 2005.
5. Dunham, "Data Mining- Introductory and Advanced Topics", Pearson Education, New Delhi, 3rd Impression, 2008.
6. Sean Kelly, "Data warehousing in action", John wiley & sons, reprint 2008.
7. Sam Anahory and Dennis Murrary, "Data warehousing in the real world", Addition Wesley, 4th Impression, 2009.

ITPE012 STORAGE TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Pre-Requsite:

- Database Management System, Cloud Computing

Course Objectives:

- To understand and assess the functionalities of logical and physical components of storage, various storage networking technologies, identify different storage virtualization technologies. To discuss the different backup and recovery strategies and storage management activities and solutions.

Course Outcomes:

- To demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.
- To illustrate the usage of advanced intelligent storage systems and RAID.
- To interpret various storage networking architectures - SAN, including storage subsystems and virtualization.
- To examine the different role in providing disaster recovery and remote replication technologies.
- To infer the security needs and security measures to be employed in information storage management.

UNIT I (9 Hrs)

STORAGE SYSTEMS: Introduction to Information Storage: Digital data and its types - Information storage - Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics - Cloud services and cloud deployment models - Big data analytics - Social networking and mobile computing - Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center - Compute systems and compute virtualization and Software-defined data center.

UNIT II (9 Hrs)

INTELLIGENT STORAGE SYSTEMS AND RAID: Components of an intelligent storage system - Components, addressing, and performance of hard disk drives and solid-state drives - RAID - Types of intelligent storage systems - Scale-up and scaleout storage Architecture.

UNIT III (9 Hrs)

STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION: Block-Based Storage System - File-Based Storage System - Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking - FC SAN components and architecture - FC SAN topologies - link aggregation and zoning - Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV (9 Hrs)

BACKUP, ARCHIVE AND REPLICATION: Introduction to Business Continuity - Backup architecture - Backup targets and methods - Data deduplication - Cloud-based and mobile device backup - Data archive - Uses of replication and its characteristics - Compute based, storage-based and network-based replication - Data migration - Disaster Recovery as a Service (DRaaS).

UNIT V (9 Hrs)

SECURING STORAGE INFRASTRUCTURE: Information security goals - Storage security domains - Threats to a storage infrastructure - Security controls to protect a storage infrastructure - Governance, risk, and compliance - Storage infrastructure management functions - Storage infrastructure management processes.

Text Books:

1. Wiley, "Information Storage and Management", EMC Corporation, India 2009.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, "Introduction to Storage Area Networks", IBM - Redbooks, 9th Edition, December 2017.
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka and Nils Haustein, "Storage Networks Explained", Wiley, 2nd Edition, 2009.

ITPE013 VIRTUALIZATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Operating Systems, Cloud Computing

Course Objectives:

- To learn the fundamentals and various forms of virtualization and to test the virtualization platforms.

Course Outcomes:

- To analyse the virtualization concepts and Hypervisor.
- To understand types of virtual machine and server& desktop virtualization concepts.
- To install & configure the different VM platforms.
- To understand the concept of storage virtualization and its types.
- To apply the virtualization for real-world applications.

UNIT I (9 Hrs)

INTRODUCTION TO VIRTUALIZATION: Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors.

UNIT II (9 Hrs)

SERVER AND DESKTOP VIRTUALIZATION: Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.

UNIT III (9 Hrs)

NETWORK VIRTUALIZATION: Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization - VLAN-WAN Architecture-WAN Virtualization.

UNIT IV (9 Hrs)

STORAGE VIRTUALIZATION: Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.

UNIT V (9 Hrs)

VIRTUALIZATION TOOLS: VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM-Google Virtualization- Case study.

LIST OF EXPERIMENTS

1. Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2. a.Shrink and extend virtual disk b. Create, Manage, Configure and schedule snapshots c. Create Spanned, Mirrored and Striped volume d. Create RAID 5 volume
3. a.Desktop Virtualization using VNC b.Desktop Virtualization using Chrome Remote Desktop
4. Create type 2 virtualization on ESXI 6.5 server
5. Create a VLAN in CISCO packet tracer
6. Install KVM in Linux
7. Create Nested Virtual Machine(VM under another VM)

Text Books:

1. Anthony T.Velte and Toby J. Velte Robert Elsenpeter, "Cloud computing a practical approach", TATA McGraw-Hill, New Delhi 2010.
2. Rajkumar Buyya, James Broberg and Andrzej Goscinski, "Cloud Computing (Principles and Paradigms)", John Wiley & Sons, Inc., 2011.
3. David Marshall and Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach, 2011.
4. Chris Wolf and Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.

References:

1. James E. Smith and Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. David Marshall and Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

ITPE014 CLOUD SERVICES MANAGEMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Cloud Computing

Course Objectives:

- To understand the fundamental of Cloud Service Management and strategy.To familiariaze with cloud service economic, cloud service governance and value.

Course Outcomes:

- To exhibit cloud-design skills to build and automate business solutions using cloud technologies.
- To understand the cloud service strategy.
- To understand the cloud service reference model, lifecycle and operation management.
- To understand about cloud service economic and cloud cost models.
- To understand cloud governance and measure the value of cloud services.

UNIT I (9 Hrs)

CLOUD SERVICE MANAGEMENT FUNDAMENTALS: Cloud Ecosystem - The Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models.

UNIT II (9 Hrs)

CLOUD SERVICES STRATEGY: Cloud Strategy Fundamentals - Cloud Strategy Management Framework - Cloud Policy - Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching - Demand Queueing - Change Management - Cloud Service Architecture.

UNIT III (9 Hrs)

CLOUD SERVICE MANAGEMENT: Cloud Service Reference Model - Cloud Service LifeCycle - Basics of Cloud Service Design - Dealing with Legacy Systems and Services - Benchmarking of Cloud Services - Cloud Service Capacity Planning - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.

UNIT IV (9 Hrs)

CLOUD SERVICE ECONOMICS: Pricing models for Cloud Services - Freemium, Pay Per Reservation, Pay per User, Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models.

UNIT V (9 Hrs)

CLOUD SERVICE GOVERNANCE & VALUE: IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Consideration - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.

LIST OF EXPERIMENTS

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Open-stack, Eucalyptus, OpenNebula with Role-based access control.
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis.
3. Create alerts for usage of Cloud resources.
4. Create Billing alerts for your Cloud Organization.
5. Compare Cloud cost for a simple web application across AWS, Azure and GCP andsuggest the best one.

Text Books:

1. Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020.
2. Thomas Erl, Ricardo Puttini and Zaigham Mohammad, "Cloud Computing: Concepts, Technology & Architec-ture", 2013.
3. Thomas Erl, Robert Cope and Amin Naserpour, "Cloud Computing Design Patterns"

References:

1. Praveen Ayyappa, "Economics of Cloud Computing", LAP Lambert Academic Publishing.
2. Rajkumar Buyya, Christian Vechhiola and S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming"

ONLINE/NPTEL Courses:

1. Cloud Computing: https://onlinecourses.nptel.ac.in/noc21 cs14
2. Google Cloud Computing Foundation Course: https://nptel.ac.in/courses/106105223

ITPE015 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System, Cloud Computing

Course Objectives:

- To understand the concepts of big data, NoSQL big data management, map reduce analytics using Hadoop and related tools.

Course Outcomes:

- To describe big data and use cases from selected business domains.
- To explain NoSQL big data management.
- To install, configure, and run Hadoop and HDFS.
- To perform map-reduce analytics using Hadoop.
- To use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

UNIT I (9 Hrs)

UNDERSTANDING BIG DATA: Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II (9 Hrs)

NOSQL DATA MANAGEMENT: Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III (9 Hrs)

MAP REDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN –job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV (9 Hrs)

BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures -Cassandra – Hadoop integration.

UNIT V (9 Hrs)

HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

LIST OF EXPERIMENTS

1. Downloading and installing Hadoop; Understanding different
2. Hadoop modes. Startup scripts, Configuration files.
3. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
4. Implement of Matrix Multiplication with Hadoop Map Reduce
5. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
6. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. Practice importing and exporting data from various databases.

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage and Pramod J., "NoSQL distilled", 2013.

References:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

ONLINE/NPTEL Courses:

1. Big Data Concepts: https://onlinecourses.nptel.ac.in/noc20cs92

VERTICAL 4 CYBER SECURITY

ITPE016 CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	C
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Course Pre-requisite:

- Computer Networks

Course Objectives:

- To learn various cryptographic techniques using private and public keys algorithms. To understand wired and wireless network security algorithms.

Course Outcomes:

- To understand classical crypto system and basic number theory.
- To learn the concept of block cipher.
- To understand discrete Logarithms and various message authentication algorithms.
- To learn key management & distribution and various network security algorithms.
- To learn wireless network security concepts.

UNIT I (9 Hrs)

CLASSICAL CRYPTOSYSTEM: Security trends – Security Attacks and services – Classical Encryption Techniques — Symmetric cipher model– Basic Number theory –Pseudorandom Number Generation - Stream Ciphers - RC4.

UNIT II (9 Hrs)

SYMMETRIC CIPHER: Simple DES – DES – Modes of operation – Triple DES – AES – RSA – Attacks – Primality test – factoring.

UNIT III (9 Hrs)

ASYMMETRIC CIPHER AND DIGITAL SIGNATURE: Discrete Logarithms – Computing discrete logs – Diffie-Hellman key exchange – ElGamal Public key cryptosystems – Hash functions – Secure Hash - MD5 – Digital signatures – RSA – ElGamal Digital signature scheme.

UNIT IV (9 Hrs)

NETWORK SECURITY: Key Management and Distribution: X.509, PKI – Electronic Mail security – PGP – IP security – Web Security – SSL, TLS.

UNIT V (9 Hrs)

WIRELESS NETWORK SECURITY: Wireless Network Security- IEEE 802.11 Wireless LANs - Protocol Overview and Security - Wireless Application Protocol (WAP) - Protocol Overview – Wireless Transport Layer Security (WTLS), WAP end-to-end Security.

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) Playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation
3. Implement DES algorithm for practical applications
4. Implement AES algorithm for practical applications.
5. Implement RSA algorithm.
6. Implement the Diffie-Hellman Key Exchange algorithm.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Calculate the message digest of a text using the MD5 algorithm.
9. Implement digital signature schemes.
10. Check message integrity and confidentiality using SSL
11. Study to configure Firewall, VPN.

Text Books:

1. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI, 5th Edition, 2006.
2. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson, 2nd Edition, 2007.

References:

1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2nd Edition, 2007.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in computing", Prentice Hall of India, 3rd Edition, 2006.
3. Douglas R. Stinson, "Cryptography, theory and practice", CRS Press, 2nd Edition, 2006.

ONLINE/NPTEL Courses:

1. Modern Cryptography- https://onlinecourses.nptel.ac.in/noc22 cs03
2. Cryptography and Network Security- https://nptel.ac.in/courses/106105031

ITPE017 DATABASE AND APPLICATION SECURITY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System, Cyber Security

Course Objectives:

- To describe and apply Security Policies on Databases and understand Authentication and Password Security. To know about Application Vulnerabilities, Auditing Techniques.

Course Outcomes:

- To understand various components of database and application security.
- To understand the authentication and authorization of database.
- To explain securing database communication.
- To understand encrypting and auditing the data.
- To understand the application security and data vulnerabilities.

UNIT I (9 Hrs)

DATABASE SECURITY: Introduction to database Security – Security in Information Technology – importance of data – data review – identity theft – levels of security – Human level: Corrupt/careless user, Network/User Interface, Database application program, Database system, Operating System, Physical level.

UNIT II (9 Hrs)

AUTHENTICATION AND AUTHORIZATION: Passwords, Profiles, Privileges and Roles - Authentication – operating system authentication, database authentication, Network or third-party authentication, Database vector password policies -Authorization – User Account authorization - Database/Application Security - Limitations of SQL Authorization – Access Control in Application Layer - Oracle Virtual Private Database – Privacy.

UNIT III (9 Hrs)

SECURING DATABASE TO DATABASE COMMUNICATIONS: Monitor and limit outbound communications – secure database links – protect link usernames and passwords – monitor usage of database links – secure replication mechanisms - map and secure all data sources and sinks. Trojans – four types of database Trojans.

UNIT IV (9 Hrs)

ENCRYPTING AND AUDITING THE DATA: Encrypting data in transit – encrypting data at rest – auditing architectures – audit trail – architectures of external audit systems - archive auditing information – secure auditing information – audit the audit system.

UNIT V (9 Hrs)

APPLICATION SECURITY & VULNERABILITIES: Application Security – Application Vulnerabilities - OWASP Top 10 Web Security Vulnerabilities - Unvalidated input, Broken access control, Broken account/session management, Cross-site scripting (XSS) flaws, Buffer overflows - SQL Injection flaws, Improper error handling, Insecure storage, Denial-of service, Insecure configuration management – Insecure File Handling.

Text Books:

1. Ron Ben-Natan, "Implementing Database Security and Auditing: A Guide for DBAs, Information Security Administrators and Auditors", Published by Elsevier, 2005.
2. Silvana Castano, "Database Security", Published by Addison-Wesley, 1994.
3. Alfred Basta, Melissa Zgola, Dana Bullaboy and Thomas L. Witlock SR, "Database Security", google books, 2011.
4. Silberschatz, Korth and Sudarshan, "Database System Concepts", 6th Edition, 2010.

Website References:

1. The Open Web Application Security Project, http://www.owasp.org
2. Web application security scanners, http: // www. Window security. com / software/Web-Application-Security
3. SQL Injection, http://www.cgisecurity.com/development/sql.shtml
4. 9 ways to hack a web app, http: / / developers. sun. com / learning / javaone online/2005/webtier/TS-5935.pdf
5. Database security, http:/ /docs.oracle.com/cd / B19306_01 / server.102 / b14220/security.htm

ITPE018 DIGITAL AND MOBILE FORENSICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Databases for Digital Forensics
- Mobile Forensics
- Database Security and Forensics
- Digital Electronics

Course Objectives:

- To understand the basic concepts of digital forensics and techniques. To use forensics tools for iOS devices and Android devices.

Course Outcomes:

- To understand the basic concept of digital forensics.
- To understand digital crime and investigations.
- To explain digital forensic readiness.
- To investigate, identify and extract digital evidence from iOS devices.
- To investigate, identify and extract digital evidence from Android devices.

UNIT I (9 Hrs)

INTRODUCTION TO DIGITAL FORENSICS: Forensic Science – Digital Forensics, Digital Evidence, The Digital Forensics Process, Introduction, The Identification Phase, The Collection Phase, The Examination Phase, The Analysis Phase – The Presentation Phase

UNIT II (9 Hrs)

DIGITAL CRIME AND INVESTIGATION: Digital Crime – Substantive Criminal Law, General Conditions, Offenses, Investigation Methods for Collecting Digital Evidence, International Cooperation to Collect Digital Evidence.

UNIT III (9 Hrs)

DIGITAL FORENSIC READINESS: Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness, Rationale for Digital Forensic Readiness, Frameworks, Standards and Methodologies, Enterprise Digital Forensic Readiness, Challenges in Digital Forensics

UNIT IV (9 Hrs)

iOS FORENSICS: Mobile Hardware and Operating Systems - iOS Fundamentals, Jailbreaking, File System, Hardware, iPhone Security, iOS Forensics, Procedures and Processes,Tools, Oxygen Forensics, MobilEdit, iCloud.

UNIT V (9 Hrs)

ANDROID FORENSICS: Android basics – Key CodesADB, Rooting Android, Boot Process, File Systems, Security, Tools, Android Forensics, Forensic Procedures, ADB, Android Only Tools, Dual Use Tools, Oxygen Forensics MobilEdit, Android App Decompiling.

LIST OF EXPERIMENTS

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. Process and parse records from the iOS system.
6. Extract installed applications from Android devices.
7. Extract diagnostic information from Android devices through the adb protocol.
8. Generate a unified chronological timeline of extracted records.

Text Books:

1. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", CRC Press, 1st Edition, 2022.
2. Andre Arnes, "Digital Forensics", Wiley, 2018.

