



**DADI INSTITUTE OF ENGINEERING & TECHNOLOGY (A)**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING ANAKAPALLE -  
531002, A.P**

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**Academic Regulations (DR23) for B. Tech. (Regular-Full time)**

(Effective for the students admitted into I year from the Academic  
Year 2023-24 onwards)

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**Academic Regulations (DR23) for B.Tech.(Lateral Entry Scheme)**

(Effective for the students admitted into II year through Lateral Entry  
Scheme from the Academic Year 2024 - 25 onwards)

**B. Tech – I Year I Semester**

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Linear Algebra & Calculus	3	0	0	3
2	BS&H	Engineering Physics	3	0	0	3
3	BS&H	Communicative English	2	0	0	2
4	Engineering Science	Basic Civil & Mechanical Engineering	3	0	0	3
5	Engineering Science	Introduction to Programming	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	Engineering Science	Engineering Workshop	0	0	2	1.5
9	Engineering Science	IT Workshop	0	0	2	1
10	Engineering Science	Computer Programming Lab	0	0	3	1.5
11	BS&H	Health and Wellness, Yoga and Sports	0	-	1	0.5
<b>Total</b>						<b>20.5</b>

**B. Tech – I Year II Semester**

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Differential Equations & Vector Calculus	3	0	0	3
2	BS&H	Chemistry	3	0	0	3
3	Engineering Science	Engineering Graphics	1	0	4	3
4	Engineering Science	Basic Electrical & Electronics Engineering	3	0	0	3
5	Professional Core	Data structures	3	0	0	3
6	BS&H	Chemistry Lab	0	0	2	1
7	Engineering Science	Electrical & Electronics Engineering workshop	0	0	3	1.5
8	Professional Core	Data structures Lab	0	0	3	1.5
9	Professional Core	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
<b>Total</b>						<b>19.5</b>



### B.Tech. II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Mathematical Foundations of Computer Science	3	0	0	3
2	BS&H	Universal Human Values– Understanding Harmony	2	1	0	3
3	Engineering Science	Digital Logic & Computer Organization	3	0	0	3
4	Professional Core	Software Engineering	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	CASE Tools Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement Course	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
<b>Total</b>			<b>16</b>	<b>2</b>	<b>8</b>	<b>20</b>

### B.Tech. II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics and Financial Analysis	2	0	0	2
2	Engineering Science/ Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Formal Languages and Automata Theory	2	1	0	3
6	Professional Core	Operating Systems Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement Course	Full Stack Development –I	0	1	2	2
9	BS&H	Design Thinking & Innovation	1	0	2	2
<b>Total</b>			<b>14</b>	<b>2</b>	<b>10</b>	<b>21</b>
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

**B.Tech. – III Year I Semester**

S.No	Category	Title	L	T	P	Credits
1	Professional Core	Data Warehousing and Data Mining	3	0	0	3
2	Professional Core	Compiler Design	3	0	0	3
3	Professional Core	Design and Analysis of Algorithms	3	0	0	3
4	Professional Elective-I	1. Object Oriented Analysis and Design 2. Software Testing Methodologies 3. Advanced Computer Architecture 4. Computer Graphics 5. 12 week MOOC Swayam/ NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-I	1. Data Structures 2. Database Management Systems 3. Computer Organization 4. Scripting Languages 5. Operating Systems	3	0	0	3
6	Professional Core	Data Mining Lab	0	0	3	1.5
7	Professional Core	Compiler Design Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack development-2	0	1	2	2
9	Engineering Science	Tinkering Lab/ SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
10	Evaluation of Community Service Project		-	-	-	2
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>23</b>



### B.Tech. III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Computer Networks	3	0	0	3
2	Professional Core	Artificial Intelligence	3	0	0	3
3	Professional Core	Cryptography & Network Security	3	0	0	3
4	Professional Elective-II	1. Cloud Computing 2. Cyber Security 3. DevOps 4. No SQL Databases 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Human Computer Interaction 3. Big Data Analytics 4. Distributed Systems 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – II	1. Web services 2. Computer Networks 3. OOPS through Java 4. Fundamentals of Cloud Computing 5. Fundamentals of Information Security	3	0	0	3
7	Professional Core	AI Tools Lab	0	0	3	1.5
8	Professional Core	Computer Network Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills // SWAYAM Plus - 21st Century Employability Skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
<b>Total</b>			<b>20</b>	<b>01</b>	<b>08</b>	<b>23</b>
Mandatory Industry Internship of 08 weeks duration during summer vacation						



### B.Tech. IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Machine Learning	2	1	0	3
2	Management Course- II	Human Resources & Project Management	2	0	0	2
3	Professional Elective-IV	1. Software Architecture & Design Patterns 2. Blockchain Technology 3. Internet of Things 4. Quantum Computing 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Soft Computing 2. Digital Image Processing 3. Natural Language Processing 4. Mobile Adhoc Networks 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-III	1.Big Data Analytics 2. Block Chain Technologies 3.CyberSecurity 4.Devops 5. Quantum Computing	3	0	0	3
6	Open Elective-IV	1.Fundamentals of Optimization Techniques 2.Computer Forensics and Law Protection 3.Ethical Hacking 4.Augmented Reality &Virtual Reality 5.Biometrics	3	0	0	3
7	Skill Enhancement Course	Prompt Engineering/ SWAYAM Plus - Certificate program in Prompt Engineering and ChatGPT	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
<b>Total</b>			<b>18</b>	<b>2</b>	<b>02</b>	<b>21</b>

**B.Tech IV Year II Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

**Note : Student need to do at least ONE MOOC/NPTEL Course (of 3 credits out of 160 credits) to meet the mandatory requirement (11<sup>th</sup> criteria, as per R23 Regulations); they are allowed to register one semester in advance**



**Suggested NPTEL Courses**

<b>S.No.</b>	<b>Course Title</b>	<b>Institute offering Course</b>	<b>Weeks</b>	<b>Credits</b>
1	Advanced R Programming for Data Analytics in Business	IIT Kanpur	12 Weeks	3
2	Computer Vision	IIT Kharagpur	12 Weeks	3
3	Deep Learning	IIT Ropar & IIT Madras	12 Weeks	3
4	Deep Learning for Computer Vision	IIT Hyderabad & IIT Madras	12 Weeks	3
5	Ethical Hacking	IIT Kharagpur	12 Weeks	3
6	Numerical Methods for Engineers	IIT Madras	12 Weeks	3
7	Programming in Modern C++	IIT Kharagpur	12 Weeks	3
8	Reinforcement Learning	IIT Madras	12 Weeks	3
9	Social Network Analysis	IIT Delhi	12 Weeks	3
10	The Joy of Computing using Python	IIT Ropar & IIT Madras	12 Weeks	3

## **Academic Regulations (DR23) for B. Tech (Regular-Full time)**

(Effective for the students admitted into I year from the Academic Year 2023-24 onwards)

### **1. Award of the Degree**

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
- (i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).
  - (ii) Registers for 160 credits and secures all 160 credits.
- (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
- (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.
  - (ii) Registering for Honors is optional.
  - (iii) Honors is to be completed simultaneously with B.Tech. programme.

Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

### **2. Admissions**

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

### **3. Program related terms**

#### **Credit Definition:**

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

- a) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic

year.

b) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

#### 4. Semester/Credits:

- i) A semester comprises 90 working days and an academic year is divided into two semesters.
- ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
- iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

#### 5. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE
1	Humanities and Social Science including Management (HM)	13	8%	Recommendation (%)
2	Basic Sciences (BS)	20	13%	8 – 9%
3	Engineering Sciences (ES)	23.5	14%	12 - 16%
4	Professional Core (PC)	54.5	34%	10 – 18%
5	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21%	30 – 36%
6	Internships & Project work (PR)	16	10%	19 - 23%
7	Mandatory Courses (MC)	Non-credit	Non-credit	8 – 11%

#### 6. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.no	Broad Course Classification	Course Category	Description
1	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline / department / branch of Engineering
3	Elective	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/ branch of Engineering

		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
4	Courses	Domain specific skill enhancement courses (SEC)	interdisciplinary/job-oriented/domain courses which are relevant to the industry
5	Project	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
6	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

## 7. Programme Pattern

- i. Total duration of the of B. Tech (Regular) Programme is four academic years.
- ii. Each academic year of study is divided into two semesters.
- iii. Minimum number of instruction days in each semester is 90 days.
- iv. There shall be mandatory student induction program for freshers, with a three- week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
- v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
- vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
- vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
- viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.
- ix. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
- x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.
- xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
- xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.
- xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks

- duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year. xiv. There shall also be mandatory full internship in the final semester of the programme along with the project work.
- xv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.
  - xvi. Each college shall take measures to implement Virtual Labs (<https://www.vlab.co.in>) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs. xvii. Each college shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth/placements/opportunities for higher studies/GATE/other competitive exams etc. xviii. Preferably 25% of course work for the theory courses in every semester shall be conducted in the blended mode of learning.

### 8. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

### Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
<b>Total</b>	<b>100</b>

- i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination. ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
- iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.
- iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of „T“ for theory subject and „P“ for practical subject.

**(a) Continuous Internal Evaluation**

- i) or theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minutes duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
- ii) Objective paper shall contain for 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

**Note:**

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
  - The subjective paper shall contain 3 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
  - The objective paper shall be conducted by the respective institution on the day of subjective paper test.
  - Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the semester and the average marks shall be considered.
- iii) If the student is absent for the mid semester examination, no re-exam shall be conducted and mid semester marks for that examination shall be considered as zero.
  - iv) First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
  - v) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

**For Example:**

Marks obtained in first mid: 25 Marks obtained in second mid: 20

Final mid semester Marks:  $(25 \times 0.8) + (20 \times 0.2) = 24$

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent Marks obtained in second mid: 25

Final mid semester Marks:  $(25 \times 0.8) + (0 \times 0.2) = 20$

**(b) End Examination Evaluation:**

End examination of theory subjects shall have the following pattern:

- i) There shall be 6 questions and all questions are compulsory.
- ii) Question I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.
- iii) There shall be 2 short answer questions from each unit.
  - a) In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

- i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
- ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
- iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
- iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

**Practical Courses**

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
<b>Total</b>	<b>100</b>

- b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
- c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.
- d) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.  
 Procedure: 20 marks  
 Experimental work & Results: 30 marks • Viva voce: 20 marks.

In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid semester examination shall be evaluated as above for 30 marks in each part and final mid semester marks shall be arrived by considering the average of marks obtained in two parts.

- e) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
<b>Total</b>	<b>100</b>

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be two midterm examinations in a semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final sessional marks for the subject.

The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing , multiple branches, etc is mentioned along with the syllabus.

- f) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.
- g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

### 9. Skill oriented Courses

- i) There shall be five skill-oriented courses offered during III to VII semesters.
- ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain/Interdisciplinary/Job oriented.
- iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.
- iv) The Head of the Department shall identify a faculty member as coordinator for the

course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process.

The marks/grades shall be assigned to the students by the above committee based on their performance.

- v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.
- vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the University at the beginning of the semester. The principal of the respective college shall forward such proposals to the University for approval.
- vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

#### **10. Massive Open Online Courses (MOOCs):**

A Student has to pursue and complete one course compulsorily through MOOCs approved by the University. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the university.

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

## 11. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

- i) The University shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
- ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
- iii) Credit transfer policy will be applicable to the Professional & Open Elective courses only.
- iv) The concerned department shall identify the courses permitted for credit transfer.
- v) The University/institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer.
- vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.
- vii) The university shall ensure no overlap of MOOC exams with that of the university examination schedule. In case of delay in results, the university will re-issue the marks sheet for such students.
- viii) Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.
- ix) The institution shall submit the following to the examination section of the university:
  - List of students who have passed MOOC courses in the current semester along with the certificate of completion.
  - Undertaking form filled by the students for credit transfer.
- x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

**Note:** Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

## 12. Academic Bank of Credits (ABC)

- I. The University has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to
- II. provide option of mobility for learners across the universities of their choice
- III. provide option to gain the credits through MOOCs from approved digital platforms.
- IV. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
- V. Execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

### 13. Mandatory Internships

**Summer Internships :** Two summer internships either onsite or virtual each with a minimum of 08 weeks duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries in the areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations/NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

**Full Semester Internship and Project work:** In the final semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the University and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

#### 14. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

- i) The Minor program requires the completion of 12 credits in Minor stream chosen.
- ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.
- iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

**Note:** A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

#### 15. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

- i. Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
- ii. A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).
- iii. A student is permitted to register for Honors in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to the Honors from V Semester onwards.
- iv. The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.
- v. Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
- vi. Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course and 8 weeks duration for a 2-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
- vii. The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.
- viii. A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.
- ix. A student registered for Honors shall pass in all subjects that constitute the requirement

for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree programme.

- x. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
- xi. The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

**Enrolment into Honors:**

- i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline
- ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.
- iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.
- iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.
- v) Honors is to be completed simultaneously with a Major degree program.

**Registration for Honors:**

- i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.
- ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.
- iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress. iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

**16. Attendance Requirements:**

- i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.
- ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.
- iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the University.
- iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

- v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work. vi) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.
- vii) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

**17. For induction programme attendance shall be maintained as per AICTE norms. Promotion Rules:**

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

- i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.
- ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any **decimal** fraction should be **rounded off to lower** digit) up to in the subjects that have been studied up to III semester. iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any **decimal** fraction should be **rounded off to lower** digit) in the subjects that have been studied up to V semester. And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.
- iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

**18. Grading:**

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Range in which the marks in the subject fall	Grade	Grade points
		Assigned
90 & above	Superior	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7

50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

**Structure of Grading of Academic Performance**

- i) A student obtaining Grade „F“ or Grade „Ab“ in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
- ii) For non-credit audit courses, “Satisfactory” or “Unsatisfactory” shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative GradePoint Average (CGPA):

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

$$SGPA = \frac{\sum (Ci \times Gi)}{\sum Ci}$$

where, Ci is the number of credits of the i<sup>th</sup> subject and Gi is the grade point scored by the student in the i<sup>th</sup> course.

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

$$CGPA = \frac{\sum (Ci \times Si)}{\sum Ci}$$

where “Si” is the SGPA of the i<sup>th</sup> semester and Ci is the total numberof credits up to that semester. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

**Award of Class:**

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

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

**CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10**

## 19. With-holding of Results

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

## 20. Multiple Entry / Exit Option

### (a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

- i) **UG Certificate in (Field of study/discipline)** - Programme duration: First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.
- iii) **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

### (b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

**Note:** The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

## 21. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

## **22. Transitory Regulations**

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

## **23. Minimum Instruction Days for a Semester:**

The minimum instruction days including exams for each semester shall be 90 days.

## **24. Medium of Instruction:**

The medium of instruction of the entire B. Tech undergraduate programme in Engineering & Technology (including examinations and project reports) will be in English only.

## **25. Student Transfers:**

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

## **26. General Instructions:**

- i. The academic regulations should be read as a whole for purpose of any interpretation.
- ii. Malpractices rules-nature and punishments are appended.
- iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
- iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- v. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
- vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

**ACADEMIC REGULATIONS (R23)  
FOR B. TECH. (LATERAL ENTRY SCHEME)**

*(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year 2024-25 onwards)*

**1. Award of the Degree**

- (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
- (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
  - (ii) Registers for 120 credits and secures all 120 credits.
- (b) **Award of B.Tech. degree with Honors** if he/she fulfils the following:
- (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
  - (ii) Registering for Honors is optional.
  - (iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

**3. Minimum Academic Requirements**

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.
- ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

**4. Course Pattern**

- i) The entire course of study is three academic years on semester pattern. ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
- iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

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

**INDUCTION PROGRAMME**

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

**B. Tech – I Year I Semester**

S.No.	Category	Title	L/D	T	P	Credits
1	BS&H	Linear Algebra & Calculus	3	0	0	3
2	BS&H	Engineering Physics	3	0	0	3
3	BS&H	Communicative English	2	0	0	2
4	Engineering Science	Basic Civil & Mechanical Engineering	3	0	0	3
5	Engineering Science	Introduction to Programming	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	Engineering Science	Engineering Workshop	0	0	2	1.5
9	Engineering Science	IT Workshop	0	0	2	1
10	Engineering Science	Computer Programming Lab	0	0	3	1.5
11	BS&H	Health and Wellness, Yoga and Sports	0	-	1	0.5
<b>Total</b>						<b>20.5</b>

**B. Tech – I Year II Semester**

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Differential Equations & Vector Calculus	3	0	0	3
2	BS&H	Chemistry	3	0	0	3
3	Engineering Science	Engineering Graphics	1	0	4	3
4	Engineering Science	Basic Electrical & Electronics Engineering	3	0	0	3
5	Professional Core	Data structures	3	0	0	3
6	BS&H	Chemistry Lab	0	0	2	1
7	Engineering Science	Electrical & Electronics Engineering workshop	0	0	3	1.5
8	Professional Core	Data structures Lab	0	0	3	1.5
9	Professional Core	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
<b>Total</b>						<b>19.5</b>

**I Year-I Semester**

L	T	P	C
3	0	0	3

**LINEAR ALGEBRA & CALCULUS****(Common to All Branches of****Engineering) Course Objectives:**

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

**Course Outcomes:**

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

- develop matrix algebra techniques that is needed by engineers for practical applications.  
□ to find the eigen values and eigen vectors and solve the problems by using linear transformation □ learn important tools of calculus in higher dimensions.
- familiarize with functions of several variables which is useful in optimization.
- familiarize with double and triple integrals of functions of several variables in two and three dimensions.

**UNIT - I: Matrices**

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method

System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

**UNIT- II: Linear Transformation and Orthogonal Transformation:**

Eigen values, Eigen vectors and their properties (without Proof), Diagonalization of a matrix, CayleyHamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation

**UNIT- III : Calculus**

**Mean Value Theorems:** Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

**UNIT- IV : Partial differentiation and Applications (Multi variable calculus)**

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT – V : Multiple Integrals (Multi variable Calculus)**

Duble integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

**Text books:**

1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

**Reference Books:**

1. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand, 2021

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**I Year-I Semester****ENGINEERING PHYSICS**

(Common for all branches of Engineering)

**Course Objectives:**

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

**Course Outcomes:**

CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.

CO2: Familiarize with the basics of crystals and their structures.

CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.

CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.

CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids. CO6:

Identify the type of semiconductor using Hall effect.

**UNIT I Wave Optics**

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization -

Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

**UNIT II Crystallography and X-ray diffraction**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

### **UNIT III Dielectric and Magnetic Materials**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

### **UNIT IV Quantum Mechanics and Free electron Theory**

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

### **UNIT V Semiconductors**

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

#### **Textbooks:**

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

#### **Reference Books:**

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

**Web Resources:** <https://www.loc.gov/rr/scitech/selected-internet/physics.html>

## I Year-I Semester

L	T	P	C
2	0	0	2

**COMMUNICATIVE ENGLISH**

(Common to All Branches of Engineering)

**Course Objectives:**

The main objective of introducing this course, *Communicative English*, is to facilitate using Listening, Reading, Speaking and Writing skills effectively by the students. It should result in their better comprehending abilities, oral presentations, reporting useful information and with enhanced knowledge of grammatical structures and vocabulary. This course helps the students in using speaking and writing (productive) skills more efficiently and to make them industryready

**Course Outcomes**

- **By the end of the course the students will have** Learned how to understand the context, topic, and specific information from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence sand use appropriate words and correct word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions.(not required)
- Improved communicative competence in formal and informal contexts and for social and academic purposes.
- Critically comprehending and appreciatingeading /listening texts and to write summaries based on global comprehension of these texts.
- Writing coherent paragraphs essays, letters/e-mails and resume.

**Instructions:**

1. The reading texts can be given as podcasts to the students so that their listening skills can be enhanced
2. While listening and reading to the text can be given as homework, the class work for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understanding it from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic ( pleasure) purposes has to be inculcated in the students. So training has to be given in intensive and extensive reading strategies.
4. Writing for both academic (assignments, examinations, reports, e-mails/letters etc)
5. The writing tasks given in the class are to be self and peer evaluated by the students before they are finally graded by the faculty.

Note: Please note that the texts given here are just contexts for teaching various language skills and sub skills. The students' ability to use language cannot be confined to comprehending or using the language related to the given texts (textbooks). The given texts can be used only for practice.

6. All the activities to develop language skills have to be integrated and interconnected, within each unit and across the units.
7. Use as many supplementary materials as possible in various modes ( Audio, visual and printed versions) in the classroom so that the students get multimode input and will know how to use language skills in the absence of the teacher.

## UNIT I

### Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (Short story)

- Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
- Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
- Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.
- Writing:** Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.( That has to be part of the bridge course- 2 weeks before the actual academic programme starts)
- Grammar:** Parts of Speech, Basic Sentence Structures-forming questions **Vocabulary:** Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

## UNIT II

### Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

- Listening:** Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
- Speaking:** Discussion in pairs/small groups on specific topics followed by short structure talks.
- Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
- Writing:** Structure of a paragraph - Paragraph writing (specific topics)
- Grammar:** Cohesive devices -linkers, use of articles and zero article prepositions. **Vocabulary:** Homonyms, Homophones, Homographs.

## UNIT III

### Lesson: BIOGRAPHY: Steve Jobs

- Listening:** Listening for global comprehension and summarizing what is listened to.
- Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed
- Reading:** Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
- Writing:** Summarizing, Note-making, paraphrasing

**Grammar:** Verbs - tenses; subject-verb agreement; Compound words, Collocations

**Vocabulary:** Compound words, Collocations

#### UNIT IV

##### Lesson: **INSPIRATION: The Toys of Peace** by Saki

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

**Writing:** Letter Writing: Official Letters, Resumes

**Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice

**Vocabulary:** Words often confused, Jargons

#### UNIT V

##### Lesson: **MOTIVATION: The Power of Intrapersonal Communication (An Essay)**

**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

**Speaking:** Formal oral presentations on topics from academic contexts

**Reading:** Reading comprehension.

**Writing:** Writings structured essays on specific topics.

**Grammar:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject-verb agreement)

**Vocabulary:** Technical Jargons

#### **Textbooks:**

1. Pathfinder: Communicative English for Undergraduate Students, 1<sup>st</sup> Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Suggestion: Instead of giving the syllabus in the form of textbooks it would be better to procure the soft copies of individual texts ( stories or poems or biographies and non-fiction texts) by the university and make them available on the university website for registered students to access and download

#### **Reference Books:**

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.

4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

**Web Resources:**

**GRAMMAR:**

1. [www.bbc.co.uk/learningenglish](http://www.bbc.co.uk/learningenglish)
2. <https://dictionary.cambridge.org/grammar/british-grammar/>
3. [www.eslpod.com/index.html](http://www.eslpod.com/index.html)
4. <https://www.learngrammar.net/>
5. <https://english4today.com/english-grammar-online-with-quizzes/>
6. <https://www.talkenglish.com/grammar/grammar.aspx>

**VOCABULARY**

1. <https://www.youtube.com/c/DailyVideoVocabulary/videos>
2. [https://www.youtube.com/channel/UC4cmBAit8i\\_NJZE8qK8sfpA](https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA)

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**I Year-I Semester****BASIC CIVIL & MECHANICAL ENGINEERING**  
**(Common to All branches of Engineering)****Course Objectives:**

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

**Course Outcomes:** On completion of the course, the student should be able to:

- CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
- CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
- CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
- CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
- CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

**UNIT I**

**Basics of Civil Engineering:** Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

**UNIT II**

**Surveying:** Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

**UNIT III**

**Transportation Engineering** Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

**Water Resources and Environmental Engineering:** Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

**Textbooks:**

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

**Reference Books:**

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38<sup>th</sup> Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10<sup>th</sup> Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

**PART B: BASIC MECHANICAL ENGINEERING**

**Course Objectives:** The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

**Course Outcomes:** On completion of the course, the student should be able to CO1: Understand the different manufacturing processes.

CO2: Explain the basics of thermal engineering and its applications.

CO3: Describe the working of different mechanical power transmission systems and power plants.

CO4: Describe the basics of robotics and its applications.

## UNIT I

**Introduction to Mechanical Engineering:** Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

**Engineering Materials** - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

## UNIT II

**Manufacturing Processes:** Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

**Thermal Engineering** – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

## UNIT III

**Power plants** – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission** - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

**Introduction to Robotics** - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

### Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

### Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

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**I Year-I Semester**

## **INTRODUCTION TO PROGRAMMING** **(Common to All branches of Engineering)**

### **Course Objectives:**

**The objectives of this course is to acquire knowledge on the**

- i. To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- ii. To enable effective usage of Control Structures and Implement different operations on arrays.
- iii. To demonstrate the use of Strings and Functions.
- iv. To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- v. To understand structures and unions and illustrate the file concepts and its operations.
- vi. To impart the Knowledge Searching and Sorting Techniques

### **UNIT-I Introduction to Computer Problem Solving:**

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

### **UNIT-II Introduction to C Programming:**

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

### **UNIT-III Arrays:**

Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

### **UNIT-IV Functions:**

Introduction Function : Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion. Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

## UNIT-V

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

**Note:** The syllabus is designed with C Language as the fundamental language of implementation.

### Course Outcomes:

At the end of the Course, Student should be able to:

- i. Illustrate the Fundamental concepts of Computers and basics of computer programming and problem-solving approach
- ii. Understand the Control Structures, branching and looping statements
- iii. Use of Arrays and Pointers in solving complex problems.
- iv. Develop Modular program aspects and Strings fundamentals.
- v. Demonstrate the ideas of User Defined Data types, files. Solve real world problems using the concept of Structures, Unions and File operations.

### Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage.
2. How to solve it by Computer, R. G. Dromey, and Pearson Education.
3. Programming In C A-Practical Approach. Ajay Mittal, Pearson

### References:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Computer Programming. Reema Thareja, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
4. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.
5. Let us C, Yaswanth Kanetkar, 16th Edition, BPB Publication.
6. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008

### Web References:

1. <http://www.c4learn.com/>
2. <http://www.geeksforgeeks.org/c/>
3. <http://nptel.ac.in/courses/122104019/>
4. <http://www.learn-c.org/>
5. <https://www.tutorialspoint.com/cprogramming/>

**I Year-I Semester**

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**COMMUNICATIVE ENGLISH LAB**  
**(Common to All Branches of****Engineering) Course Objectives:**

The main objective of introducing this course, *Communicative English Laboratory*, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. (That can be for theory paper) is to train the students in oral communication skills in real situations. Students will get trained in the basic communication skills and also make them ready to face job interviews. They will be helped to overcome the mother tongue/local language influence and neutralize their accent which makes their speech more intelligible to all listeners.

**Course Outcomes:**

By the end of the course, the students will be have

- Understand the different aspects of the English language oral communication with emphasis on Listening and Speaking S skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm and intonation for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions with polite turn taking strategies and sound more professional while communicating with others
- Create effective resonate and prepare them to face interviews communicate appropriately in corporate settings.

**List of Topics:**

1. Vowels & Consonants( Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules(No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. ( This can be part of theory course)Resume Writing, Cover letter, SOP
6. Group Discussions-methods & practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

**Suggested Software:**

- Walden InfoTech
- Young India Films

**Reference Books:**

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.( This can be for theory and not for lab)

2. Samson T : Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016
4. Jayashree, M Let's Hear them Speak: Developing Listening-Speaking skills in English. Sage Publications
5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012. ( That is for reading and writing and can be used in theory classes but not in Lab)
6. T.Balasubramanyam, A Textbook of English Phonetics for Indian Students, (3rd Ed) Trinity Press. (This is all theory and can be for MA English students but not for B.Tech students)

**Web Resources:**

**Spoken English:**

1. [www.esl-lab.com](http://www.esl-lab.com)
2. [www.englishmedialab.com](http://www.englishmedialab.com)
3. [www.englishinteractive.net](http://www.englishinteractive.net)
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. [https://www.youtube.com/c/mmmEnglish\\_Emma/featured](https://www.youtube.com/c/mmmEnglish_Emma/featured)
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. [https://www.youtube.com/channel/UCV1h\\_cBE0Drdx19qkTM0WNw](https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw)
12. <https://www.linguahouse.com/en-GB>
13. <https://www.ted.com/watch/ted-ed>

**Voice & Accent:**

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. [https://www.youtube.com/channel/UC\\_OskgZBoS4dAnVUgJVexc](https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc)
4. [https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp\\_IA](https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA)

I Year-I Semester

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## ENGINEERING PHYSICS LAB (Common to All Branches of Engineering)

### Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

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

CO1: Operate optical instruments like travelling microscope and spectrometer. CO2:

Estimate the wavelengths of different colours using diffraction grating.

CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.

CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic

materials respectively. CO5: Calculate the band gap of a given semiconductor. CO6: Identify the type of semiconductor using Hall effect.

### List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods. 9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.

16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

**Note:** Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

**References:**

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

**Web Resources**

- [www.vlab.co.in](http://www.vlab.co.in)  
<https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype>

I Year-I Semester

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## ENGINEERING WORKSHOP

(Common to All branches of Engineering)

### Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

### Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.

CO3: Apply fitting operations in various applications.

CO4: Apply basic electrical engineering knowledge for House Wiring Practice

### SYLLABUS

1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
  - a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
  - a) Tapered tray    b) Conical funnel    c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
  - a) V-fit    b) Dovetail fit c) Semi-circular fit    d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
  - a) Parallel and series    b) Two-way switch    c) Godown lighting
  - d) Tube light    e) Three phase motor    f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

**Textbooks:**

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

**Reference Books:**

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

I Year-I Semester

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## IT WORKSHOP

(Common to all branches of Engineering)

### Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

### Course Outcomes:

CO1: Perform Hardware troubleshooting.

CO2: Understand Hardware components and inter dependencies.

CO3: Safeguard computer systems from viruses/worms.

CO4: Document/ Presentation preparation.

CO5: Perform calculations using spreadsheets.

### PC Hardware & Software Installation

**Task 1:** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Task 2:** Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

**Task 3:** Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

**Task 4:** Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

**Task 5:** Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

### **Internet & World Wide Web**

**Task1:** Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

**Task 2:** Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

**Task 3:** Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

**Task 4:** Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

### **LaTeX and WORD**

**Task 1 – Word Orientation:** The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

**Task 2:** Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

**Task 3:** Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

**Task 4:** Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

### **EXCEL**

**Excel Orientation:** The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that

would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

**Task 1:** Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 2:** Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

### **LOOKUP/VLOOKUP**

**Task 3:** Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

### **POWER POINT**

**Task 1:** Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

**Task 2:** Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

**Task 3:** Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

### **AI TOOLS – Chat GPT**

**Task 1:** Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

**Task 2:** Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

**Task 3:** Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

**Reference Books:**

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2<sup>nd</sup> edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3<sup>rd</sup> edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3<sup>rd</sup> edition

I Year-I Semester

L	T	P	C
0	0	3	1.5

## COMPUTER PROGRAMMING LAB (Common to All branches of Engineering)

### Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

### Course Outcomes:

CO1: Read, understand, and trace the execution of programs written in C language.

CO2: Select the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

## UNIT I

### WEEK 1

**Objective:** Getting familiar with the programming environment on the computer and writing the first program.

### Suggested Experiments/Activities:

**Tutorial 1:** Problem-solving using Computers.

**Lab1:** Familiarization with programming environment

- i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- ii) Exposure to Turbo C, gcc
- iii) Writing simple programs using printf(), scanf()

### WEEK 2

**Objective:** Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

### Suggested Experiments /Activities:

**Tutorial 2:** Problem-solving using Algorithms and Flow charts.

**Lab 1:** Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- i) Sum and average of 3 numbers
- ii) Conversion of Fahrenheit to Celsius and vice versa
- iii) Simple interest calculation

**WEEK 3**

**Objective:** Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

**Suggested Experiments/Activities:**

**Tutorial 3:** Variable types and type conversions:

**Lab 3:** Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

**UNIT II****WEEK 4**

**Objective:** Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

**Suggested Experiments/Activities:**

**Tutorial4:** Operators and the precedence and as associativity:

**Lab4:** Simple computational problems using the operator' precedence and associativity

- i) Evaluate the following expressions.
  - a.  $A+B*C+(D*E) + F*G$
  - b.  $A/B*C-B+A*D/3$
  - c.  $A+++B---A$
  - d.  $J= (i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

**WEEK 5**

**Objective:** Explore the full scope of different variants of —if constructl namely if-else, null-else, if-else if\*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for —if constructl.