References:

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, Charles River Media, 2nd Edition, 2005, ISBN: 1-58450-389.

ONLINE/NPTEL Courses:

1. ACM Summer School in Information Security and Forensics-https://nptel.ac.in/courses/128106006

ITPE019 BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Cryptography and Network Security, Data Structures and algorithm

Course Objectives:

- The objective of this course is to cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus. To familiarize with potential applications for Bit coin-like crypto currencies.

Course Outcomes:

- To understand emerging abstract models for Block chain Technology.
- To analyse the concept of bit coin and mathematical background behind it.
- To apply the tools for understanding the background of crypto currencies.
- To identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
- To understanding of latest advances and its applications in Block Chain Technology.

UNIT I (9 Hrs)

INTRODUCTION: Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Princi- ples -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

UNIT II (9 Hrs)

CRYPTOGRAPHIC FUNDAMENTALS: Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.

UNIT III (9 Hrs)

BIT COIN: Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT IV (9 Hrs)

ETHEREUM: Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts.

UNIT V (9 Hrs)

BLOCK CHAIN APPLICATIONS: Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - advent of algorand, and Sharding based consensus algorithms.

LIST OF EXPERIMENTS

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 1st Edition, 2015.
2. Daniel Drescher, "Block Chain Basics", Apress, 1st Edition, 2017.
3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, 1st Edition, 2012.

References:

1. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing.

Website References:

1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/
2. https://docs.docker.com/get-started/https:/console.ng.bluemix.net/docs/services/block

ONLINE/NPTEL Courses:

1. Cryptocurrency and Blockchain Technologies- https://onlinecourses.nptel.ac.in/noc22 cs44
2. Blockchain Technologies- https://nptel.ac.in/courses/106104220

ITPE020 ETHICAL HACKING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Network Security & Threat Mechanisms

Course Objectives:

- To understand the ethical hacking Process and familiarize with tools and techniques of ethical hacking.

Course Outcomes:

- To understand the processes involved in ethical hacking.
- To understand the foot printing concepts and scanning networks.
- To analyse the steganography applications and detection tools.
- To analyse malware threats and developing solutions.
- To understand concepts of attacks and session hijacking.

UNIT I (9 Hrs)

Introduction to Ethical Hacking: - Types of attacks – Information Security threats, attack vectors, and controls – Information Assurance (IA) – Information Security Laws and Standards – Security Policies types, HR/legal implications – Physical Security – Threat Modelling – Enterprise Information Security Architecture (EISA) – Network Security Zoning.

UNIT II (9 Hrs)

Foot Printing & Reconnaissance: Foot printing concepts, threats, attack vectors and controls, Foot printing through Search Engines, Foot Printing through Social Networking sites, Website Foot printing, Competitive Intelligence, WHOIS Foot printing, Foot Printing tools. Scanning Networks: Scanning Methodology, techniques, and countermeasures - Techniques for IDS evasion, scanning, HTTP tunneling, and IP spoofing - Drawing network diagrams—latest network discovery and mapping tools, network discovery tools for mobile - Proxy chaining—latest proxy tools, proxy tools for mobile Enumeration: Protocols: NetBIOS, SNMP, LDAP, NTP, SMTP, DNS – Countermeasures - Techniques

UNIT III (9 Hrs)

System Hacking: Cracking passwords, escalating privileges, executing applications, hiding files and covering tracks – Steganography application and classification, tools, methods/attacks on Steganography, Steganography detection tools. Practical: Foot Printing & Reconnaissance, Scanning Networks, Enumeration, System Hacking.

UNIT IV (9 Hrs)

Malware Threats: Introduction to malware – Trojans attacks, how to infect a system, crypters, how to deploy, latest types, analysis, countermeasures - Viruses—stages, types, latest virus maker, analysis, countermeasures - Worms—types, makers, analysis, countermeasures - Malware analysis - Antivirus tools - Penetration testing.

UNIT V (9 Hrs)

Sniffing: Attacks: MAC, DHCP, and spoofing - Poisoning: ARP and DNS – Tools Social Engineering: Concepts, techniques, impersonation, identity theft, and Counter measures -Phases of an attack - Common targets of an attack - Impersonation scenario - Computer based, mobile based, social networking based Denial of Service: Concepts, case study, tools, attack techniques, and Countermeasures Botnet - Scanning methods for vulnerable machines - Detection Techniques and tools. Session Hijacking: Concepts, case study, tools, attack techniques, and Countermeasures - Five stages of a web malware attack - Application level session hijacking - Network level session hijacking - TCP/IP Hijacking. Practical: Trojans and Backdoors, Viruses and Worms, Sniffers, Social Engineering, Denial of Service, Session Hijacking.

LIST OF EXPERIMENTS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage
   (a) FOCA : http://www.informatica64.com/foca.aspx.
   (b) Nessus : http://www.tenable.com/products/nessus.
   (c) Wireshark : http://www.wireshark.org.
   (d) Armitage : http://www.fastandeasyhacking.com/.
   (e) Kali or Backtrack Linux, Metasploitable, Windows XP

Text Books:

1. Kimberly Graves, "CEH: Certified Ethical Hacker Study Guide", Wiley; 2010.

ONLINE/NPTEL Courses:

1. Ethical Hacking- https://nptel.ac.in/courses/106105217
2. Computer Networks and internet protocol- https://archive.nptel.ac.in/courses/106 105/106105183/

VERTICAL 5

ADVANCED NETWORKS

ITPE021 MOBILE COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks

Course Objectives:

- To learn the basics of mobile computing, the emerging wireless network standards, mobile networking and data management concepts of mobile computing.

Course Outcomes:

- To gain basic knowledge in mobile computing.
- To understand the emerging wireless network standards.
- To understand the mobile networking concepts and quality of service.
- To explain mobile data management.
- To gain the knowledge on various mobile computing models.

UNIT I (9 Hrs)

INTRODUCTION: Wireless and Mobile Computing Architecture – Limitations of wireless and mobile communication – Wireless Telecommunication Networks: Digital cellular Systems, TDMA - CDMA – Wireless Networking Techniques –Mobility Bandwidth Tradeoffs – Portable Information Appliances.

UNIT II (9 Hrs)

EMERGING WIRELESS NETWORK STANDARDS: 3 G Wireless Networks – State of Industry – Mobility support Software – End User Client Application – Mobility Middleware –Middleware for Application Development - Adaptation and Agents - Service Discovery Middleware – Finding Needed Services - Interoperability and Standardization.

UNIT III (9 Hrs)

MOBILE NETWORKING: Virtual IP Protocols - Loose Source Routing Protocols - Mobile IP – CDPD – GPRS – UMTS Security and Authentication – Quality of Service – Mobile Access to the World Wide Web.

UNIT IV (9 Hrs)

MOBILE DATA MANAGEMENT: Mobile Transactions - Reporting and Co Transactions –Kangaroo Transaction Model – Clustering Model –Isolation only transaction – 2 Tier Transaction Model – Semantic based nomadic transaction processing.

UNIT V (9 Hrs)

MOBILE COMPUTING MODELS: Client Server model – Client/Proxy/Server Model – Disconnected Operation Model – Mobile Agent Model – Thin Client Model – Tools: Java, Brew, Windows CE, WAP, Sybian, and EPOC.

LIST OF EXPERIMENTS

1. Study of WML and J2ME simulators
2. Design of simple Calculator having +,,,* and / using WML
3. Design of Calendar for any given month and year using WML
4. Design of simple game using WML
5. Animate an image using WML
6. Simulation of application using J2ME simulator a)Midlet and other basic UI items. b)Bluetooth API c)Implementation of Wireless Messaging d)MMAPI
7. Simulation of Authentication and encryption technique used in GSM
8. Simulation of applications to access web sites using Microsoft Windows Mobile .net environment.

Text Books:

1. Reza B Fat and Roy.T. Fielding, "Mobile Computing Principles", Cambridge University Press, 2005.
2. Abdelsalam A Helal, Richard Brice, Bert Haskel, MarekRusinkiewicz, Jeffery L Caster and DarellWoelk, "Any-time, Anywhere Computing, Mobile Computing Concepts and Technology", Springer International Series in Engineering and Computer Science, 2000

References:

1. Golden Richard, Frank Adelstein, Sandeep KS Gupta, Golden Richard and LorenSchwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional Publishing", 2005.
2. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.

ONLINE/NPTEL Courses:

1. Mobile Computing: https://nptel.ac.in/courses/106106147
2. Advanced 3G and 4G Wireless Mobile Communications: https://nptel.ac.in/courses/117104099

ITPE022 WIRELESS NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks

Course Objectives:

- To understand the functioning of wireless communication system, evolution of different wireless communication systems and standards. To evaluate design challenges, constraints and security issues associated with Ad hoc wireless networks.

Course Outcomes:

- To understand the different generations and standards. in wireless communication system wireless communication systems.
- To understand the various wireless technologies.
- To demonstrate an ability for multiple access techniques for Wireless Communication.
- To explain the concept of wireless personal area networks.
- To understand design challenges in Adhoc wireless networks and wireless system protocols.

UNIT I (9 Hrs)

OVERVIEW OF WIRELESS COMMUNICATION: Cellular communication - different generations and standards in cellular communication system - satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.

UNIT II (9 Hrs)

RECENT WIRELESS TECHNOLOGIES: Multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade off, MIMO,OFDM system, smart antenna - beam forming and MIMO, cognitive radio, software defined radio, communication relays, spectrum sharing.

UNIT III (9 Hrs)

MULTIPLE ACCESS TECHNIQUES IN WIRELESS COMMUNICATION: Contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid) - Contention-based multiple access schemes (ALOHA and CSMA).

UNIT IV (9 Hrs)

WIRELESS PERSONAL AREA NETWORKS: (Bluetooth, UWB and ZigBee) - wireless local area networks (IEEE 802.11, network architecture, medium access methods, WLAN standards) - wireless metropolitan area networks (WiMAX).Lines.

UNIT V (9 Hrs)

AD HOC WIRELESS NETWORKS: Design Challenges in Adhoc wireless networks - concept of cross layer design - security in wireless networks - energy constrained networks, MANET and WSN. Wireless system protocols:mobile network layer protocol (mobile IP, IPv6, dynamic host configuration protocol) - mobile transport layer protocol (traditional TCP, classical TCP improvements) - support for mobility (wireless application protocol).

LIST OF EXPERIMENTS

1. Create a sample wireless topology using NS2/NS3 Simulation Tool.
2. Identification of first tier co-channels using MATLAB Simulation Tool
3. To model and simulate TDMA, FDMA and CDMA for wireless communication using MATLAB Simulation Tool.
4. Connect the computers in Local Area Network.
5. Create a mobile Ad-hoc networks using NS2/NS3 Simulation Tool.
6. To Plot Efficiency of pure Aloha and slotted ALOHA in MATLAB.
7. Implement an User Datagram Protocol using NS2/NS3 Simulation Tool.
8. Implement a Scheduling based protocol for WSNs using MATLAB Simulation Tool.
9. To Study OSI reference model and TCP/IP reference model.

Text Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts", River Publishers, Denmark (Indian reprint) 2015.

References:

1. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA (Indian reprint) 2009.
2. J. Schiller, "Mobile Communication", Pearson Education, 2nd Edition, 2012.
3. Iti Saha Misra, "Wireless Communication and Networks:3G and Beyond", McGraw Hill Education (India) Private Ltd, 2nd Edition, New Delhi 2013.

ONLINE/NPTEL Courses:

1. Wireless Ad Hoc and Sensor Networks: https://nptel.ac.in/courses/106105160
2. Introduction to Wireless and Cellular Communications: https://nptel.ac.in/courses/106106167

ITPE023 SOFTWARE DEFINED NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks, Distributed Computing

Course Objectives:

- The aim of the course is to acquaint the need for SDN and its data plane operations ,control plane, the migration of networking functions to SDN environment and network function virtualization concepts behind network virtualization.

Course Outcomes:

- To describe the motivation behind SDN
- To identify the functions of the data plane and control plane
- To design and develop network applications using SDN
- To orchestrate network services using NFV
- To explain various use cases of SDN and NFV

UNIT I (9 Hrs)

SDN INTRODUCTION: Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane.

UNIT II (9 Hrs)

SDN DATA PLANE AND CONTROL PLANE: Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions -Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers.

UNIT III (9 Hrs)

SDN APPLICATIONS: SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering –Measurement and Monitoring – Security – Data Center Networking.

UNIT IV (9 Hrs)

NETWORK FUNCTION VIRTUALIZATION: Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V (9 Hrs)

NFV FUNCTIONALITY: NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases - SDN and NFV.

LIST OF EXPERIMENTS

1. Setup your own virtual SDN lab

   i) Virtualbox/Mininet Environment for SDN - http://mininet.org

   ii) https://www.kathara.org

   iii) GNS3

2. Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.
3. Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.
4. Create a simple end-to-end network service with two VNFs using vim-emu

   https://github.com/containernet/vim-emu
5. Install OSM and onboard and orchestrate network service.

Text Books:

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, 1st Edition, 2015.

References:

1. Ken Gray and Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Thomas D Nadeau and Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 1st Edition, 2014.
4. Paul Goransson and Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Press, 2nd Edition, 2016.
5. Oswald Coker, Siamak Azodo.

ITPE024 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Mobile Computing

Course Objectives:

- To understand the mobile application features and deploy applications to the android phone features.

Course Outcomes:

- To understand the basics of mobile communication technologies and multiplexing concepts.
- To explain various mobile telecommunication service and architechture.
- To understand transaction processing and data dissemination.
- To develop mobile applications using android.
- To understand the concept of mobile platforms, applications and security issues.

UNIT I (9 Hrs)

INTRODUCTION: Introduction toMobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMAFDMA- CDMA.

UNIT II (9 Hrs)

MOBILE TELECOMMUNICATION AND NETWORK LAYER: Introduction to Cellular Systems - GSM – Services & Architecture – GPRS -UMTS – Architecture – Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR- AODV - Hybrid routing –ZRP- Multicast Routing- ODMRP-MOBILE TRANSPORT AND APPLICATION LAYER :Mobile TCP– WAP – Architecture – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML.

UNIT III (9 Hrs)

MOBILE DATABASES: Issues in Transaction Processing - Transaction Processing Environment - Centralized Environment - Client-server Environment-Distributed Environment-Mobile Environment -Data Dissemination - Transaction Processing in Mobile Environment-Atomicity Relaxation - Consistency Relaxation-Isolation Relaxation - Durability Relaxation.

UNIT IV (9 Hrs)

MOBILE APPLICATION DEVELOPMENT USING ANDROID: Mobile Applications Development - Understanding the Android Software Stack – Android Application Architecture – The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity -Views- Layout - Creating User Interfaces with basic views- linking activities with Intents.

UNIT V (9 Hrs)

MOBILE PLATFORMS AND APPLICATIONS: Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

LIST OF EXPERIMENTS

1. Study and installation of Flutter/Kotlin multi-platform environment
2. Develop an application that uses Widgets, GUI components, Fonts, and Colors.
3. Develop a native calculator application.
4. Develop a gaming application that uses 2-D animations and gestures.
5. Develop a movie rating application (similar to IMDB)
6. Develop an application to connect to a web service and to retrieve data with HTTP.
7. Develop a simple shopping application.
8. Design a web server supporting push notifications.
9. Develop an application by integrating Google maps

Text Books:

1. Jochen Schiller, "Mobile Communications", PHI, 2nd Edition, 2003.
2. Prasant Kumar Pattink and Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt Ltd, 2012.

References:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to wireless and Mobile System", Thomas Asia Pvt Ltd, 2005.
2. William .C.Y.Lee, "Mobile Cellular Telecommunication –Analog and Digital System", TataMcGtaw Hill, 2nd Edition, 2006.
3. Golden Richard, Frank Adelstein, Sandeep KS Gupta, Golden Richard and LorenSchwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional Publishing, 2005.