**Suggested Experiments/Activities:**

**Tutorial 5:** Branching and logical expressions:

**Lab 5:** Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

**WEEK 6**

**Objective:** Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

**Suggested Experiments/Activities:**

**Tutorial 6:** Loops, while and for loops

**Lab 6:** Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not. iii) Compute sine and cos series iv) Checking a number palindrome
- v) Construct a pyramid of numbers.

## UNIT III

### WEEK 7:

**Objective:** Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

**Suggested Experiments/Activities:**

**Tutorial 7:** 1 D Arrays: searching.

**Lab 7:** 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array. iii) The reverse of a 1D integer array iv) Find 2's complement of the given binary number. v) Eliminate duplicate elements in an array.

### WEEK 8:

**Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

**Suggested Experiments/Activities:**

**Tutorial 8:** 2 D arrays, sorting and Strings.

**Lab 8:** Matrix problems, String operations, Bubble sort

- i) Addition of two matrices ii) Multiplication two matrices iii) Sort array elements using bubble sort iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

## UNIT IV

### WEEK 9:

**Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

**Suggested Experiments/Activities:**

**Tutorial 9:** Pointers, structures and dynamic memory allocation

**Lab 9:** Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

**WEEK 10:**

**Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

**Suggested Experiments/Activities:**

**Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists

**Lab10 :** Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

**UNIT V**

**WEEK 11:**

**Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

**Suggested Experiments/Activities:**

**Tutorial 11:** Functions, call by value, scope and extent,

**Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

**WEEK 12:**

**Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

**Suggested Experiments/Activities:**

**Tutorial 12:** Recursion, the structure of recursive calls

**Lab 12:** Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

**WEEK 13:**

**Objective:** Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

**Suggested Experiments/Activities:**

**Tutorial 13:** Call by reference, dangling pointers

**Lab 13:** Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

**WEEK14:**

**Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

**Suggested Experiments/Activities:**

**Tutorial 14:** File handling

**Lab 14:** File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command-line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

**Textbooks:**

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

I Semester

L	T	P	C
0	0	1	0.5

**HEALTH AND WELLNESS, YOGA AND SPORTS**

(Common to All branches of Engineering)

**Course Objectives:**

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

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

**CO1:** Understand the importance of yoga and sports for Physical fitness and sound health.

**CO2:** Demonstrate an understanding of health-related fitness components.

**CO3:** Compare and contrast various activities that help enhance their health.

**CO4:** Assess current personal fitness levels.

**CO5:** Develop Positive Personality

**UNIT I**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

**Activities:**

- i) Organizing health awareness programmes in community
- ii) Preparation of health profile
- iii) Preparation of chart for balance diet for all age groups

**UNIT II**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice. **Activities:**

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

**UNIT III**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

**Activities:**

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.  
Practicing general and specific warm up, aerobics
- ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

**Reference Books:**

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

**General Guidelines:**

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

**Evaluation Guidelines:**

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

II Semester

L	T	P	C
3	0	0	3

## DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches of Engineering)

### Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

### Course Outcomes:

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

- solve the differential equations related to various engineering fields.
- model engineering problems as higher order differential equations and solve analytically.
- identify solution methods for partial differential equations that model physical processes.
- interpret the physical meaning of different operators such as gradient, curl and divergence.
- estimate the work done against a field, circulation and flux using vector calculus.

### UNIT- I : Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits

### UNIT – II : Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

### UNIT – III : Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

### UNIT - IV : Vector differentiation

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

### UNIT –V : Vector integration

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

**Textbooks:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**Reference Books:**

1. Dennis G.Zill and Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

I Year-II Semester

L	T	P	C
3	0	0	3

**CHEMISTRY**

(Common to EEE, ECE, CSE, IT &amp; allied branches)

**Course Objectives:**

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches.

**Course Outcomes:** At the end of the course, the students will be able to:**CO1:** Compare the materials of construction for battery and electrochemical sensors.**CO2:** Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.**CO3:** Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.**CO4:** Apply the principle of Band diagrams in the application of conductors and semiconductors.**CO5:** Summarize the concepts of Instrumental methods.**UNIT I Structure and Bonding Models:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of  $\Psi$  and  $\Psi^2$ , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O<sub>2</sub> and CO, etc.  $\pi$ -molecular orbitals of butadiene and benzene, calculation of bond order.

**UNIT II Modern Engineering materials**

Semiconductors – Introduction, basic concept, application

Super conductors-Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

**UNIT III Electrochemistry and Applications**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

#### **UNIT IV Polymer Chemistry**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio-Degradable polymers - Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA).

#### **UNIT V Instrumental Methods and Applications**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC: Principle, Instrumentation and Applications.

##### **Textbooks:**

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

##### **Reference Books:**

1. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
2. J.D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> Edition, Wiley Publications, Feb.2008
3. Textbook of Polymer Science, Fred W. Billmeyer Jr, 3rd Edition

**I Year-II Semester**

L	T	P	C
1	0	4	3

**ENGINEERING GRAPHICS**  
(Common to All branches of Engineering)**Course Objectives:**

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

**Course Outcomes:**

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.

CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.

CO3: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind development of surfaces.

CO5: Prepare isometric and perspective sections of simple solids.

**UNIT I**

**Introduction:** Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

**Curves:** construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves.

**Scales:** Plain scales, diagonal scales and vernier scales.

**UNIT II**

**Orthographic Projections:** Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

**Projections of Straight Lines:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one

reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

**Projections of Planes:** regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

### **UNIT III**

**Projections of Solids:** Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

### **UNIT IV**

**Sections of Solids:** Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

**Development of Surfaces:** Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

### **UNIT V**

**Conversion of Views:** Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

**Computer graphics:** Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

#### **Textbook:**

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

#### **Reference Books:**

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

I Year-II Semester

L	T	P	C
3	0	0	3

## BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

### Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/electronic engineering and to acquire fundamental knowledge in the relevant field.

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

### Course Outcomes:

**CO1:** Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

**CO2:** Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.

**CO3:** Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.

**CO4:** Analyze different electrical circuits, performance of machines and measuring instruments.

**CO5:** Evaluate different circuit configurations, Machine performance and Power systems operation.

## PART A: BASIC ELECTRICAL ENGINEERING

### UNIT I DC & AC Circuits

**DC Circuits:** Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

**AC Circuits:** A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

## UNIT II Machines and Measuring Instruments

**Machines:** Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

**Measuring Instruments:** Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

## UNIT III Energy Resources, Electricity Bill & Safety Measures

**Energy Resources:** Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

**Electricity bill:** Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of —unitl used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

**Equipment Safety Measures:** Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

### Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

### Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.

### Web Resources:

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

## PART B: BASIC ELECTRONICS ENGINEERING

### Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

### UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

### UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

### UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

#### Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2009

#### Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

I Year-II Semester

L	T	P	C
3	0	0	3

## DATA STRUCTURES

(Common to CSE, IT & allied branches)

### Course Objectives:

- Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.
- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth-first search algorithms and understand the versatility of dequeues and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

### UNIT I

**Introduction to Linear Data Structures:** Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. **Searching Techniques:** Linear & Binary Search, **Sorting Techniques:** Bubble sort, Selection sort, Insertion Sort

### UNIT II

**Linked Lists:** Singly linked lists, representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

### UNIT III

**Stacks:** Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

### UNIT IV

**Queues:** Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc. **Dequeues:** Introduction to dequeues (double-ended queues), Operations on dequeues and their applications.

### UNIT V

**Trees:** Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals **Hashing:** Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

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

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

**Reference Books:**

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

L	T	P	C
0	0	2	1

**I Year-II Semester****CHEMISTRY LAB**

(Common to EEE, ECE, CSE, IT & allied branches)

**Course Objectives:**

- Verify the fundamental concepts with experiments.

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

CO1: Determine the cell constant and conductance of solutions.

CO2: Prepare advanced polymer Bakelite materials.

CO3: Measure the strength of an acid present in secondary batteries.

CO4: Analyse the IR spectra of some organic

compounds. CO5: Calculate strength of acid in Pb-

Acid battery. **List of Experiments:**

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy
10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

**Reference:**

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

I Year-II Semester

L	T	P	C
0	0	3	1.5

## **ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP**

**(Common to All branches of Engineering)**

### **Course Objectives:**

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

### **Course Outcomes:**

**CO1:** Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.

**CO2:** Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.

**CO3:** Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.

**CO4:** Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.

**CO5:** Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

### **Activities:**

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
  - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
  - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
  - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.

- Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

### **PART A: ELECTRICAL ENGINEERING LAB**

#### **List of experiments:**

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

#### **Reference Books:**

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

**Note:** Minimum Six Experiments to be performed.

### **PART B: ELECTRONICS ENGINEERING LAB**

#### **Course Objectives:**

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

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

- CO1: Identify & testing of various electronic components.
- CO2: Understand the usage of electronic measuring instruments.
- CO3: Plot and discuss the characteristics of various electron devices.
- CO4: Explain the operation of a digital circuit.

**List of Experiments:**

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices. **References:**

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4<sup>th</sup> Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

## I Year-II Semester

L	T	P	C
0	0	3	1.5

**DATA STRUCTURES LAB (Common to CSE, IT & allied branches of Engineering)****Course Objectives:**

Understand the significance of linear data structures in problem-solving and basic time/space complexity analysis.

- Create and manage linked lists to efficiently organize and manipulate data, emphasizing memory efficiency.
- Implement and apply stacks to manage program flow and solve problems involving expression evaluation and backtracking.
- Utilize queues to model real-world scenarios, such as process scheduling and breadth first search algorithms and understand the versatility of deques and prioritize data management using priority queues.
- Impart basic understanding of non-linear data structures such as trees.
- Explore basic concepts of hashing and apply it to solve problems requiring fast data retrieval and management.

**List of Experiments:****Exercise 1: Array Manipulation**

- Write a program to reverse an array.
- C Programs to implement the Searching Techniques – Linear & Binary Search
- C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

**Exercise 2: Linked List Implementation**

- Implement a singly linked list and perform insertion and deletion operations.
- Develop a program to reverse a linked list iteratively and recursively.
- Solve problems involving linked list traversal and manipulation.

**Exercise 3: Linked List Applications**

- Create a program to detect and remove duplicates from a linked list.
- Implement a linked list to represent polynomials and perform addition.
- Implement a double-ended queue (deque) with essential operations.

**Exercise 4: Double Linked List Implementation**

- Implement a doubly linked list and perform various operations to understand its properties and applications.

- ii) Implement a circular linked list and perform insertion, deletion, and traversal.

**Exercise 5: Stack Operations**

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

**Exercise 6: Queue Operations**

- i) Implement a queue using arrays and linked lists.
- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

**Exercise 7: Stack and Queue Applications**

- i) Use a stack to evaluate an infix expression and convert it to postfix.
- ii) Create a program to determine whether a given string is a palindrome or not.
- iii) Implement a stack or queue to perform comparison and check for symmetry

**Exercise 8: Binary Search Tree**

- i) Implementing a BST using Linked List.
- ii) Traversing of BST.

**Exercise 9: Hashing**

- i) Implement a hash table with collision resolution techniques.
- ii) Write a program to implement a simple cache using hashing.

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

- Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
- Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
- Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
- Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between dequeues and priority queues, and apply them appropriately to solve data management challenges.
- Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
- Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

**Textbooks:**

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

**Reference Books:**

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

I Year-II Semester

L	T	P	C
0	0	1	0.5

## **NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE** (Common to All branches of Engineering)

### **Course Objectives:**

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

- Course Outcomes:** After completion of the course the students will be able to
- CO1:** Understand the importance of discipline, character and service motto.
  - CO2:** Solve some societal issues by applying acquired knowledge, facts, and techniques.
  - CO3:** Explore human relationships by analyzing social problems.
  - CO4:** Determine to extend their help for the fellow beings and downtrodden people.
  - CO5:** Develop leadership skills and civic responsibilities.

### **UNIT I            Orientation**

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

#### **Activities:**

- i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

### **UNIT II            Nature & Care**

#### **Activities:**

- i) Best out of waste competition.
- ii) Poster and signs making competition to spread environmental awareness.
- iii) Recycling and environmental pollution article writing competition.
- iv) Organising Zero-waste day.
- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

### **UNIT III            Community Service**

#### **Activities:**

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health,
  - i. Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

#### Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 ( ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., —Introduction to Environmental Engineeringl, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. —Introduction to Environmental Engineering and Science, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

#### General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

#### Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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### B.Tech. II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS&H	Mathematical Foundations of Computer Science	3	0	0	3
2	BS&H	Universal Human Values– Understanding Harmony	2	1	0	3
3	Engineering Science	Digital Logic & Computer Organization	3	0	0	3
4	Professional Core	Software Engineering	3	0	0	3
5	Professional Core	Object Oriented Programming Through Java	3	0	0	3
6	Professional Core	CASE Tools Lab	0	0	3	1.5
7	Professional Core	Object Oriented Programming Through Java Lab	0	0	3	1.5
8	Skill Enhancement Course	Python Programming	0	1	2	2
9	Audit Course	Environmental Science	2	0	0	-
<b>Total</b>			<b>16</b>	<b>2</b>	<b>8</b>	<b>20</b>

### B.Tech. II Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Managerial Economics and Financial Analysis	2	0	0	2
2	Engineering Science/ Basic Science	Probability & Statistics	3	0	0	3
3	Professional Core	Operating Systems	3	0	0	3
4	Professional Core	Database Management Systems	3	0	0	3
5	Professional Core	Formal Languages and Automata Theory	2	1	0	3
6	Professional Core	Operating Systems Lab	0	0	3	1.5
7	Professional Core	Database Management Systems Lab	0	0	3	1.5
8	Skill Enhancement Course	Full Stack Development –I	0	1	2	2
9	BS&H	Design Thinking & Innovation	1	0	2	2
<b>Total</b>			<b>14</b>	<b>2</b>	<b>10</b>	<b>21</b>
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

## MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

### Course Objectives:

- CO1: To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic, and truth tables.
- CO2: To understand about elementary of combinatorics, the principle of inclusion and exclusion and the pigeonhole principle.
- CO3: To expose the students to Binary relations, posets, Hasse diagram, lattice, and discuss various properties of relations.
- CO4: To understand Algebraic structures like groups, semigroups, monoids. CO5: To introduce generating functions and recurrence relations.