ONLINE/NPTEL Courses:

1. Mobile Computing: https://nptel.ac.in/courses/106106147
2. Advanced 3G and 4G Wireless Mobile Communications: https://nptel.ac.in/courses/117104099

ITPE025 ADVANCED MOBILE COMMUNICATIONS

L	T	P	C
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Course Pre-requisite:

- Computer Networks, Communication Engineering

Course Objectives:

- To understand the basics of mobile communication and basics of 5G. To learn the 5G networking protocols and standards. They can gain knowledge in frameworks used in 5G and the challenges of 5G environment.

Course Outcomes:

- To analyze and compare differences in generations of communication networks.
- To describe the basic concepts of 5G
- To apply protocols in mobile communication
- To design the frameworks for 5G networks.
- To understand the current state and challenges in 5G networks.

UNIT I (9 Hrs)

EVOLUTION FROM 1G TO 5G: Analog voice systems in 1G - digital radio systems in 2G, voice and messaging services, TDMA based GSM,CDMA, 2.5G (GPRS), 2.75G (EDGE) - IMT2000: 3G UMTS, WCDMA, HSPA,HSPA+, 3G services and data rates - IMT Advanced: 4G, LTE, VoLTE, OFDM, MIMO, LTE Advanced Pro (3GPP Release 13+) - IMT2020: 5G, enhancements in comparison to IMT Advanced .

UNIT II (9 Hrs)

BASICS OF 5G: 5G potential and applications - Usage scenarios: enhanced mobile broadband (eMBB), ultra reliable lowlatency communications (URLLC), massive machine type communications (MMTC), D2D communications,V2X communications - Spectrum for 5G, spectrum access/sharing; millimeter Wave communication, channels and signals/waveforms in 5G, carrier aggregation, small cells, dual connectivity.

UNIT III (9 Hrs)

5G NETWORK: New Radio (NR), Standalone and non standalone mode - non orthogonal multiple access (NOMA) - massive MIMO, beam formation, FAPI: PHY API Specification, flexible frame structure, Service Data Adaptation Protocol (SDAP) - centralized RAN, open RAN - multi access edge computing (MEC).

UNIT IV (9 Hrs)

5G FRAMEWORKS: Software defined networking (SDN), network function virtualization (NFV) - network slicing; restful API for service based interface - private networks.

UNIT V (9 Hrs)

CURRENT STATE AND CHALLENGES AHEAD: 5G penetration in developed countries - deployment challenges in low,middle income countries, stronger backhaul requirements, dynamic spectrum access and usage of unlicensed spectrum, contrasting radio resource requirements - large cell usage: LMLC; possible solutions for connectivity in rural areas (BharatNet, TVWS, Long range WiFi, FSO) - non terrestrial fronthaul/backhaul solutions: LEOs, HAP/UAV.

LIST OF EXPERIMENTS

1. Demonstrates the basic concepts of Orthogonal Frequency Division Multiplexing (OFDM). OFDM modulation technique in modern wireless communication systems using different Modulation Techniques like BPSK, QPSK, 16QAM.
2. a) Measure and compare the Bit Error Rate (BER) or Signal-to-Noise Ratio (SNR) for different MIMO configurations and channel conditions.
   b) Experiment with different MIMO configurations, such as 2x2, 4x4, etc., and observe how they affect performance.
3. a) Implement beamforming algorithms (e.g., Maximum Ratio Combining, Zero Forcing) and observe their impact on signal quality.
   b) Simulate a Massive MIMO system with a large number of antennas to analyze its performance.
4. Study the implementation of Quality of Service mechanisms in 5G networks. Evaluate how different QoS parameters affect network performance.
5. Simulate a NOMA system with two users:NOMA allows multiple users to share the same time-frequency resources non-orthogonally, exploiting power domain multiplexing.
6. Simulate network slicing scenarios to understand how 5G can support multiple virtual networks with different characteristics.
7. Simulate the functions of the 5G core network, including network slicing, service-based architecture, and user plane function.
8. Simulation of SDR using MATLAB .
9. simulating a long-range Wi-Fi link focusing on evaluating the signal propagation and channel characteristics over a specified distance.
10. Implement synchronization and scheduling algorithms for 5G NR systems. Evaluate the impact of synchronization errors on system performance.
11. Investigate security challenges in 5G networks and simulate security mechanisms such as authentication, encryption, and secure key exchange.

Text Books:

1. Erik Dahlman, Stefan Parkvall and Johan Sko¨ld, “4G, LTE ,Advanced Pro and The Road to 5G”, 3*rd* Edition, 2016.
2. Dr.Sassan Ahmadi, “5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio”, Standards Hardcover, 2019.

ONLINE/NPTEL Courses:

1. Advanced 3G and 4G Wireless Mobile Communications: https://nptel.ac.in/courses/117104099

VERTICAL 6

MULTI MEDIA TECHNOLOGIES

ITPE026 MULTIMEDIA AND ANIMATION

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize with the fundamental knowledge of Multimedia systems, file formats and standards. To understand the different standard administration techniques 2D, 3D and applications of multimedia.

Course Outcomes:

- To understand the bigger picture of the context of Multimedia and its applications
- To use the different types of media elements of different formats on content pages
- To understand 2D and 3D creative and interactive presentations for different target multimedia applications.
- To use different standard animation techniques for 2D, 21/2 D, 3D applications
- To understand the complexity of multimedia applications in the context of cloud, security, bigdata streaming, social networking, CBIR etc.,

UNIT I (9 Hrs)

INTRODUCTION TO MULTIMEDIA : Definitions , Elements - Multimedia Hardware and Software - Distributed multimedia systems - challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata - Multimedia databases - Hypermedia - Multimedia Learning.

UNIT II (9 Hrs)

MULTIMEDIA FILE FORMATS AND STANDARDS : File formats - Text - Image file formats - Graphic and animation file formats - Digital audio and Video file formats - Color in image and video - Color Models. Multimedia data and file formats for the web.

UNIT III (9 Hrs)

MULTIMEDIA AUTHORING : Authoring metaphors - Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning, simulations.

UNIT IV (9 Hrs)

ANIMATION : Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D, 2 ½ D, and 3D animation - Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, Fluid Simulation, skeletal animation.

UNIT V (9 Hrs)

MULTIMEDIA APPLICATIONS : Multimedia Big data computing - social networks - smart phones - surveillance - Analytics - Multimedia Cloud Computing - Multimedia streaming cloud - media on demand - security and forensics - Online social networking - multimedia ontology - Content based retrieval from digital libraries.

List of Experiments:

1. Working with Image Editing tools: Install tools like GIMP/ InkScape / Krita /
2. Pencil and perform editing operations: Ø Use different selection and transform tools to modify or improve an image Ø Create logos and banners for home pages of websites.
3. Working with Audio Editing tools: Ø Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade in or fade out etc., Ø Perform audio compression by choosing a proper codec.
4. Working with Video Editing and conversion tools: Install tools like OpenShot / Cinelerra / HandBrake for editing video content. Ø Edit and mix video content, remove noise, create special effects, add captions. Ø Compress and convert video file format to other popular formats.
5. Working with web/mobile authoring tools: Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ Net-Beans / WordPress /Expression Web: Ø Design simple Home page with banners, logos, tables quick links etc Ø Provide a search interface and simple navigation from the home page to the inside pages of the website. Ø Design Responsive web pages for use on both web and mobile interfaces.
6. Working with Animation tools: Install tools like, Krita, Wick Editor, Blender: Ø Perform a simple 2D animation with sprites Ø Perform simple 3D animation with keyframes, kinematics
7. Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,
8. Working with ELearning authoring tools: Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStu-dio/Ampache, VideoLAN: Ø Demonstrate screen recording and further editing for Elearning content. Ø Create a simple ELearning module for a topic of your choice.

Text Books:

1. Ze-Nian Li, Mark S. Drew, and Jiangchuan Liu, "Fundamentals of Multimedia", Springer Texts in Computer Science, 3rd Edition, 2021. (UNIT-I, II, III)

References:

1. John M Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", CRC press, 3rd Edition, 2016.
2. Gerald Friedland and Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018.
3. Prabhat K.Andleigh and Kiran Thakrar, "Multimedia System Design", Pearson Education, 1st Edition, 2015.
4. Mohsen Amini Salehi and Xiangbo Li, "Multimedia Cloud Computing Systems", Springer Nature, 1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", New Riders, 2nd Edition, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles River Media, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", 3rd Edition, Morgan Kauffman, 2012.
8. Emilio Rodriguez Martinez and Mireia Alegre Ruiz, "UI Animations with Lottie and After Effects: Create, render, and ship stunning After Effects animations natively on mobile with React Native", Packt Publishing, 2022.