### Course Outcomes:

1. Recall the concepts of Mathematical logic and statement & predicate calculus
2. Recall the concepts of combinatorics, set theory, posets and lattices
3. Recall the concepts of algebraic structures, recurrence relations and generating functions
4. Use and interpret the concepts of Mathematical logic and statement & predicate calculus
5. Use and interpret the concepts of combinatorics, set theory, posets and lattices
6. Use and interpret the concepts of algebraic structures, recurrence relations and generating functions
7. Apply the concepts of discrete mathematical structures to computer science and engineering

### Unit-I:

#### Mathematical Logic

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

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

### Unit-II:

#### Functions & Relations

Set Theory: Introduction, Operations on Binary Sets, Principle of Inclusion and Exclusion, Relations: Properties of Binary Relations, Relation Matrix and Digraph, Operations on Relations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering Relations, Hasse Diagrams, Functions: Bijective Functions, Composition of Functions, Inverse Functions, Permutation Functions, Recursive Functions, Lattice and its Properties

### Unit-III:

#### Algebraic Structures and Number Theory

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

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

#### **Unit-IV:**

##### **Recurrence Relations**

Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations

#### **Unit-V:**

##### **Graph Theory**

Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs)

#### **Text Books:**

1. J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to C Sc, Tata McGraw Hill, 1997
2. C. L. Liu and , Elements of Discrete Mathematics-A Computer Oriented Approach

#### **Reference Books:**

1. Kenneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.
2. Discrete Mathematics for Computer Scientists and Mathematicians, J.L.Mott, A. Kandel, T. P. Baker, 2nd Edition, Prentice Hall of India.
3. Dr. D S Chandrasekharaiah, Mathematical Foundations of Computer Science, Prism Book Pvt Ltd.
4. S. K. Chakraborty and B.K. Sarkar , Discrete Mathematics, Oxford, 2011

## **UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**

### **Course Objectives:**

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

### **Course Outcomes:**

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

### **Course Topics**

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1 hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

## UNIT I

### **Introduction to Value Education (6 lectures and 3 tutorials for practice session)**

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

## UNIT II

### **Harmony in the Human Being (6 lectures and 3 tutorials for practice session)**

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self

Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self

Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

## UNIT III

### **Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)**

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect

Lecture 16: Other Feelings, Justice in Human-to-Human Relationship

Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

#### **UNIT IV**

##### **Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)**

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

#### **UNIT V**

##### **Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)**

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

#### **Practice Sessions for**

### **UNIT I – Introduction to Value Education**

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

### **Practice Sessions for UNIT II – Harmony in the Human Being**

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

### **Practice Sessions for UNIT III – Harmony in the Family and Society**

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

### **Practice Sessions for UNIT IV – Harmony in the Nature (Existence)**

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

### **Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics**

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order **Readings:**

#### **Textbook and Teachers Manual a.**

The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

#### **Reference Books**

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English) **Mode of Conduct:**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and selfexploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

**Online Resources:**

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%20I%20Teaching%20Material/D3S2%20Respect%20July%202023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDPSI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicteindia.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202325%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-humanvalues/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. [https://onlinecourses.swayam2.ac.in/aic22\\_ge23/preview](https://onlinecourses.swayam2.ac.in/aic22_ge23/preview)

## DIGITAL LOGIC & COMPUTER ORGANIZATION

### Course Objectives:

The main objectives of the course is to

- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

### Course Outcomes:

After completion of the course, students will be able to

1. Differentiate between combinational and sequential circuits based on their characteristics and functionalities. (L2)
2. Demonstrate an understanding of computer functional units. (L2)
3. Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems. (L3)
4. Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability. (L3)
5. Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques. (L3)

### UNIT – I:

**Data Representation:** Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes

**Digital Logic Circuits-I:** Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

### UNIT – II:

**Digital Logic Circuits-II:** Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

**Basic Structure of Computers:** Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

### UNIT – III:

**Computer Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

**Processor Organization:** Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

**UNIT – IV:**

**The Memory Organization:** Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

**UNIT – V:**

**Input/Output Organization:** Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

**Textbooks:**

1. Digital Logic Design, 6<sup>th</sup> Edition, M. Morris Mano, Pearson Education.
2. Computer Systems Architecture, M.Moris Mano, 3<sup>rd</sup>Edition, Pearson
3. Computer Organization and Architecture, William Stallings, 11<sup>th</sup>Edition, Pearson.

**Reference Books:**

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6<sup>th</sup> edition, McGraw Hill
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier
3. Fundamentals of Logic Design, Roth, 5<sup>th</sup>Edition, Thomson

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/106/103/106103068/>

## SOFTWARE ENGINEERING

### Course Objectives:

The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures. **Course Outcomes:**

After completion of the course, students will be able to

1. Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance (L3)
2. Analyse various software engineering models and apply methods for design and development of software projects. (L4)
3. Develop system designs using appropriate techniques. (L3)
4. Understand various testing techniques for a software project. (L2)
5. Apply standards, CASE tools and techniques for engineering software projects (L3)

### UNIT I:

**Introduction:** Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

**Software Life Cycle Models:** Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

### UNIT II:

**Software Project Management:** Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

**Requirements Analysis and Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

### UNIT III:

**Software Design:** Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

**Agility:** Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

**Function-Oriented Software Design:** Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

**User Interface Design:** Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

#### UNIT IV:

**Coding And Testing:** Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.  
**Software Reliability And Quality Management:** Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

#### UNIT V:

**Computer-Aided Software Engineering (Case):** CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

**Software Maintenance:** Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

**Software Reuse:** reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

#### Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5<sup>th</sup> Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9<sup>th</sup> Edition, McGraw Hill International Edition.

#### Reference Books:

1. Software Engineering, Ian Sommerville, 10<sup>th</sup> Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

#### e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>
- 2) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01260589506387148827\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview)
- 3) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_013382690411003904735\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview)

## OBJECT ORIENTED PROGRAMMING THROUGH JAVA

### Course Objectives:

The learning objectives of this course are to:

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

### Course Outcomes:

After completion of the course, students will be able to

1. Analyze problems, design solutions using OOP principles, and implement them efficiently in Java. (L4)
2. Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects (L4)
3. Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch. (L3)
4. Apply Competence in handling exceptions and errors to write robust and fault-tolerant code. (L3)
5. Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX. (L3)

### UNIT I

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

**Data Types, Variables, and Operators :**Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final,

**Introduction to Operators,** Precedence and Associativity of Operators, Assignment Operator ( = ), Basic Arithmetic Operators, Increment (++) and Decrement (--) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

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

### UNIT II

**Classes and Objects:** Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class

Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

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

### UNIT III

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

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

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

### UNIT IV

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

**Exception Handling:** Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

**Java I/O and File:** Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

### UNIT V

**String Handling in Java:** Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

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

**Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

**Text Books:**

- 1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
- 2) Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
- 3) JAVA for Programmers, Paul Deitel, Harvey Deitel, 4<sup>th</sup> Edition, Pearson.

**References Books:**

- 1) The complete Reference Java, 11<sup>th</sup> edition, Herbert Schildt, TMH
- 2) Introduction to Java programming, 7<sup>th</sup> Edition, Y Daniel Liang, Pearson

**Online Resources:**

- 1) <https://nptel.ac.in/courses/106/105/106105191/>
- 2) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_012880464547618816347\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview)

## CASE TOOLS LAB

### Course Objectives

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

### Course Outcomes

1. Ability to translate end-user requirements into system and software requirements
2. Ability to generate a high-level design of the system from the software requirements
3. Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

### Course Level Learning Outcomes (Cos)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

### List of Experiments:

Do the following 8 exercises for any two projects given in the list of sample projects or any other projects:

- 1) Development of problem statement.
- 2) Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents.
- 3) Preparation of Software Configuration Management and Risk Management related documents.
- 4) Study and usage of any Design phase CASE tool
- 5) Performing the Design by using any Design phase CASE tools.
- 6) Develop test cases for unit testing and integration testing
- 7) Develop test cases for various white box and black box testing techniques. **Sample Projects:**

1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System
8. Credit Card Processing
9. E-book management System.
10. Recruitment system

### Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

## OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

### Course Objectives:

The aim of this course is to

- Practice object-oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

### Course Outcomes:

After completion of the course, students will be able to

1. Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling. (L2)
2. Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively. (L3)
3. Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, JDBC, and other utility classes. (L2)
4. Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges. (L3)
5. Proficiently construct graphical user interface (GUI) applications using JavaFX (L4)

### Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

### Sample Experiments:

#### Exercise – 1:

- a) Write a JAVA program to display default value of all primitive data type of JAVA
- b) Write a java program that display the roots of a quadratic equation  $ax^2+bx=0$ . Calculate the discriminant D and basing on value of D, describe the nature of root.

#### Exercise - 2

- a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- b) Write a JAVA program to sort for an element in a given list of elements using bubble sort
- c) Write a JAVA program using StringBuffer to delete, remove character.

#### Exercise - 3

- a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- b) Write a JAVA program implement method overloading.
- c) Write a JAVA program to implement constructor.
- d) Write a JAVA program to implement constructor overloading.

**Exercise - 4**

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

**Exercise - 5**

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

**Exercise - 6**

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses
- c) Write a JAVA program for creation of Java Built-in Exceptions
- d) Write a JAVA program for creation of User Defined Exception

**Exercise - 7**

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds,(Repeat the same by implementing Runnable) b) Write a program illustrating **is Alive** and **join ()**
- c) Write a Program illustrating Daemon Threads.
- d) Write a JAVA program Producer Consumer Problem

**Exercise – 8**

- a) Write a JAVA program that import and use the user defined packages
- b) Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
- c) Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

**Exercise – 9**

- a) Write a JAVA program for handling mouse events
- b) Write a JAVA program for handling Keyboard events

**Exercise – 10**

- a) Write a JAVA program that allows user to draw lines, rectangles and ovals.
- b) Write a Java Program for Button click Message using Swings.

**References Books:**

1. P. J. Deitel, H. M. Deitel, “Java for Programmers”, Pearson Education, PHI, 4th Edition, 2007.
2. P. Radha Krishna, “Object Oriented Programming through Java”, Universities Press, 2nd Edition, 2007
3. Bruce Eckel, “Thinking in Java”, Pearson Education, 4th Edition, 2006.
4. Sachin Malhotra, Saurabh Chaudhary, “Programming in Java”, Oxford University Press, 5th Edition, 2010.

**Online Learning Resources:**

<https://java-iitd.vlabs.ac.in/>

<http://peterindia.net/JavaFiles.html>

## **PYTHON PROGRAMMING (Skill Enhancement Course)**

### **Course Objectives:**

The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these **Course Outcomes:**

After completion of the course, students will be able to

1. showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions. (L4)
2. apply Python programming concepts to solve a variety of computational problems (L3)
3. understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
4. become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
5. exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3) **UNTI-I:**

**History of Python Programming Language**, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

**Parts of Python Programming Language:** Identifiers, Keywords, Statements and Expressions,

Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

**Control Flow Statements:** if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

**Sample Experiments:**

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
  - i) Arithmetic Operators
  - ii) Relational Operators
  - iii) Assignment Operators
  - iv) Logical Operators
  - v) Bit wise Operators
  - vi) Ternary Operator
  - vii) Membership Operators
  - viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

**UNIT-II:**

**Functions:** Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, \*args and \*\*kwargs, Command Line Arguments.

**Strings:** Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

**Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

**Sample Experiments:**

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
  - i. Addition
  - ii. Insertion
  - iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

### UNIT-III:

**Dictionaries:** Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

#### Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

### UNIT-IV:

**Files:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

**Object-Oriented Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

#### Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output files should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.

23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

#### **UNIT-V:**

**Introduction to Data Science:** Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

#### **Sample Experiments:**

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows: a) Apply head () function to the pandas data frame
- b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

#### **Reference Books:**

1. Gowri shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

#### **Online Learning Resources/Virtual Labs:**

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

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## ENVIRONMENTAL SCIENCE

### Course Objectives:

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

### UNIT I

**Multidisciplinary Nature of Environmental Studies:** – Definition, Scope and Importance – Need for Public Awareness.

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

### UNIT II

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

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

**Biodiversity and its Conservation :** Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### UNIT III

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

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

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

### UNIT IV

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

### UNIT V

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

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

### Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company

4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

**References:**

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice Hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

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## MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

### Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

### Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

### UNIT - I

#### Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

### UNIT - II

#### Production And Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

### **UNIT - III**

#### **Business Organizations and Markets**

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

### **UNIT - IV**

#### **Capital Budgeting**

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

### **UNIT - V**

#### **Financial Accounting and Analysis**

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

#### **Textbooks:**

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

#### **Reference Books:**

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

**Online Learning Resources:** <https://www.slideshare.net/123ps/managerial-economics-ppt>  
<https://www.slideshare.net/rossanz/production-and-cost-45827016>  
<https://www.slideshare.net/darkyla/business-organizations-19917607>  
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>  
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>  
<https://www.slideshare.net/ashu1983/financial-accounting>

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## PROBABILITY & STATISTICS

(Common to CSE, CSE (AI &ML), CSE(IoT), CSE(AI), AI &ML, CS, IT)

### Course Outcomes:

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

- Acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools
- Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.
- Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.
- Analyze to test various hypotheses included in theory and types of errors for large samples.
- Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems.

### UNIT I:

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

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

### UNIT II:

#### Probability and Distributions:

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

### UNIT III:

#### Sampling Theory:

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

### UNIT IV:

#### Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance- Confidence limits-Test of significance for large samples-single and two means – single and two proportions- Student's t- distribution- significance test of a sample mean – significance test of difference between sample means.F-test, chi-square test and test of goodness of fit.

### UNIT V:

#### Regression analysis:

Method of least squares – Straight line – Parabola – Exponential – Power curves. Regression  
Regression coefficients and properties – Curvilinear Regression, Multiple Regression -  
Correlation –Correlation coefficient – Rank correlation

**Textbooks:**

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

**Reference Books:**

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
2. S. Ross, a First Course in Probability, Pearson Education India, 2002.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
1. [https://onlinecourses.nptel.ac.in/noc21\\_ma74/preview](https://onlinecourses.nptel.ac.in/noc21_ma74/preview)
2. [https://onlinecourses.nptel.ac.in/noc22\\_mg31/preview](https://onlinecourses.nptel.ac.in/noc22_mg31/preview)

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## OPERATING SYSTEMS

### Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

### Course Outcomes:

After completion of the course, students will be able to

1. Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication. (L1)
2. Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection. (L2)
3. Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. (L3)
4. Illustrate different conditions for deadlock and their possible solutions. (L2)
5. Analyze the memory management and its allocation policies. (L4)

### UNIT - I

**Operating Systems Overview:** Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

**System Structures:** Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

### UNIT - II

**Processes:** Process Concept, Process scheduling, Operations on processes, Inter-process communication.

**Threads and Concurrency:** Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

### UNIT – III

**Synchronization Tools:** The Critical Section Problem, Peterson’s Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

**Deadlocks:** system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

### UNIT - IV

**Memory-Management Strategies:** Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

#### **UNIT - V**

**File System:** File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File System Mounting, Partitions and Mounting, File Sharing.

**Protection:** Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

#### **Text Books:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson , 2016

#### **Reference Books:**

1. Operating Systems -Internals and Design Principles, Stallings W, 9<sup>th</sup> edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3<sup>rd</sup> Edition, McGraw-Hill, 2013

#### **Online Learning Resources:**

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>

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## DATABASE MANAGEMENT SYSTEMS

### Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

### Course Outcomes:

After completion of the course, students will be able to

1. Understand the basic concepts of database management systems (L2)
2. Analyze a given database application scenario to use ER model for conceptual design of the database (L4)
3. Utilize SQL proficiently to address diverse query challenges (L3).
4. Employ normalization methods to enhance database structure (L3)
5. Assess and implement transaction processing, concurrency control and database recovery protocols in databases. (L4)

### UNIT I:

**Introduction:** Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

### UNIT II:

**Relational Model:** Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

### UNIT III:

**SQL:** Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries,

grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

#### UNIT IV:

**Schema Refinement (Normalization):** Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

#### UNIT V:

**Transaction Concept:** Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

#### Text Books:

- 1) Database Management Systems, 3<sup>rd</sup> edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5<sup>th</sup> edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

#### Reference Books:

- 1) Introduction to Database Systems, 8<sup>th</sup> edition, C J Date, Pearson.
- 2) Database Management System, 6<sup>th</sup> edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, 10<sup>th</sup> edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

#### Web-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01275806667282022456\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview)

## FORMAL LANGUAGES AND AUTOMATA THEORY

### Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Regular Language and Finite Automata and machines • To learn how to design Automata's and machines as Acceptors, Verifiers and Translators
- To understand the relation between Contexts free Languages, PDA and TM
- To learn how to design PDA as acceptor and TM as Calculators

### Course Outcomes:

#### By the end of the course students can

- Classify machines by their power to recognize languages.
- Summarize language classes & grammars relationship among them with the help of Chomsky hierarchy
- Employ finite state machines to solve problems in computing
- Illustrate deterministic and non-deterministic machines
- Quote the hierarchy of problems arising in the computer science

### UNIT I

**Finite Automata:** Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automata, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with  $\epsilon$ -Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

### UNIT II

**Regular Expressions,** Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

### UNIT III

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols,  $\epsilon$ -Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

#### UNIT IV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

#### UNIT V

**Turning Machine:** Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Undecidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

#### Text Books:

- 1) Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3<sup>rd</sup> Edition, Pearson, 2008
- 2) Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3<sup>rd</sup> Edition, PHI, 2007

#### Reference Books:

- 1) Elements of Theory of Computation, Lewis H.P. & Papadimition C.H., Pearson /PHI
- 2) Theory of Computation, V. Kulkarni, Oxford University Press, 2013
- 3) Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014

#### e-Resources:

- 1) <https://nptel.ac.in/courses/106/104/106104028/>

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## OPERATING SYSTEMS LAB

### Course Objectives:

The main objectives of the course are to

- Provide insights into system calls, file systems, semaphores,
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation
- Implement Bankers Algorithms to Avoid the Dead Lock

### Course Outcomes:

After completion of the course, students will be able to

1. Trace different CPU Scheduling algorithms (L2).
2. Implement Bankers Algorithms to Avoid the Dead Lock (L3).
3. Evaluate Page replacement algorithms (L5).
4. Illustrate the file organization techniques (L4).
5. Illustrate Inter process Communication and concurrent execution of threads (L4)

### Experiments covering the Topics:

- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

### Sample Experiments:

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms  
a) FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with  
a) Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition  
a) First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms  
a) FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies  
a) Sequential b) Indexed c) Linked

**Reference Books:**

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10<sup>th</sup> Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4<sup>th</sup> Edition, Pearson, 2016
3. Operating Systems -Internals and Design Principles, Stallings W, 9<sup>th</sup> edition, Pearson, 2018
4. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3<sup>rd</sup> Edition, McGraw- Hill, 2013

**Online Learning Resources:**

1. <https://www.cse.iitb.ac.in/~mythili/os/>
2. <http://peterindia.net/OperatingSystems.html>

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## DATABASE MANAGEMENT SYSTEMS LAB

### Course Objectives:

This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers

### Course Outcomes:

After completion of the course, students will be able to

1. Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment (L3)
2. Constructing and execute queries to manipulate and retrieve data from databases. (L3)
3. Develop application programs using PL/SQL. (L3)
4. Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality (L4)
5. Establish database connectivity through JDBC (Java Database Connectivity) (L3)

### Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

### Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to\_char, to\_number and to\_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next\_day, add\_months, last\_day, months\_between, least, greatest, trunc, round, to\_char, to\_date)
5.
  - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
  - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and nonindexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

**Reference Books:**

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007
4. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
5. Database Principles Fundamentals of Design Implementation and Management, 10<sup>th</sup> edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

**Online Learning Resources:**

1. <http://www.scoopworld.in>
2. <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>

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## **FULL STACK DEVELOPMENT – 1** **(Skill Enhancement Course) Course**

### **Objectives:**

The main objectives of the course are to

- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- Experiment with JavaScript to develop dynamic web pages and validate forms

### **Course Outcomes:**

1. Design Websites. (L6)
2. Apply Styling to web pages. (L3)
3. Make Web pages interactive. (L3)
4. Design Forms for applications. (L6)
5. Choose Control Structure based on the logic to be implemented. (L4)

### **Experiments covering the Topics:**

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events

### **Sample Experiments:**

#### **1. Lists, Links and Images**

- a. Write a HTML program, to explain the working of lists.  
Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
- b. Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
- c. Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
- d. Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100\*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

## 2. HTML Tables, Forms and Frames

- a. Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- b. Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- c. Write a HTML program, to explain the working of forms by designing Registration form. (Note: Include text field, password field, number field, date of birth field, checkboxes, radio buttons, list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).
- d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame  image, second frame  paragraph, third frame  hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).

## 3. HTML 5 and Cascading Style Sheets, Types of CSS

- a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, <span> tags.
- b. Write a HTML program, to embed audio and video into HTML web page.
- c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

## 4. Selector forms

- a. Write a program to apply different types of selector forms
  - i. Simple selector (element, id, class, group, universal)
  - ii. Combinator selector (descendant, child, adjacent sibling, general sibling)
  - iii. Pseudo-class selector
  - iv. Pseudo-element selector
  - v. Attribute selector

## 5. CSS with Color, Background, Font, Text and CSS Box Model

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
  - i. font-size
  - ii. font-weight
  - iii. font-style
  - iv. text-decoration
  - v. text-transformation
  - vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
  - i. Content
  - ii. Border
  - iii. Margin
  - iv. padding

## 6. Applying JavaScript - internal and external, I/O, Type Conversion

- a. Write a program to embed internal and external JavaScript in a web page.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.
- d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

## 7. JavaScript Pre-defined and User-defined Objects

- a. Write a program using document object properties and methods.
- b. Write a program using window object properties and methods.
- c. Write a program using array object properties and methods.
- d. Write a program using math object properties and methods.
- e. Write a program using string object properties and methods.
- f. Write a program using regex object properties and methods.
- g. Write a program using date object properties and methods.
- h. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

## 8. JavaScript Conditional Statements and Loops

- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words “LARGER NUMBER” in an information message dialog. If the numbers are equal, output HTML text as “EQUAL NUMBERS”.
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an ‘ARMSTRONG NUMBER’ or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e.,  $1^3 + 5^3 + 3^3 = 153$ ]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100’s, 50’s, 20’s, 10’s, 5’s, 2’s & 1’s. (Eg: If deposited amount is Rs.163, the output should be 1-100’s, 1-50’s, 1- 10’s, 1-2’s & 1-1’s)

## 9. JavaScript Functions and Events

- a. Design a appropriate function should be called to display
  - i. Factorial of that number
  - ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. Is it palindrome or not
- b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
  - i. Factorial of that number
  - ii. Fibonacci series up to that number
  - iii. Prime numbers up to that number
  - iv. Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
  - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
  - ii. Mobile (only numbers and length 10 digits)
  - iii. E-mail (should contain format like [xxxxxxx@xxxxxx.xxx](mailto:xxxxxxx@xxxxxx.xxx))

**Text Books:**

1. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.

**Reference Books:**

1. Programming the World Wide Web, 7<sup>th</sup> Edition, Robert W Sebesta, Pearson, 2013.
2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasam Subramanian, 2<sup>nd</sup> edition, APress, O'Reilly.

**Online Learning Resources:**

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>
5. <https://www.w3schools.com/typescript>

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## DESIGN THINKING & INNOVATION

### Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

### Course Outcomes:

- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

### UNIT I

#### Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

### UNIT II

#### Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, customer, journey map, brainstorming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

### UNIT III

#### Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

### UNIT IV

#### Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

## UNIT V

### Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

#### Textbooks:

1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

#### Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

#### Online Learning Resources:

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- [https://swayam.gov.in/ndl\\_noc19\\_mg60/preview](https://swayam.gov.in/ndl_noc19_mg60/preview)

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**B.Tech. – III Year I Semester**

S.No	Category	Title	L	T	P	Credits
1	Professional Core	Data Warehousing and Data Mining	3	0	0	3
2	Professional Core	Compiler Design	3	0	0	3
3	Professional Core	Design and Analysis of Algorithms	3	0	0	3
4	Professional Elective-I	1. Object Oriented Analysis and Design 2. Software Testing Methodologies 3. Advanced Computer Architecture 4. Computer Graphics 5. 12 week MOOC Swayam/ NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-I	1. Data Structures 2. Database Management Systems 3. Computer Organization 4. Scripting Languages 5. Operating Systems	3	0	0	3
6	Professional Core	Data Mining Lab	0	0	3	1.5
7	Professional Core	Compiler Design Lab	0	0	3	1.5
8	Skill Enhancement course	Full Stack development-2	0	1	2	2
9	Engineering Science	Tinkering Lab/ SWAYAM Plus - Android Application Development (with Flutter)	0	0	2	1
10	Evaluation of Community Service Project		-	-	-	2
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>23</b>



III Year I Semester	DATA WAREHOUSING & DATA MINING	L	T	P	C
		3	0	0	3

### Course Objectives:

Students undergoing this course are expected to:

1. Understand the concepts of Data Ware housing and Data Mining
2. Master data mining techniques in various applications like social, scientific and environmental context.
3. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

### Course Outcomes:

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

1. Understand Data Warehouse fundamentals, Data Mining concepts, principles and its functionalities
2. Preprocess the data using various Data Preprocessing Techniques for mining applications
3. Design and deploy appropriate classification techniques to solve real world problems and further be able to assess the strengths and weaknesses of various methods and algorithms to analyze their behavior.
4. Demonstrate Association analysis techniques for generating association rules from data.
5. Use different Clustering techniques to cluster data and Cluster the high dimensional data for better organization of the data

### UNIT –I: Data Mining Systems and Knowledge Discovery Process:

**Data Warehouse and OLAP Technology:** An Overview- What Is a Data Warehouse. A Multi dimensional Data Model - Need for Online Analytical Processing - OLTP V/s OLAP -OLAP Operations in Multidimensional Data Model. Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

**Need and Usage of Data Mining Technologies** - Overview of Knowledge Discovery Process from Databases—What Motivated Data Mining - Why Is It Important - Data Mining Functionalities—What Kinds of Patterns Can Be Mined? Are All of the Patterns Interesting Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System, Major Issues in Data Mining.

### UNIT–II: Data Pre-processing:

**Data Exploration:** Data Objects and attribute types -Statistical description of data- Descriptive Data Summarization-Data Visualization - Data similarity and dissimilarity measures.

**Data Pre-processing:** Why Pre-process the Data -Data Cleaning-Data Integration-Data Reduction-Data Transformation and Data Discretization.

### UNIT–III: Classification:

Basic issues regarding classification and predication - General Approach to solving a classification problem- Decision Tree Classification, Attribute Selection Measures, Tree Pruning- Bayesian Classification – Rule Based Classification – Support Vector Machines.

**Classification Model Evaluation and Selection** - Accuracy and Error measures, Holdout, Random Sampling, Cross Validation, Bootstrap, Comparing Classifier performance using ROC Curves. 7



#### **UNIT–IV: Mining Frequent Patterns and Association Rules:**

Basic Concepts-Problem Definition- Market Basket Analysis- Frequent Itemsets- Closed Itemsets and Association Rules - Frequent Pattern Mining - Efficient and Scalable Frequent Itemset Mining Methods- the Apriori Algorithm for finding Frequent Itemsets Using Candidate Generation - Generating Association Rules from Frequent Itemsets - A pattern growth approach for mining Frequent Itemsets- FP-Growth Algorithm

#### **UNIT V: Cluster Analysis:**

Basics and Importance of Cluster Analysis- Clustering techniques- Different Types of Clusters- Partitioning Methods (K-Means, K Medoids) -Strengths and Weaknesses. Hierarchical Methods (Agglomerative, Divisive) - Density-Based Methods (DBSCAN, OPTICS)-

#### **Text Books:**

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

#### **References:**

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

#### **E-resources:**

- i. [http://onlinecourses.nptel.ac.in/noc18\\_cs14/preview](http://onlinecourses.nptel.ac.in/noc18_cs14/preview) (NPTEL course by Prof.Pabitra Mitra)
- ii. [http://onlinecourses.nptel.ac.in/noc17\\_mg24/preview](http://onlinecourses.nptel.ac.in/noc17_mg24/preview)  
(NPTEL course by Dr. Nandan Sudarshanam & Dr. Balaraman Ravindran)
- iii. [http://www.saedsayad.com/data\\_mining\\_map.htm](http://www.saedsayad.com/data_mining_map.htm)



III Year I Semester	COMPILER DESIGN	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Design of lexical analyzers, Syntax analyzers, Intermediate code generators
2. Usage of Lex/Bison tools in writing compilers
3. Issues in the code generation, code generation generation algorithms.

### Course Outcomes:

The students should be able to:

1. Understand the basics of language processing and implement lexical analyzer for any language.
2. Describe the different types of parsing and implement parser for any language.
3. Explain the different intermediate code representations and use Syntax directed
4. Apply the basics of data flow analysis, optimizations, and run time environment required for handling recursive procedures.
5. Discuss the issues in the code generation and code generation algorithms.

### UNIT - I:

**Introduction and Lexical Analysis:** Language Processors, the structure of a compiler, the science of building a compiler, phases of a compiler. Lexical Analysis: The role of the lexical analyzer, Identifying tokens, Transition diagrams for recognizing tokens, Input buffering, The lexical analyzer generator Lex, Finite automata, Conversion from regular expressions to automata, design of a lexical analyzer generator, Optimization of DFA-based pattern matchers.

### UNIT - II:

**Syntax Analysis:** Introduction, Context-Free Grammars, BNF(Backus-Naur Form), EBNF(Extended Backus-Naur Form). Preprocessing of grammars: left recursion elimination, left factoring. Top-Down Parsing: Recursive-descent parsers, LL(1) parsers. Bottom-Up parsing: Introduction to LR parsers, Simple LR, Canonical LR, and Lookahead LR. Extending parsers to handle ambiguous grammars, Parser generators Yacc/Bison.

### UNIT – III:

#### Syntax-Directed Translation, Semantic Analysis, Intermediate Code Generation

Syntax-Directed Definitions, Evaluation orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Implementing L-Attributed SDD's.

Intermediate code generation: Variants of Syntax trees, Three-address code, Types and declarations, Type checking, Control flow, Back patching, Switch-Statements, Intermediate Code for Procedures.

### UNIT - IV:

#### Code Optimization, Run-time Environment

Run-Time Environments: Storage organization, Activation record, Stack allocation, Access to nonlocal data on the stack, Heap management, Introduction to garbage collection, Introduction to trace-based collection. Machine-Independent optimizations: The principal sources of optimization, Basic blocks and flow graphs, Introduction to data-flow analysis, Foundations of data-flow



analysis, Constant propagation.

### **UNIT - V: Target Code Generation**

Code Generation: Issues in the design of a Code Generator, The target language, Addresses in the target code, A simple code generator.

Machine-dependent Optimizations: Peephole optimization, Register allocation and assignment, Dynamic Programming code generation.

#### **Text Books:**

- i. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, MonicaS. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson.
- ii. Compiler Construction-Principles and Practice, Kenneth C Louden, Cengage Learning.

#### **Reference Books:**

- i. Modern Compiler Implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
- ii. The Theory and Practice of Compiler writing, J. P. Tremblay and P. G. Sorenson, TMH
- iii. lex & yacc, 2nd Edition by John Levine, Doug Brown, Tony Mason

#### **E-resources:**

- i. <https://www.edx.org/course/compilers>
- ii. <https://nptel.ac.in/courses/106/108/106108113/>



III Year I Semester	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Analyze the asymptotic performance of algorithms
2. Write rigorous correctness proofs for algorithms
3. Demonstrate a familiarity with major algorithms and data structures

### Course Outcomes: The students should be able to:

1. Measure the performance and calculate the Time & Space complexities of algorithms.
2. Design effective algorithms based on strategies like Decrease and Conquer, Divide and Conquer Transform and Conquer,
3. Develop efficient algorithms using Greedy method.
4. Discuss various problems suitable to Dynamic programming.
5. Find an optimal solution by applying different Backtracking and Branch & Bound technique.

### UNIT - I:

**Introduction:** What is an Algorithm, Algorithm Specification, Pseudo code Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities' Performance Measurement.

### UNIT - II:

**Decrease-and-Conquer:** Insertion Sort Algorithms for Generating Combinatorial Objects Decrease-by-a-Constant-Factor Algorithms Variable-Size-Decrease Algorithms

**Divide and Conquer:** Merge Sort, Quick Sort, Multiplication of Large Integers and Strassen's Matrix Multiplication

**Transform and conquer:** Pre-sorting Balanced Search Trees, Heaps and Heap sort

### UNIT - III:

**The Greedy Method:** The General Method, Knapsack Problem, Job Sequencing with Deadlines Minimum-cost Spanning Trees, Prim's Algorithm, Kruskal's Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

### UNIT - IV:

**Dynamic Programming:** The General Method Multistage graph ,All - Pairs Shortest Paths, , String Edition, 0/1 Knapsack, Reliability Design, optimal binary search trees.