ONLINE/NPTEL Courses:

1. Multimedia and Animation- https://nptel.ac.in/courses/106102065
2. Multimedia Design- https://archive.nptel.ac.in/courses/107/101/107101001

ITPE027 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Knowledge about Interacting with the Computers

Course Objective:

- Understanding various components of Human Computer Interaction domain and learning the process of building effective interaction.

Course Outcomes:

- To understand the terminologies associated with HCI.
- To acquire skills in designing usable interfaces.
- To understand personalization in the interaction process.
- To get insights about the importance of accessible interfaces.

UNIT I (9 Hrs)

INTRODUCTION TO HCI: Definition and scope of HCI - Historical Perspective - Theories and methods in HCI- Importance of HCI in software development.

UNIT II (9 Hrs)

HCI DESIGN PRINCIPLES AND FRAMEWORK: : : Introduction to design principles- Models of Interaction- HCI frameworks- Basics of Ergonomics - Interaction styles- Interactivity- User experience- Fundamentals of Interaction design- User Interaction design principles.

UNIT III (9 Hrs)

USER-CENTERED DESIGN AND INTERACTION DESIGN: Introduction to user-Centric design – Case studies, Historical evolution, Issues and challenges and current trend. Computational user models (classical) – GOMS, KLM, Fitts' law, Hick-Hymans law - Computational user models (contemporary) – 2D and 3D pointing, Constrained navigation, Mobile typing, Touch interaction.

UNIT IV (9 Hrs)

USABILITY EVALUATION: User centric design evaluation – Overview of evaluation techniques, Expert evaluation, User evaluation, Model-based evaluation with case studies-Accessibility in HCI.

UNIT V (9 Hrs)

FUTURE TRENDS IN HCI: Emerging technologies- Artificial intelligence- AR/VR- Multimodal interaction- Interaction in Wearable devices- Accessibility and Inclusive design- Ethical consideration in HCI.

List of Experiments:

1. Take a Product of Your choice and Perfrom Schneiderman's Golden Rules Analysis
2. Perform Content Navigation without using Mouse and Make a Report
3. Perform a Comparative analysis of Accessibility with a case study of your choice
4. Evaluate an existing interface using Nielsen's usability heuristics.
5. Create an interactive prototype using a tool like Sketch or Figma.

Text Books:

1. Samit Bhattacharya, Human-Computer Interaction: User-Centric Computing for Design, 2019, 935316804X, McGraw-Hill.
2. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russel Beale. (2003). Human-Computer Interaction (3rd Edition), Pearson.

References:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs. (2009). Designing the User Interfaces: Strategies for Effective Human-Computer Interaction, 5th Edition, Pearson.

ONLINE /NPTEL Courses:

1. Human Computer Interaction-https://onlinecourses.nptel.ac.in/noc20 .cs45/

ITPE028 GRAPHICS AND IMAGE PROCESSING

L	T	P	C
3	0	0	3

Course Objectives:

- To learn two dimensional graphical structures, the components of Graphics and Image Processing applications. To design innovative applications such as animation, the hardware & software facilities available for Graphics and Image Processing applications.

Course Outcomes:

- To describe acquainted Graphics and Image Processing domains.
- To understand the major intricacies of Graphics and Image Processing.
- To understand verbal descriptions to images and vice versa.

UNIT I (9 Hrs)

GRAPHICS SYSTEMS AND GRAPHICAL USER INTERFACE: Pixel– Resolution– types ofvideo display devices – Graphical input devices – output devices – Hard copy devices – Direct screen interaction – Logical input function – GKS User dialogue – Interactive picture construction techniques.

UNIT II (9 Hrs)

GEOMETRIC DISPLAY PRIMITIVES AND ATTRIBUTES: Geometric Display Primitives and Attributes:Geometric display primitives – Points– Lines and Polygons – Point display method – Line drawing methods. 2D Transformations and Viewing:Transformations – types – matrix representation – Concatenation – Scaling– Rotation– Translation– Shearing– Mirroring– Homogeneous coordinates. Window to view port transformations:Windowing And Clipping: Point– Lines– Polygons - boundary intersection methods.

UNIT III (9 Hrs)

DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS: Digital Image Fundamentals and Transforms:Nature of Image processing – related fields – Image representations – Image types – Image processing operations – Applications of Image processing – Imaging system – Image Acquisition – Image Sampling and Quantization – Image quality – Image storage and file formats - Image processing operations - Image Transforms - need for Transforms – Fourier Transforms and its properties – Introduction to Walsh, Hadamard, Discrete Cosine, Haar, Slant, SVD, KL and Hotelling Transforms.

UNIT IV (9 Hrs)

IMAGE ENHANCEMENT AND RESTORATION: Image Enhancement and Restoration:Image Quality and need for Enhancements – Point operations - Histogram Techniques– Spatial filtering concepts– Frequency Domain Filtering – Image Smoothening – Image Sharpening - Image degradation and Noise Models – Introduction to Restoration Techniques.

UNIT V (9 Hrs)

IMAGE COMPRESSION: Image Compression:Compression Models and measures – coding types – Types of Redundancy- Lossless compression algorithms – Lossy compression algorithms – Introduction to compression standards. Image Segmentation:Detection of Discontinuities – Edge Detection – Thresholding – Region Based Segmentation. Introduction to Color Image Processing.Introduction to Morphological operations.

LIST OF EXPERIMENTS

1. Implement Bresenham's line drawing algorithm for all types of slope.
2. Clip a line using Cohen-Sutherland algorithm
3. Analysis of spatial and intensity resolution of images.
4. Intensity transformation of images.
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Image Enhancement-Spatial filtering
7. Image Enhancement- Filtering in frequency domain
8. Image segmentation – Edge detection, line detection and point detection

Text Books:

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, "Computer Graphics with OpenGL", Pearson Education, 4th Edition, 2010.
2. S. Sridhar, "Digital Image Processing", Oxford Press, 1st Edition, 2011.

References:

1. Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 1989.
2. Sid Ahmed, "Image Processing", McGraw-Hill, 1995.
3. Gonzalez R. C and Woods R.E., "Digital Image Processing", Pearson Education, 2nd Edition, 2002.
4. Newmann W.M. and Sproull R.F., "Principles of Interactive Computer Graphics", Tata McGraw-Hill, 2nd Edition, 2000.
5. Foley J.D., Van Dam A, Fiener S.K. and Hughes J.F., "Computer Graphics", Addison-Wesley, 2nd Edition, 1993.

ONLINE/NPTEL Courses:

1. Digital Image Processing of Remote Sensing Data:https://nptel.ac.in/courses/105107160
2. Computer Vision and Image Processing - Fundamentals and Applications: https://nptel.ac.in/courses/108103174

ITPE029 AUGMENTED REALITY/VIRTUAL REALITY

L	T	P	C
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Course Objectives:

- To introduce the fundamentals aspects and principles of AR/VR technologies. To know the internals of the hardware and software components involved in the development of AR/VR enabled applications, the graphical processing units and their architectures . To gain knowledge about AR/VR application development and the technologies involved in the development of AR/VR based applications.

Course Outcomes:

- To understand the basic concepts of AR and VR
- To understand the tools and technologies related to AR/VR
- To know the working principle of AR/VR related Sensor devices
- To design of various models using modeling techniques
- To develop AR/VR applications in different domains

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies - Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II (9 Hrs)

VR MODELING: Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III (9 Hrs)

VR PROGRAMMING: VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D.

UNIT IV (9 Hrs)

APPLICATIONS: Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V (9 Hrs)

AUGMENTED REALITY: Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation - Navigation-Wearable devices.

LIST OF EXPERIMENTS

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

Text Books:

1. Charles Palmer and John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. Dieter Schmalstieg and Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.
3. John Vince, "Introduction to Virtual Reality", Springer, Verlag, 2004.
4. William R. Sherman and Alan B. Craig, "Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003.