### UNIT - V:

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

**Branch and Bound:** The Method, Least cost (LC) Search, The 15-Puzzle: an Example, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack problem, LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson problem.

### Text Books:

- i. Fundamentals of computer algorithms E. Horowitz S. Sahni, University Press
- ii. Introduction to the design and analysis of Algorithms Anany Levitin Pearson ,3<sup>rd</sup> edition
- iii. Introduction to Algorithms Thomas H Cormen PHILearning



**Reference Books:**

- i. The Design and Analysis of Computer Algorithms, Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman
- ii. Algorithm Design, Jon Kleinberg, Pearson
- iii. Algorithms, by Dasgupta, Papadimitriou and Vazirani, McGraw-Hill Education, 2006.



III Year I Semester	OBJECT ORIENTED ANALYSIS AND DESIGN (PROFESSIONAL ELECTIVE-I)	L	T	P	C
		3	0	0	3

**Course Objectives:** The main objective is the students to

1. Become familiar with all phases of OOAD.
2. Master the main features of the UML.
3. Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains.

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

1. Select the basic elements of modeling such as Things, Relationships and Diagrams depending on the views of UML Architecture and SDLC.
2. Apply basic and Advanced Structural Modeling Concepts for designing real time applications.
3. Design Class and Object Diagrams that represent Static Aspects of a Software System.
4. Analyze Dynamic Aspects of a Software System using Use Case, Interaction and Activity Diagrams.
5. Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems.

#### UNIT I:

**Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

#### UNIT II:

**Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

#### UNIT III:

**Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

#### UNIT IV:

**Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

#### UNIT V:

**Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

**Text Books:**

- i. Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2013, PEARSON.
- ii. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

**Reference Books:**

- i. Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
- ii. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd.
- iii. AtulKahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
- iv. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.



III Year I Semester	SOFTWARE TESTING METHODOLOGIES (PROFESSIONAL ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Describe the principles and procedures for designing test cases.
2. Provide supports to debugging methods.
3. Acts as the reference for software testing techniques and strategies.

### Course Outcomes:

The students should be able to:

1. Define Software testing terminology and methodology
2. Discuss and Classify various testing techniques for conducting different types of software testing
3. Apply different software testing techniques.
4. Construct test cases by understanding test suite management and software quality management.
5. Demonstrate modern software testing tools and testing of Object Oriented Software and Web based software.

### UNIT-I:

**Introduction:** Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. **FLOW GRAPHS AND PATH TESTING:** Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.

### UNIT-II:

**Transaction Flows Testing:** Transaction Flows, Transaction Flow Testing Techniques.

**Dataflow Testing:** Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.

**Domain Testing:** Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability.

### UNIT-III:

**Paths, Path Products and Regular Expressions:**

Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection.

**Syntax Testing:** Why, What and How, A Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips.

**Based Testing:** Overview, Decision Tables, Path Expressions, KV Charts, and Specifications.

### UNIT-IV:

**State, State Graphs And Transition Testing:** State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips.

**Graph Matrices and Application:**

Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.

**UNIT-V:**

**Software Testing Tools:** Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Winrunner, LoadRunner, Jmeter, Selenium About Win Runner Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, Putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.

**Text Books:**

- i. Software testing techniques – Boris Beizer, Dreamtech, second edition.
- ii. Software Testing- Yogesh Singh, Cambridge

**Reference Books:**

- i. The Craft of software testing - Brian Marick, Pearson Education.
- ii. Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
- iii. Software Testing, N.Chauhan, Oxford University Press.
- iv. Introduction to Software Testing, P.Ammann & J. Offutt, Cambridge Univ. Press.
- v. Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999.
- vi. Software Testing Concepts and Tools, P.Nageswara Rao, dreamtech Press
- vii. Win Runner in simple steps by Hakeem Shittu, Genixpress, 2007.
- viii. Foundations of Software Testing, D.Graham & Others, Cengage Learning.



III Year I Semester	ADVANCED COMPUTER ARCHITECTURE (PROFESSIONAL ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Understand fundamentals of computer design
2. Understand instruction level parallelism
3. Understand memory hierarchy in computer systems

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

- 1: Describe fundamentals concepts of computer design
- 2: Explain different types of Parallelisms in Computer Architectures.
3. Design memory hierarchy methods
- 4: Explain the Thread level parallelism
- 5: Explain the different types of Storage systems and bench marking the storage device.

### UNIT I

**Introduction:** Fundamentals of Computer design- Technology trends- cost- measuring and reporting performance quantitative principles of computer design. Instruction level parallelism (ILP) - over coming data hazards- reducing branch costs –high performance instruction delivery- hardware based speculation- limitation of ILP

### UNIT II

**ILP software approach** - compiler techniques- static branch protection - VLIW approach - H.W support for more ILP at compile time- H.W verses S.W Solutions

### UNIT III

**Memory hierarchy design**- cache performance- reducing cache misses penalty and miss rate – virtual memory- protection and examples of VM.

### UNIT IV

**Multiprocessors and thread level parallelism**- symmetric shared memory architecturesdistributed shared memory- Synchronization- multi threading.

### UNIT V

**Storage systems**- Types – Buses - RAID- errors and failures- bench marking a storage device- designing a I/O system.



**TEXT BOOK(S)**

i. Computer Architecture and parallel Processing, Kai Hwang and A.Briggs International Edition McGraw-Hill.

**REFERENCES BOOK(S)**

i. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

ii. Advanced Computer Architectures, Dezsó Sima, Terence Fountain, Peter Kacsuk, Pearson.

iii. Parallel Computer Architecture, A Hardware / Software Approach, David E. Culler, Jaswinder Pal Singh with Anoop Gupta, Elsevier

**E-Resources:**

i. <https://nptel.ac.in/courses/106/105/106105163/>



III Year I Semester	COMPUTER GRAPHICS	L	T	P	C
		0	0	3	1.5

### Course Objectives:

1. To introduce fundamental concepts and theory of computer graphics.
2. To develop, design and implement two and three dimensional graphical structures
3. To learn Creation, Management and Transmission of Multimedia objects.

### Course Outcomes:

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

1. Develop various 2D output primitives like lines, circles, polygons.
2. Generate 3D representations by using various projection transformations.
3. Illustrate various illumination and shading models.
4. Apply OpenGL graphic software and rendering techniques for 3D object representations.
5. Create images using fractals and iterated functions

### UNIT-I:

**Introduction to Graphics:** Application areas of Computer Graphics, overview of graphics systems, video-display devices, graphics monitors and work stations and input devices.

**2D Primitives:** Output primitives-Line, Circle and Ellipse drawing algorithms, Attributes of output primitives, Two dimensional Geometric transformations, Two dimensional viewing Line, Polygon, Curve and Text clipping algorithms.

### UNIT-II:

**3D Concepts:** Parallel and Perspective projections - Three dimensional object representations – Polygons, Curved lines, Splines, Quadric Surfaces, - Visualization of data sets - 3D transformations – Viewing -Visible surface identification.

### UNIT-III:

**Illumination and Shading:** Background, simple lighting model, shading models, intensity representation, color models, texture synthesis

### UNIT-IV:

**Graphics Hardware and Software:** Graphics programming using OpenGL-Basic graphics primitives, Drawing three dimensional objects, Drawing three dimensional scenes.

**Rendering:** Introduction to shading models, Flat and Smooth shading, Adding texture to faces, Adding shadows of objects, Building a camera in a program, Creating shaded objects.

### UNIT V:

**Fractals:** Fractals and Self similarity, Peano curves, Creating image by iterated functions, Mandelbrot sets, Julia Sets, Random Fractals

**Overview of Ray Tracing:** Intersecting rays with other primitives, Adding Surface texture, Reflections and Transparency, Boolean operations on Objects.



**Text Books:**

- i. Donald Hearn, Pauline Baker, Computer Graphics – C Version, Pearson Education.
- ii. F.S. Hill, Computer Graphics using OpenGL, Pearson Education.

**Reference Books:**

- i. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics Principles and practice in C, Pearson Education.



III Year I Semester	DATA STRUCTURES (OPEN ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To teach efficient storage mechanisms of data for an easy access.
2. To develop application using data structures.
3. To improve the logical ability

### Course Outcomes: On completion of this course, the student will be able to:

1. Compare the performances of various Searching and Sorting techniques in terms of time and space complexities.
2. Illustrate the applications of Stacks.
3. Implement various types of Queues and their efficient operations.
4. Demonstrate the advantages of dynamic memory allocation via linked lists.
5. Implement the basic operations, search and traversals on Trees.

### UNIT-I

Time and space complexity, Data Structures – Introduction to Data Structures, abstract data types, Searching and Sorting – Sorting- selection sort, bubble sort, insertion sort, quick sort, merge sort, shell sort, radix sort, Searching-linear and binary search methods, comparison of sorting and searching methods.

### UNIT –II

Stacks-Operations, array and linked representations of stacks, stack applications -infix to postfix conversion, postfix expression evaluation, recursion implementation.

### UNIT-III

Queues-operations, array, and linked representations. Circular Queue operations, Dequeues, applications of queues.

### UNIT-IV

Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, circular linked list implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists.

### UNIT-V

Trees – Definitions, tree representation, properties of trees, Binary tree, Binary tree representation, binary tree properties, binary tree traversals, binary tree implementation, applications of trees.

### Text Books:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.



**References:**

1. Data structures: A Pseudocode Approach with C, 2nd edition,
2. R.F.GilbergAndB.A.Forouzan, CengageLearning.
3. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
4. Data Structures using C, A.M.Tanenbaum,Y. Langsam, M.J.Augenstein, Pearson.
5. Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.TondoandB.Leung,Pearson



III Year I Semester	DATA BASE MANAGEMENT SYSTEMS (OPEN ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Train in the fundamental concepts of database management systems, database modeling and design, SQL, PL/SQL, and System implementation techniques.
2. Enable students to model ER diagram for any customized applications.
3. To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

### Course Outcomes:

1. Understand the usage of Key Constraints on Database.
2. Describe ER model and normalization for database design.
3. Create, maintain, and manipulate a relational database using SQL.
4. Understand efficient data storage and retrieval mechanism, recovery techniques.
5. Design and build database system for a given real world problem.

### UNIT-I:

**An Overview of Database Management:** Introduction- Importance of Database System, Data Independence- Relation Systems and Others- Summary, Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator-The Database Management Systems- Client/Server Architecture.

### UNIT-II:

**The E/R Models:** The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and ER Diagrams-Entities Attributes, Entity Sets-Relationship and Relationship Sets-Conceptual Design with the ER Models.

**The Relational Model:** Integrity Constraints Over Relations- Key Constraints –Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation, Renaming – Joins- Division- More Examples of Queries, Relational Calculus - Tuple Relational Calculus, Domain Relational Calculus.

### UNIT-III:

**Queries, Constraints, Triggers:** The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and ActiveDatabase.

**Schema Refinement (Normalization) :** Purpose of Normalization or Schema Refinement, Concept of Functional Dependency, Normal Forms Based on Functional Dependency(1NF, 2NF and 3 NF), Concept of Surrogate Key, Boyce-Codd Normal Form(BCNF), Lossless Join and Dependency Preserving Decomposition, Fourth Normal Form(4NF).

**UNIT-IV:****Transaction Management and Concurrency Control:**

Transaction, Properties of Transactions, Transaction Log, Transaction Management with SQL using Commit Rollback and Save Point, Concurrency Control for Lost Updates, Uncommitted Data, Inconsistent Retrievals, and the Scheduler.

**Concurrency Control with Locking Methods:** Lock Granularity, Lock Types, Two Phase Locking For Ensuring Serializability, Deadlocks, Concurrency Control with Time Stamp Ordering: Wait/Die and Wound/Wait Schemes, Database Recovery Management : Transaction Recovery.

**UNIT-V:**

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

**Text Books:**

1. Introduction to Database Systems, CJ Date, Pearson.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATAMcGraw Hill 3rd Edition.

**References Books:**

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Corone17th Edition.
2. Fundamentals of Database Systems, ElmasriNavrate Pearson Education.
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J WidomPearson.
4. Data base System Concepts,5/e, Silberschatz, Korth,TMH.



III Year I Semester	COMPUTER ORGANIZATION (OPEN ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Gives a view of computer system from user's perspective, representation of data.
2. Understand the architecture of a modern computer with its various processing units. Also the Performance measurement of the computer system.
3. Illustration of data paths and control flow for sequencing in CPUs, Microprogramming of control unit of CPU.

### Course Outcomes:

1. Understand the architecture of modern computer.
2. Able to calculate the effective address of an operand by addressing modes.
3. Apply different instruction types.
4. Determine the importance of memory management system of computer.
5. Design the roles and functions of processing unit and micro programmed control.

### UNIT -I:

**Basic Structure of Computers:** Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development.

**Data Representation:** Data types, Complements, Fixed Point Representation, Floating- Point Representation, Other Binary Codes, Error Detection codes.

### UNIT -II:

#### Machine Instruction and Programs:

Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types, Addressing Modes, Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Logic Instructions, shift and Rotate Instructions.

### UNIT -III:

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

**Input/output Organization:** Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB).

### UNIT -IV:

**The Memory Systems:** Basic memory circuits, Memory System Consideration, Read-Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Cache Memories: Mapping Functions, INTERLEAVING

**Secondary Storage:** Magnetic Hard Disks, Optical Disks.

**UNIT -V:**

**Processing Unit:** Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control,  
**Micro programmed Control:** Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next – Address Field.

**Text Books:**

- i. Computer Organization, Carl Hamacher, Zvonks Vranesic, Safea Zaky, 5th Edition, McGraw Hill.
- ii. Computer Architecture and Organization, John P. Hayes, 4<sup>th</sup>Edition, McGrawHill.

**Reference Books:**

- i. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
- ii. Structured Computer Organization–AndrewS.Tanenbaum,4th Edition PHI/Pearson.
- iii. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int.Edition.
- iv. “Computer Organization and Design: The Hardware/Software Interface” by David A. Patterson and John L.Hennessy.
- vi. J.P. Hayes, "Computer Architecture and Organization", McGraw-Hill,1998.

**E-Resources:**

- i. <https://nptel.ac.in/courses/106/106/106106092/>
- ii. <https://nptel.ac.in/courses/106/105/106105163/>



III Year I Semester	SCRIPTING LANGUAGES (OPEN ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Introduces scripting languages such as Perl, Ruby, PHP and TCL.
2. Design, code, and test applications using scripting languages.
3. An ability to create PHP scripts to store and manipulate user data.

### Course Outcomes:

1. Acquire programming skills in RUBY scripting language.
2. Ability to create and run scripts using PERL.
3. To gain some fluency programming in Perl and PHP and related languages.
4. To improve knowledge of advanced concepts in PHP.
5. Gain knowledge of the strengths and weakness of Perl, TCL and Ruby; and select an appropriate language for solving a given problem.

### UNIT-I:

**Introduction:** Ruby, Rails, the structure and Execution of Ruby Programs, Package Management with RUBYGEMS.

**Ruby and Web:** Writing CGI scripts, cookies, Choice of Web servers, SOAP and web services

**Ruby Tk:** Simple Tk Application, widgets, Binding events, Canvas, scrolling

### UNIT-II:

#### Introduction to PERL and Scripting:

Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

### UNIT-III:

#### Advanced PERL:

Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

**PHP Basics :** PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

### UNIT-IV:

**Advanced PHP Programming:** PHP and Web Forms, Files, PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package and Building Web sites for the World.

**UNIT -V:**

TCL: Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures , strings , patterns, files, Advance TCL, eval, source, exec and uplevel commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, CInterface.

**Tk:** Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding, Perl- Tk.

**Text Books:**

- i. The World of Scripting Languages, David Barron, Wiley Publications.
- ii. Ruby Programming language by David Flanagan and Yukihiro Matsumoto O'Reilly
- iii. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications(Dream tech)

**Reference Books:**

- i. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
- ii. Perl by Example, E.Quigley, Pearson Education.
- iii. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.



III Year I Semester	OPERATING SYSTEMS (OPEN ELECTIVE-I)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Provide knowledge about the services rendered by operating systems.
2. Present detail discussion on processes, threads and scheduling algorithms.
3. Discuss various file-system implementation issues and memory management techniques.

### Course Outcomes:

1. Understand the importance of operating systems and different types of system calls.
2. Analyze the communication between processes and various process scheduling algorithms.
3. Understand the process synchronization, different ways for deadlocks handling.
4. Analyze various memory mapping techniques and different page replacement methods.
5. Evaluate various file allocation and disk scheduling algorithms.

### UNIT-I: Operating Systems Overview:

**Introduction:** what is an operating system, Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types, Operating System Generation.

### UNIT-II: Process Management:

**Process concept:** Process Concept, Process Scheduling, Operations on Processes, Inter process Communication.

**Multithreaded Programming:** Overview, Multithreading models, Threading Issues.

**Process scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

### UNIT-III: Synchronization:

**Process Synchronization:** The Critical-Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization examples.

**Principles of deadlock** – System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

### UNIT-IV: Memory Management:

**Memory Management strategies:** Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

**Virtual Memory Management:** Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing.

**UNIT-V: File system Interface-** The concept of a file, Access Methods, Directory and Disk structure, File system mounting.

**File System implementation:** File system structure, allocation methods, free-space management.

**Mass-storage structure:** Overview of Mass-storage structure, Disk scheduling, Device drivers.

**Text Books:**

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems).

**References:**

- i. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
- ii. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012.
- iii. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009.
- iv. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004.



III Year I Semester	DATA MINING LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

1. Practical exposure on implementation of well known data mining tasks and their effective use in discovering interesting hidden patterns from large datasets.
2. Exposure to real time data sets for analysis and prediction.
3. Focus is on the main process of data mining such as data preparation, classification, clustering, association analysis, and pattern evaluation

**Software Requirements:** WEKA Tool and R Programming/Python Programming

**Course Outcomes:** After undergoing the course students will be able to:

1. Create summary statistics for the given datasets.
2. Analyze various datasets and perform Data Pre-processing.
3. Apply various data mining algorithms on the give data set to select the appropriate one.
4. Develop skills and apply data mining tools for solving practical problems.
5. Handling a small data mining project for a given practical domain.

### LIST OF EXPERIMENTS:

1. Study of WEKA tool and applying data mining techniques on following data sets in ARFF or CSV file Format.
2. Implementation / Usage of WEKA for classification of datasets such as customer's data, weather forecasting data, agricultural data etc.
3. Experiment to summarize and visualization of various datasets.
4. Experiment to demonstrate various data pre-processing techniques
5. Experiment to select prominent feature subsets of various datasets.
6. Experiment to Evaluate Information Gain of an attribute in the student database
7. Demonstration of classification rule process using j48 decision tree algorithm
8. Demonstration of classification rule process using ID3 decision tree algorithm
9. Experiment to predict the class using the Bayesian classification
10. Experiment to predict the class using the k-Nearest Neighbor classification
11. Experiment to implement weight & bias updating using the Back propagation Neural Network
12. Demonstration of clustering process using k-means algorithm
13. Demonstration of mining frequent patterns using Apriori algorithm
14. Demonstration of mining frequent patterns using FP-Growth algorithm
15. Experiment to compare the performance of various data mining algorithms on the give database.



III Year I Semester	COMPILER DESIGN LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Implementation of a compiler for a basic language
2. Lex/Yacc specifications for designing frontend of a compiler
3. Generate MIPS instruction set

### Course Outcomes:

The students should be able to:

1. Understand the different phases of compilation and the working of compilers like gcc, c lang etc
2. Implement lexical analyzer for any language
3. Implement parser for any language
4. Implement 3-address code generator for simple programming constructs
5. Implement MIPS code generator by considering simple programming constructs

### List of experiments

1. Check the output of different compilers gcc, g++, clang, clang++, javac, python etc by running respective language programs with different flags. (purpose to understand preprocessor, optimizations, linker)
2. The Language called TinyCStr is described as follows
  - a) Every TinyCStr program has one or more functions and syntax of function declaration and function definition is similar to C, one function must be main.
  - b) Every TinyCStr function has zero or statements
  - c) The possible statements are declaration, assignment, conditional statements (if,else, for, while) except switch.
  - d) TinyCStr supports primitive data types of C and a string datatype
    - i. Implement a lexical analyser for TinyCStr using flex/lex
    - ii. Implement a parser for TinyCStr using bison/yacc and generate AST(Abstract Syntax Tree)
    - iii. Generate a 3-address code from the AST
    - iv. Generate MIPS instructions from 3-address code and run it on SPIM simulator
3. Write a program illustrating code optimization techniques:
  - i) Constant folding    ii) Copy propagation    iii) Common subexpression elimination
  - iv) Loop unrolling    v) Dead code elimination

### Text Books:

- i. flex & bison by John Levine Released August 2009 Publisher(s): O'Reilly Media, Inc.
- ii. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson.

### Reference Books:

- i. LLVM Cookbook, Mayur pandey

### E-resources:

- i. <https://llvm.org/>
- ii. <https://gcc.gnu.org/>
- iii. [https://www.dsi.unive.it/~gasparetto/materials/MIPS\\_Instruction\\_Set.pdf](https://www.dsi.unive.it/~gasparetto/materials/MIPS_Instruction_Set.pdf)



III Year I Semester	FULL STACK DEVELOPMENT - 2 (SKILL ENHANCEMENT COURSE)	L	T	P	C
		0	1	2	2

### Course Objectives:

The main objectives of the course are to

1. Make use of router, template engine and authentication using sessions to develop application in ExpressJS.
2. Build a single page application using RESTful APIs in ExpressJS
3. Apply router and hooks in designing ReactJS application

### Course Outcomes:

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

1. Apply core concepts of ExpressJS to build web applications
2. Design and develop web applications using ExpressJS by connecting to MongoDB with Mongoose
3. Creating reusable components using both function-based and class-based approaches.
4. Implement dynamic user interfaces in ReactJS
5. Install and configure MongoDB (including Atlas) and perform essential database operations

### Experiments covering the Topics:

1. ExpressJS – Routing, HTTP Methods, Middleware, Templating, Form Data
2. ExpressJS – Cookies, Sessions, Authentication, Database, RESTful APIs
3. ReactJS – Render HTML, JSX, Components – function & Class, Props and States, Styles, Respond to Events
4. ReactJS – Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
5. ReactJS – Hooks, Sharing data between Components, Applications – To-do list and Quiz
6. MongoDB – Installation, Configuration, CRUD operations, Databases, Collections and Records

### Sample Experiments:

#### 1. ExpressJS – Routing, HTTP Methods, Middleware.

- a. Write a program to define a route, Handling Routes, Route Parameters, Query Parameters and URL building.
- b. Write a program to accept data, retrieve data and delete a specified resource using http methods.
- c. Write a program to show the working of middleware.

#### 2. ExpressJS – Templating, Form Data

- a. Write a program using templating engine.
- b. Write a program to work with form data.

#### 3. ExpressJS – Cookies, Sessions, Authentication



- a. Write a program for session management using cookies and sessions.
- b. Write a program for user authentication.

#### **4. ExpressJS – Database, RESTful APIs**

- a. Write a program to connect MongoDB database using Mongoose and perform CRUD operations.
- b. Write a program to develop a single page application using RESTful APIs.

#### **5. ReactJS – Render HTML, JSX, Components – function & Class**

- a. Write a program to render HTML to a web page.
- b. Write a program for writing markup with JSX.
- c. Write a program for creating and nesting components (function and class).

#### **6. ReactJS – Props and States, Styles, Respond to Events**

- a. Write a program to work with props and states.
- b. Write a program to add styles (CSS & Sass Styling) and display data.
- c. Write a program for responding to events.

#### **7. ReactJS – Conditional Rendering, Rendering Lists, React Forms**

- a. Write a program for conditional rendering.
- b. Write a program for rendering lists.
- c. Write a program for working with different form fields using react forms.

#### **8. ReactJS – React Router, Updating the Screen**

- a. Write a program for routing to different pages using react router.
- b. Write a program for updating the screen.

#### **9. ReactJS – Hooks, Sharing data between Components**

- a. Write a program to understand the importance of using hooks.
- b. Write a program for sharing data between components.

#### **10. MongoDB – Installation, Configuration, CRUD operations**

- a. Install MongoDB and configure ATLAS
- b. Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()

#### **11. MongoDB – Databases, Collections and Records**

- a. Write MongoDB queries to Create and drop databases and collections.
- b. Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().

#### **12. Augmented Programs: (Any 2 must be completed)**

- a. Design a to-do list application using NodeJS and ExpressJS.
- b. Design a Quiz app using ReactJS.
- c. Complete the MongoDB certification from MongoDB University website.

**Text Books:**

- i. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2<sup>nd</sup> edition, APress, O'Reilly.
- ii. Node.js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
- iii. React Quickly, AzatMardan, Manning Publications (Chapters 1-8, 12-14)

**Web Links:**

- i. ExpressJS - <https://www.tutorialspoint.com/expressjs>
- ii. ReactJS - <https://www.w3schools.com/REACT> (and) <https://react.dev/learn#>
- iii. MongoDB - <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>



III Year I Semester	<b>TINKERING LAB (ENGINEERING SCIENCE)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### Course Objectives:

1. The Tinkering Lab course aims to foster an environment where students can explore, experiment, and innovate through hands-on learning.
2. The lab encourages creativity, problem-solving, prototyping, and teamwork.
3. It provides interdisciplinary exposure to mechanical, electronic, and digital fabrication tools, sensors, IoT, coding, and product design.

### Course Outcomes:

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

1. Apply knowledge from various engineering disciplines to build and test prototypes
2. Use tools, equipment, and software for basic mechanical, electronic, and digital fabrication.
3. Understand the basics of product design, prototyping, and iteration
4. Work collaboratively on real-world problem statements and interdisciplinary projects
5. Develop problem-solving skills through tinkering and experimentation

### Module– I

**Introduction to Tinkering:** The principles of creativity, innovation, and tinkering. What is tinkering? Importance of creativity and experimentation in engineering, Overview of Tinkering Labs: Spaces, tools, and possibilities, Safety and best practices in the lab.

#### Lab Work

- Simple individual projects using hand tools(e.g., wood/metal cutting, joining,etc.).
- Demonstrations of sample projects from different engineering streams.

### Module– II

**Introduction to Mechanical Prototyping:** Basic mechanical fabrication tools and techniques:3D modeling and CAD tools (Introduction to software like Solid Works, AutoCAD), Introduction to 3D printing and laser cutting, Using hand tools, drills, and mechanical prototyping kits.

#### Lab Work

- Create simple mechanical prototypes using 3Dprinting and basic fabrication tools.
- Build and test basic structural models using wood, plastic, and metal materials.
- Introduction to Electronics Prototyping: Basic electronics and circuit design. Introduction to bread boarding, resistors, capacitors, transistors, and ICs., Use of Arduino/Raspberry Pi or similar microcontrollers, Working with sensors and actuators, Introduction to simple programming for hardware integration.

#### LabWork

- Build a simple electronic project like an automatic light sensor or basic robot.
- Implement hands-on projects using Arduino,basic wiring,and circuit design.
- Digital Fabrication and IoT: Digital tools for fabrication and integrate IoT-based systems, Introduction to IoT: Sensors, communication protocols (Bluetooth,Wi-Fi, etc.),Working with embedded systems, IoT platforms, and cloud-based services, Introduction to digital fabrication techniques (Laser cutting, CNC machines).

#### Lab Work

- Build a basic IoT project (e.g.,smart home device or weather station using sensors).
- Fabricate components of IoT projects using 3Dprinters or laser cutters.



### Module– III

**Design Thinking and Ideation:** Process of design thinking for problem-solving, Steps of design thinking: Empathize, Define, Ideate, Prototype, and Test, Case studies of successful product design and innovation, Understanding user needs and translating them into tangible solutions.

#### Lab Work

- Brainstorm ideas for final projects.
- Work in teams to develop multiple solutions to a given challenge.

### Module– IV

**Rapid Prototyping and Iteration:** Prototype and test ideas iteratively, Concepts of rapid prototyping: fail-fast, iterate often, Tools for prototyping across disciplines (CAD, electronics simulation, 3D printing), Testing and evaluating prototypes for functionality, usability, and cost. **Artificial Intelligence & Machine Learning utilization in prototypes.**

#### Lab Work

- Create initial prototypes for the final project.
- Conduct iterative testing and modifications.

### Module– V

**Collaborative Final Project:** Application of interdisciplinary knowledge to solve real-world problems, Work in interdisciplinary teams(mix of mechanical, electronics, computer science, etc.), Solving real-world problems by building a functional prototype, Document project progress, design decisions, and iterations.

#### Lab Work

- Develop and finalize a working prototype that addresses as elected challenge.
- Present the project to peers and faculty for evaluation.

### Text Books

- i. Designing for Growth: A Design Thinking Tool Kit for Managers by Jeanne Liedtka and Tim Ogilvie.
- ii. The Art of Tinkering by Karen Wilkinson and Mike Petrich.
- iii. Make: Electronics: Learning by Discovery by Charles Platt.

### Reference Links

- i. Arduino,Raspberry Pi,and IoT tutorial platforms.
- ii. 3D modeling and CAD tutorials on platforms like Tinkercad or Fusion360.
- iii. MIT's FabLab and Fab Academy resources.

### Tools and Equipment:

- i. 3D printers,laser cutters, CNC machines.
- ii. Arduino and RaspberryPi kits.
- iii. Basic electronic components: sensors, LEDs, motors, breadboards.
- iv. Mechanical tools: drills, saws, hand tools, etc.



### B.Tech. III Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Computer Networks	3	0	0	3
2	Professional Core	Artificial Intelligence	3	0	0	3
3	Professional Core	Cryptography & Network Security	3	0	0	3
4	Professional Elective-II	1. Cloud Computing 2. Cyber Security 3. DevOps 4. No SQL Databases 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Professional Elective-III	1. Software Project Management 2. Human Computer Interaction 3. Big Data Analytics 4. Distributed Systems 5. 12-week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
6	Open Elective – II	1. Web services 2. Computer Networks 3. OOPS through Java 4. Fundamentals of Cloud Computing 5. Fundamentals of Information Security	3	0	0	3
7	Professional Core	AI Tools Lab	0	0	3	1.5
8	Professional Core	Computer Network Lab	0	0	3	1.5
9	Skill Enhancement course	Soft skills // SWAYAM Plus - 21st Century Employability Skills	0	1	2	2
10	Audit Course	Technical Paper Writing & IPR	2	0	0	-
<b>Total</b>			<b>20</b>	<b>01</b>	<b>08</b>	<b>23</b>
Mandatory Industry Internship of 08 weeks duration during summer vacation						



III Year II Semester	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To introduce the fundamental various types of computer networks.
2. To understand state-of-the-art in network protocols, architectures, and applications.
3. To explore the various layers of OSI Model.

### Course Outcomes:

The students are able to

1. Understand OSI and TCP/IP reference models with an emphasis to Physical Layer, Data Link Layer and Network Layer.
2. Analyze the issues related to data link, medium access and transport layers by using channel allocation and connection management schemes. Analyze MAC layer protocols and LAN technologies.
3. Solve problems related to Flow control, Error control, Congestion control and Network Routing.
4. Design and compute subnet masks and addresses for networking requirements.
5. Understand how internet works,

### UNIT-I:

**Introduction:** Network Hardware and software Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

**Physical Layer:** Guided Transmission Media, Digital Modulation and Multiplexing: frequency division multiplexing, wave length division multiplexing, synchronous time division multiplexing, statistical time division multiplexing.

### UNIT-II:

**The Data Link Layer** - Design Issues, Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols, Sliding Window Protocols.