ONLINE/NPTEL Courses:

1. Augmented and Virtual Reality courses- https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-courseon-virtual-reality-and-augmented-reality/
2. Virtual Reality- https://archive.nptel.ac.in/courses/121/106/121106013/

ITPE030 COMPUTER VISION

L	T	P	C
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Course Objectives:

- To understand the fundamental concepts related to image formation and processing. To familiariaze with feature based alignment, motion estimation. To develop skills on 3D reconstruction, understand image based rendering and recognition.

Course Outcomes:

- To understand basic knowledge, theories and methods in image processing and computer vision.
- To implement basic and some advanced image processing techniques in OpenCV.
- To apply 2D a feature,based based image alignment, segmentation and motion estimations.
- To apply 3D image reconstruction techniques
- To design and develop innovative image processing and computer vision applications

UNIT I (9 Hrs)

INTRODUCTION TO IMAGE FORMATION AND PROCESSING: Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II (9 Hrs)

FEATURE DETECTION, MATCHING AND SEGMENTATION: Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III (9 Hrs)

FEATURE,BASED ALIGNMENT & MOTION ESTIMATION: 2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration -Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV (9 Hrs)

3D RECONSTRUCTION: Shape from X - Active rangefinding - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V (9 Hrs)

IMAGE BASED RENDERING AND RECOGNITION: View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes -Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

LIST OF EXPERIMENTS

OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or or equivalent

1. OpenCV Installation and working with Python
2. Basic Image Processing , loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection
3. Image Annotation – Drawing lines, text circle, rectangle, ellipse on images
4. Image Enhancement , Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
5. Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment
6. Image segmentation using Graphcut / Grabcut
7. Camera Calibration with circular grid
8. Pose Estimation
9. 3D Reconstruction – Creating Depth map from stereo image
10. Object Detection and Tracking using Kalman Filter, Camshift

1. docs.opencv.org
2. https://opencv.org/opencv-free-course/

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, Texts in Computer Science, 2nd Edition, 2022.
2. D. A. Forsyth and J. Ponce, "Computer Vision:A Modern Approach", Pearson Education, 2nd Edition, 2015.

References:

1. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", Cambridge University Press, 2nd Edition, March 2004.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
3. E. R. Davies, "Computer and Machine Vision", Academic Press, 4th Edition, 2012.

ONLINE/NPTEL Courses:

1. Computer Vision and Image Processing - Fundamentals and Applications: https://nptel.ac.in/courses/108103174

OPEN ELECTIVES

ITOE001 PYTHON PROGRAMMING

L	T	P	C
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Course Pre-requisite:

- Basic programming language

Course Objectives:

- To familiarize with python programming concepts, functions, modules, object oriented programming, exceptions handling and python for multimedia.

Course Outcomes:

- To understand the basic concepts of python.
- To understand basic components of python programming.
- To understand Functions and modules in python.
- To develop simple python programs for solving problems.
- To develop python programs for real time applications.

UNIT I (9 Hrs)

INTRODUCTION: History, Features - Working with python- Installing python, Basic syntax, Data types, Variables, manipulating numbers, Text manipulations, Python build in functions.

UNIT II (9 Hrs)

COMPONENTS OF PYTHON PROGRAMMING: Python objects and other languages - Operator basics, Numbers, String, List, Tuples, Dictionaries, Files, Object Storage. Type conversion- Type comparison statements, Assignments, Control statements.

UNIT III (9 Hrs)

FUNCTIONS AND MODULES: Functions definition and execution, Arguments, Return values, Advanced function calling, Modules - Importing modules, Tricks for importing modules, Packages, Creating a module.

UNIT IV (9 Hrs)

EXCEPTION HANDLING: Classes and Objects - creating a class, class methods, class inheritance, Exceptions Handling, Build in Exceptions, Files - File operations, reading a file content, writing a file, change position, controlling file I/O, manipulating file paths.

UNIT V (9 Hrs)

APPLICATIONS: Working with PDF and word Documents- working with CSV Files and JSON Data, sending Email and text messages, manipulating images, using Python for multimedia.

Text Books:

1. Martin C. Brown, "The Complete reference - Python", Tata McGraw hill Edition, 2018. (Unit 1, Unit 2, Unit 3)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Shroff O'Reilly Publishers, 2nd Edition, Updated for Python 3, 2016 (Unit 1, Unit 2, Unit 3)
3. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python", Revised and updated for Python", Network Theory Ltd., 2011. (Unit 1, Unit 2, Unit 3)
4. Al Sweigart, "Automate the Boring Stuff with Python", 2nd Edition: Practical Programming for Total Beginners, no starch press, 2019. (Unit 5)

References:

1. Timothy Budd, "Exploring Python", Tata McGraw Hill Education, 2009.
2. Mark Lutz, "Learning Python", O'Re illy publication, 4th Edition, 2011.
3. Robert Sedgewick, Kevin Wayne and Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Eric Matthes "Python Crash Course", 2nd Edition: A Hands-On, Project-Based Introduction To Programming, 2019.

ONLINE/NPTEL Courses:

1. Python Programming: https://nptel.ac.in/courses/106106145
2. https://onlinecourses.nptel.ac.in/noc22 _cs26/

ITOE002 OBJECT ORIENTED PROGRAMMING USING C++

L	T	P	C
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Course Pre-requisite:

- Basic programming language

Course Objectives:

- To familiarize with the concept of object-oriented programming (OOP) like classes, constructors, polymorphism, inheritance, file handling and open source libraries.

Course Outcomes:

- To understand the concepts of features of object oriented programming.
- To understand the concept of inheritance in object oriented programming.
- To understand concepts of pointers and array in C++.
- To understand the concept of Files and Exception Handling.
- To develop UML design diagrams using OOP concepts.

UNIT I (9 Hrs)

INTRODUCTION TO OBJECT- ORIENTED PROGRAMMING: Evolution of programming methodologies - key concepts of object oriented programming, input and output in C++, control structures, classes and objects, functions in C++.

UNIT II (9 Hrs)

INHERITANCE: Introduction to constructors and destructors, overloading functions, unary, binary operators, friend functions, inheritance, types of inheritance, virtual base class.

UNIT III (9 Hrs)

POINTERS AND ARRAYS: Pointer to class and object, pointer to derived classes and base classes, accessing private members with pointers, address of object and void pointers, characteristics of arrays, array of classes, Memory models.

UNIT IV (9 Hrs)

FILES AND EXCEPTION HANDLING: File Stream classes, checking for errors, file opening modes, file pointers and manipulators, manipulators with arguments, read and write operations, fundamentals of exception Handling-catching class types, using multiple catch statements, catching All Exception, rethrowing Exception.

UNIT V (9 Hrs)

OBJECT MODELLING AND OBJECT ORIENTED SOFTWARE DEVELOPMENT: Overview of OO concepts, UML - Use case model, Class diagrams, Interaction diagrams, Activity diagrams, State chart diagrams, Patterns, Types, Object Oriented Analysis and Design methodology, Interaction Modelling, OOD Goodness criteria.

Text Books:

1. Ashok N.Kamthane, "Object Oriented Programming with ANSI and Turbo C++", Pearson Edition, 2006. (Unit 1, Unit 2, Unit 3, Unit 4)
2. Deitel & Deitel, "C++ How to program", Prentice Hall, 8th Edition, 2011. (Unit 1, Unit 2, Unit 3, Unit 4)
3. Rajib Mall, "Fundamentals of Software Engineering". PHI Learning, 3rd Edition, 2013.(Unit 5)

References:

1. E Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 8th Edition, 2020.
2. Eric Nagler, "Learning C++ A Hands on Approach", Jaiho publishing house, 2007.
3. Sotter A Nicholas and Kleper J Scott, "Professional C++", Wiley Publishing Inc, 2005.

ONLINE/NPTEL Courses:

1. Object Oriented Programming with C++: https://onlinecourses.nptel.ac.in/noc22 cs47/
2. https://archive.nptel.ac.in/courses/106/105/106105151/

ITOE003 ESSENTIALS OF MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Objectives:

- To familarize basic concepts of mobile computing, mobile telecommunication system, mobile networks, mobile platform and applications.

Course Outcomes:

- To understand the basics of mobile communication technology.
- To explain various mobile telecommunication service and architecture.
- To describe mobile transport and application layer.
- To develop the mobile application using android.
- To understand the concepts of mobile platforms, applications and security issues.

UNIT I (9 Hrs)

INTRODUCTION: Introduction to Mobile Computing - Applications of Mobile Computing, Generations of Mobile Communication Technologies, Multiplexing, Spread spectrum,MAC Protocols, SDMA, TDMA, FDMA, CDMA.

UNIT II (9 Hrs)

MOBILE TELECOMMUNICATION SYSTEM: Introduction to Cellular Systems- GSM, Services & Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, PRSUMTS, Architecture, Handover, Security.

UNIT III (9 Hrs)

MOBILE NETWORK LAYER: Mobile IP, DHCP, AdHoc, Proactive protocol, DSDV, Reactive Routing Protocols, DSR, AODV , Hybrid routing, ZRP, Multicast Routing, ODMRP, Vehicular Ad Hoc networks(VANET), MANET Vs VANET, Security.

UNIT IV (9 Hrs)

MOBILE TRANSPORT AND APPLICATION LAYER: Mobile TCP, WAP, Architecture, WDP, WTLS, WTP, WSP, WAE, WTA Architecture, WML.

UNIT V (9 Hrs)

MOBILE PLATFORMS AND APPLICATIONS: Mobile Device Operating Systems, Special Constraints & Requirements, Commercial Mobile Operating Systems, Software Development Kit - iOS, Android, BlackBerry, Windows Phone, MCommerce, Structure, Pros & Cons, Mobile Payment System, Security Issues Too.

Text Books:

1. Jochen Schiller, “Mobile Communications”, PHI, 2nd Edition, 2008.(Unit 1, Unit 2, Unit 3, Unit 4)
2. Prasant Kumar Pattnaik and Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi, 2012.(Unit 1, Unit 2, Unit 3, Unit 4, Unit 5)

References:

1. Dharma PrakashAgarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”,Thomson Asia Pvt Ltd, 2005.
2. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications - Analog and Digital Systems”, 2nd Edition, TataMc-Graw Hill Edition, 2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, 1st Edition, Pearson Education, 2002.

ONLINE/NPTEL Courses:

1. Mobile Application Development: https://onlinecourses.swayam2.ac.in/nou21-ge41/

ITOE004 BIOINFORMATICS

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize with data types, databases in molecular biology.
- To learn the sequence alignment, multiple alignment, substitution matrices, phylogenetic trees, protein analyses and DNA sequence analyses.

Course Outcomes:

- To understand the molecular biology, storage, representation, transfer of genetic information and overview of IT and science.
- To understand data types, sequence databases and structure databases in molecular biology.
- To explain sequence alignment and dynamic programming in sequence alignment.
- To explore the multiple alignment, substitution matrices and phylogenetic trees
- To understand protein and DNA sequence analyses in nucleic acids.

UNIT I (9 Hrs)

INTRODUCTION: An Elementary Introduction to Modern Molecular Biology - The reductionist programme in biology, A cell is the smallest unit of Life, Storage and representation of genetic information, Transfer of genetic information - Transcription, Translation and protein folding, Genome organization. A Brief Overview of Information Technology and Science- History, Hardware and Software, Internet. Bioinformatics- Introduction, Elemental tasks of bioinformatics analyses.

UNIT II (9 Hrs)

DATA TYPES AND DATABASES IN MOLECULAR BIOLOGY: Data types in Molecular biology, Mutations and polymorphisms, Sequence databases - Primary nucleotide sequence repositories, Primary protein sequence repositories, Derived or Secondary Databases of Amino Acid Sequences - Subcollections Derived or Secondary Databases of Amino Acid Sequences- Patterns Signatures, Structure databases- The Primary Structure Databases, Derived or Secondary Databases of Biomolecular Structures, Summary.

UNIT III (9 Hrs)

SEQUENCE ALIGNMENT : Introduction, why align sequences, Similarity vs Homology, The significance of an alignment Dot matrices and Hash coding - Comparing sequences using dot matrices, Pattern searching using hash coding Dynamic programming in sequence alignment, The Needleman-Wunsch algorithm, Scoring schemes, The Smith-Waterman algorithm BLAST and FASTA: BLAST-FASTA, summary.

UNIT IV (9 Hrs)

MULTIPLE ALIGNMENT, SUBSTITUTION MATRICES AND PHYLOGENETIC TREES: Multiple sequence alignment- Goals of multiple sequence alignment, Representation of a multiple sequence alignment, Scoring a MSA, Dynamic programming for MSA, Progressive or hierarchical alignment, Substitution matrices - Evolutionary models, PAM substitution matrices, Phylogenetic trees - Introduction, Distance matrix methods, UPGMA, Distance matrix methods, Maximum likelihood-Summary.

UNIT V (9 Hrs)

PROTEIN AND DNA SEQUENCE ANALYSES: Pattern Representations and Characterisation - Deterministic patterns, Pattern characterisation and classification, Pattern Discovery and Sequence Classification in Protein - General methods, Application to analyses of protein sequences, Pattern Discovery and Sequence Classification in Nucleic Acids- Gene discovery using ANN, GRAIL, Gene discovery using Fourier analysis, GeneScan, Other analyses of DNA sequences, Summary.

Text Books:

1. N. Gautham, "Bioinformatics: Databases and Algorithms", Alpha Science, 2006.

References:

1. Dr. P S Verma & amp and Dr. V K Agarwal, "Molecular Biology", S. Chand publishing, 2020.
2. Barry G Hall, "Phylogenetic Trees Made Easy", Third edition Phylogenetic Trees Made Easy: A How-to Manual, 3rd edition - Barry G. Hall. 2008.
3. Mark D. Adams, Chris Fields, J. Craig Venter, "Automated DNA sequencing and analysis", Academic Press, 2012.

ONLINE/NPTEL Courses:

1. BioInformatics: https://onlinecourses.swayam2.ac.in/cec21_bt04/
2. https://onlinecourses.nptel.ac.in/noc20_bt10/

ITOE005 WEB ENGINEERING

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Course Pre-requisite:

- Basic Programming languages

Course Objectives:

- To learn the various characteristics of web applications, requirements engineering, architectures of web application design and testing.

Course Outcomes:

- To understand the characteristics of web applications and acquire the knowledge of requirements engineering.
- To understand model architectures for web applications.
- To apply appropriate web design for applications.
- To understand the concept of testing web applications.
- To develop and manage web-based projects.

UNIT I (9 Hrs)

INTRODUCTION : Introduction to Web Engineering and Requirements Engineering, Motivation, Categories of Web Applications, Characteristics of Web Applications, Evolution of web engineering, Requirements Engineering Activities, RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types.

UNIT II (9 Hrs)

WEB APPLICATION ARCHITECTURES: Categorization of Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modelling Specifics in Web Engineering, Modelling Requirements, Hypertext Modelling, Relation to Hypertext Modelling, Customization Modelling.

UNIT III (9 Hrs)

WEB APPLICATION DESIGN: Web Design, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Inter action Design, Navigation Design, Designing Link Internals, Navigation and Orientation, Functional Design.

UNIT IV (9 Hrs)

TESTING WEB APPLICATIONS: Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Applying the Scheme to Web Applications, Test Methods and Techniques, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools.

UNIT V (9 Hrs)

WEB PROJECT MANAGEMENT: Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risks, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JavaScript, web sockets.

Text Books:

1. GertiKappel and Birgit Proll, "Web Engineering", John Wiley and Sons Ltd, 2009.
2. Roger S. Pressman and David Lowe, "Web Engineering: A Practitioner's Approach", McGraw-Hill, 2017.
3. Guy W. Lecky-Thompson, "Web Programming", Cengage Learning, 2008.

References:

1. Chris Bates, "Web Programming: Building Internet Applications", 3rd Edition, Wiley India Edition, 2007.
2. http://www.csun.edu

ONLINE/NPTEL Courses:

1. Web Programming: https://onlinecourses.swayam2.ac.in/nou20_cs05/
2. https://archive.nptel.ac.in/courses/106/105/106105084/