**Channel allocation methods:** TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision Free protocols – IEEE standard 802 for LANS – Ethernet, Token Bus, Token ring, Bridges and IEEE 802.11 and 802.16. Data link layer switching, virtual LANs.

### UNIT-III:

**Network layer Routing Algorithms:** Design Issues, Routing Algorithms-Shortest path, Flooding, Flow based Distance vector, Link state, Hierarchical, Broadcast routing, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Choke packets, Load shedding, and Jitter Control.

**Internet Working:** Tunneling, internetworking, Fragmentation, Network layer in the internet

– IP protocols, IP address, Subnets, Internet control protocols, OSPF, BGP, Internet multicasting, Mobile IP, IPV6.

### UNIT IV:

**The Transport Layer:** Elements of transport protocols – addressing, establishing a connection, releasing connection, flow control and buffering and crash recovery, End to end protocols: UDP, Real Time Transport Protocol.

**The Internet Transport Protocol: TCP-** reliable Byte Stream (TCP) end to end format, segment



format, connection establishment and termination, sliding window revisited, adaptive retransmission, TCP extension, Remote Procedure Call.

#### **UNIT – V:**

**Application Layer:** WWW and HTTP: Architecture- Client (Browser), Server, Uniform Resource Locator HTTP: HTTP Transaction, HTTP Operational Model and Client/Server Communication, HTTP Generic Message Format, HTTP Request Message Format, HTTP Response Message Format.

**The Domain Name System:** The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery.

#### **Text Books:**

- i. Data Communications and Networks – Behrouz A. Forouzan, Third Edition TMH.
- ii. Computer Networks, 5ed, David Patterson, Elsevier
- iii. Computer Networks: Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
- iv. Computer Networks, Mayank Dave, CENGAGE

#### **References:**

- i. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
- ii. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education
- iii. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
- iv. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson The TCP/IP Guide, by Charles M. Kozierok,
- v. Free online Resource, <http://www.tcpipguide.com/free/index.htm>



III Year II Semester	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

### Course Objectives:

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

### Course Outcomes:

1. Outline problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
2. Apply the language/framework of different AI methods for a given problem
3. Implement basic AI algorithms- standard search algorithms or dynamic programming
4. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports
5. Design Expert Systems using fuzzy logic theory

#### UNIT- I:

**Introduction:** history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

#### UNIT -II:

**Problem solving:** state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A\*, constraint satisfaction.

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

#### UNIT -III:

**Logic concepts:** Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic.

#### UNIT -IV:

**Knowledge representation:** Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.

Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, CYC theory, case grammars, semantic web

**UNIT-V:**

**Expert system and applications:** Introduction phases in building expert systems, expert system versus traditional systems Uncertainty measure: probability theory: Introduction, probability theory, Bayesian belief networks, certainty factor theory, Dempster-Shafer theory, Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi-valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems. **Real Time Artificial Intelligence applications.**

**Text Books:**

- i. Artificial Intelligence- Saroj Kaushik, CENGAGE ELearning
- ii. Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA

**Reference Books:**

- i. Artificial Intelligence- Deepak Khemani, TMH, 2013
- ii. Introduction to Artificial Intelligence, Patterson, PHI
- iii. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Luger, 5th ed, PEA

**e-Resources:**

- i. <https://nptel.ac.in/courses/106/105/106105077/>
- ii. <http://aima.cs.berkeley.edu/>



III Year II Semester	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

### Course Objective:

This course aims at training students to master the:

1. The concepts of classical encryption techniques and concepts of finite fields and number theory
2. Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
3. Design issues and working principles of various authentication protocols and PKI standards

### Course Outcomes:

Upon completion of the course, it is expected that student will be able to:

1. Identify information security goals and acquire fundamental knowledge on the concepts of finite fields and number theory
2. Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and create secure applications
5. Apply network security basics, analyze different attacks on networks and evaluate the performance of security protocols like SSL, IPSec, and PGP

### UNIT- I:

**Introduction to Security:** Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, a Model for Network Security

**Mathematics of Cryptography:** Algebraic Structures (Groups, Rings, Fields and Galois Fields), Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms

### UNIT- II:

**Classical Encryption Techniques:** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography

**Block Ciphers:** Traditional Block Cipher Structure, The Data Encryption Standard, The Strength of DES, Block Cipher Design Principles, Advanced Encryption Standard, AES Structure, AES Transformation Functions, AES Key Expansion, Multiple Encryption and Triple DES, Block Cipher Modes of Operation

**UNIT- III:**

**Public-Key Cryptography:** Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Cryptography

**Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA)

**Message Authentication Codes:** Requirements for Message Authentication Codes, HMAC, CMAC

**UNIT- IV:**

**Digital Signatures:** Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme, NIST Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm

**Key Management and Distribution:** Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

**User Authentication:** Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos, Remote User-Authentication Using Asymmetric Encryption:

**UNIT -V:**

**Transport-Level Security:** Web Security Considerations, Transport Layer Security, Secure Shell (SSH)

**Electronic Mail Security:** S/MIME, Pretty Good Privacy

**IP Security:** IP Security Overview, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange

**Text Book:**

- i. Cryptography and Network Security, William Stallings, 8th Edition, Pearson Education

**Reference Books:**

- i. Cryptography, Network Security and Cyber Laws, Bernard L. Menezes, Ravinder Kumar, Cengage Learning.
- ii. Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyaya, 3rd Edition, Mc-GrawHill.
- iii. Network Security Illustrated, Jason Albanese, Wes Sonnenreich, McGrawHill.

**E-Resources:**

- i. <https://nptel.ac.in/courses/106/105/106105031/> lecture by Dr. Debdeep Mukhopadhyay IIT Kharagpur [VideoLecture]
- ii. <https://nptel.ac.in/courses/106/105/106105162/> lecture by Dr. Sourav Mukhopadhyay IIT Kharagpur [VideoLecture]
- iii. <https://www.mitel.com/articles/web-communication-cryptography-and-network-security> articles by Mitel PowerConnections



III Year II Semester	CLOUD COMPUTING (PROFESSIONAL ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objective:

1. To understand the concept of cloud computing.
2. To appreciate the evolution of cloud from the existing technologies.
3. To appreciate the emergence of cloud as the next generation computing paradigm.

### Course Outcomes:

Upon completion of the course, it is expected that student will be able to:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Learn the key and enabling technologies that help in the development of cloud.
3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
4. Explain the core issues of cloud computing such as resource management and security.
5. Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

### UNIT-I:

**Introduction:** Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud – On-Demand Provisioning.

### UNIT-II:

**Cloud Enabling Technologies:** Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery.

### UNIT-III:

**Cloud Architecture, Services And Storage:** Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, IaaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, S3.

### UNIT-IV:

**Resource Management And Security In Cloud:** Inter Cloud Resource Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

### UNIT-V:

**Cloud Technologies And Advancements:** Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation.

**Text Book:**

- i. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Morgan Kaufmann Publishers.
- ii. Cloud Computing: Implementation, Management and Security, Rittinghouse, John W., and James F. Ransome, CRC Press.

**Reference Books:**

- i. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Tata Mcgraw Hill.
- ii. Cloud Computing - A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Tata McGrawHill.
- iii. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), George Reese, O'Reilly.



III Year II Semester	CYBER SECURITY (PROFESSIONAL ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objectives:

The aim of the course is to

1. identify security risks and take preventive steps
2. understand the forensics fundamentals
3. understand the preservation of digital evidence

### Course Outcomes:

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

1. Identify various types and classifications of cybercrimes
2. Explain various cyberattack tools and methods
3. Explain the process of cybercrime investigation
4. Demonstrate an understanding of computer forensics principles and investigation procedures
5. Analyze the provisions and challenges of the Indian IT Act

**UNIT I: Introduction to Cybercrime:** Introduction, Cyber crime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyber stalking, Cyber cafe and Cyber crimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

**UNIT II: Tools and Methods :** Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

**UNIT III: Cyber Crime Investigation:** Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

**UNIT IV: Computer Forensics and Investigations:** Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

**UNIT V: Cyber Crime Legal Perspectives:** Introduction, Cyber crime and the Legal Land scape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India,



Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyber law, Technology and Students: Indian Scenario.

### **Text Books:**

- i. Sunit Belapure Nina Godbole “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, WILEY, 2011.
- ii. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.

### **Reference Books:**

- i. Michael T. Simpson, Kent Backman and James E. Corley, “Hands on Ethical Hacking and Network Defence”, Cengage, 2019.
- ii. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
- iii. Alfred Basta, Nadine Basta, Mary Brown and Ravinder Kumar “Cyber Security and Cyber Laws” , Cengage, 2018.

### **E-Resources:**

- i. CERT-In Guidelines- <http://www.cert-in.org.in/>
- ii. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> [ Online Course]
- iii. <https://computersecurity.stanford.edu/free-online-videos> [ Free Online Videos]
- iv. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu> License:Creative CommonsBY-NC-SA.



III Year II Semester	DEVOPS (PROFESSIONAL ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To understand the DevOps Concepts and DevOps Tools
2. To implement automated system update and DevOps lifecycle
3. Providing the perfect security for the entire infrastructure

### Course Outcomes:

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

1. Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility
2. Describe DevOps & DevSecOps methodologies and their key concepts
3. Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
4. Set up complete private infrastructure using version control systems and CI/CD tools
5. Know about DevOps maturity model.

### UNIT- I:

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

### UNIT –II:

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

### UNIT –III:

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

### UNIT –IV:

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

### UNIT -V:

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

### Text Books:

- i. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. It is written by Gene Kim, Jez Humble,Patrick Debois, and John Willis
- ii. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, is by Jez Humble and David Farley
- iii. Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis &Ryn Daniels.

**References/Web Links:**

- i. <https://www.udacity.com/course/intro-to-devops--ud611> - Good online course with sample exercises.
- ii. <http://www.edureka.co/devops> - Online Training covering high level process and tools. (Needs Registration)
- iii. [https://www.edx.org/course?search\\_query=devops](https://www.edx.org/course?search_query=devops) – Has no. of courses from MS and Redhat.
- iv. <https://www.codementor.io/devops/tutorial> - Basic Tutorial on DevOps.
- v. <https://mva.microsoft.com/training-topics/devops#!lang=1033> – Lists no. of courses related to DevOps and various tools, methods used.
- vi. <http://devops.com/> - A good blog, has lots of contents.
- vii. <https://dzone.com/devops-tutorials-tools-news> - Lots of links and tutorials



III Year II Semester	NoSQL DATABASES (PROFESSIONAL ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objective of this course is to

1. Distinguish the different types of NoSQL databases.
2. Explore the emergence, requirements and benefits of a NoSQL database.
3. Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases).

### Course Outcomes:

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

1. Differentiate between various non-relational (NoSQL) database.
2. Create Document oriented NoSQL databases using MongoDB.
3. Create Column- oriented NoSQL databases using ApacheHBASE.
4. Create NoSQL Key/Value databases using Riak.
5. Create Graph NoSQL databases using Neo4.

### UNIT-I:

#### Introduction and Basic Concepts:

Overview, and History of NoSQL Databases, Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points, Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases.

### UNIT-II:

#### NoSQL Key/Value databases using MongoDB:

**Document** Databases, What Is a Document Database? Features, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

### UNIT-III:

#### Column- oriented NoSQL databases using Apache HBASE:

Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, When Not to Use.

**UNIT-IV:****NoSQL Key/Value databases using Riak:**

Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

**UNIT-V:****Graph NoSQL databases using Neo4:**

NoSQL database development tools and programming languages, Graph Databases, What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

**Text Books:**

- i. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage, Martin Fowler, Pearson Education, 2013.
- ii. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN:978-0-470-94224-6.

**Reference Books:**

- i. A Guide to Modern Databases and the NoSQL Movement Edition, Redmond, E. & Wilson
- ii. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1<sup>st</sup> Ed.). Raleigh, NC: The Pragmatic Programmers, LLC.
- iii. Dan Sullivan. NoSQL for Mere Mortals. Addison-Wesley Professional. 2015.
- iv. Guy Harrison. Next-Generation Databases. Apress. 2016.



III Year II Semester	SOFTWARE PROJECT MANAGEMENT (PROFESSIONAL ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

- 1.To study how to plan and manage projects at each stage of the software development life cycle(SDLC)
- 2.To train software project managers and other individuals involved in software project planning and tracking and oversight in the implementation of the software project management process.
- 3.To understand successful software projects that support organization's strategic goals.

### Course Outcomes:

The students should be able to:

- 1.Estimate overall cost of a software project.
- 2.Explain software development process.
- 3.Distinguish workflows of process.
- 4.Design project organization structure & analyze quality.
- 5.Estimate effort and schedule needed for project.

### UNIT-I:

**Conventional Software Management:** The Waterfall Model, Conventional Software Management Performance.

**Evolution of Software Economics:** Software Economics, Pragmatic Software Cost Estimation.

**Improving Software Economics:** Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation through Software Economics.

### UNIT-II:

**The Old Way and the New:** The Principles of Conventional Software Engineering, The Principles of Modern Software Management, Transitioning to an Iterative Process.

**Life Cycle Phases:** Engineering and Production Stages, Inception Phase, Elaboration Phase, Construction Phase, Transition Phase.

### UNIT-III:

**Model Based Software Architectures:** A Management Perspective, A Technical Perspective.

**Workflows of the Process:** Software Process Workflows, Iteration Workflows.

**Iterative Process Planning:** Work Breakdown Structures, Planning Guidelines, The Cost and Schedule Estimating Process, The Iteration Planning Process.

### UNIT-IV:

**Project Organization and Responsibilities:** Line-Of-Business Organizations, Project Organizations, Evolution of Organizations.



**Project Control and Process Instrumentation:** The Seven Core Metrics, Management Indicators, Quality Indicators Modern Project Profiles. The COCOMO Cost Estimation Model: COCOMO.

#### **UNIT-V:**

**Effort Estimation and Scheduling:** Effort Estimation, Scheduling.

**Quality Planning:** Quality Concepts, Quantitative Quality Management Planning. **RISK MANAGEMENT:** Risk Assessment, Risk Control.

#### **Textbooks:**

- i. Walker Royce, “Software Project Management – A Unified Framework”, 1stEdition, Pearson Education,2002.
- ii. Pankaj Jalote, “Software Project Management in Practice”, 1stEdition, Pearson Education, 2005.
- iii. Software Project Management, Bob Hughes & Mike Cotterell, TATA Mcgraw-Hill.

#### **References:**

- i. Bob Hughes, “Mike Cotterell, Rajib Mall, Software Project Management”, 5thEdition, McGraw-Hill Higher Education,2011.
- ii. Joel Henry, “Software Project Management”, 1st Edition, Pearson Education,2006.
- iii. Norman E. Fenton,Shari Lawrence Pfleeger, “Software Metrics: A Rigorous and Practical Approach “, 1st Edition, PWS Publishing Company,1997



III Year II Semester	HUMAN COMPUTER INTERACTION (PROFESSIONAL ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
2. Apply an interactive design process and universal design principles to designing HCI systems.
3. Describe and use HCI design principles, standards and guidelines.

### Course Outcomes:

1. Explain the capabilities of both humans and computers from the viewpoint of human information processing.
2. Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Describe and use HCI design principles, standards and guidelines.
5. Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.

### UNIT I:

**Introduction:** Usability of Interactive Systems- introduction, usability goals and measures, usability motivations, universal usability, goals for our profession  
**Managing Design Processes:** Introduction, Organizational design to support usability, Four pillars of design, development methodologies, Ethnographic observation, Participatory design, Scenario Development, Social impact statement for early design review, legal issues, Usability Testing and Laboratories

### UNIT II:

Menu Selection, Form Fill-In and Dialog Boxes: Introduction, Task- Related Menu Organization, Single menus, Combinations of Multiple Menus, Content Organization, Fast Movement Through Menus, Data entry with Menus: Form Fill-in, dialog Boxes, and alternatives, Audio Menus and menus for Small Displays

### UNIT III:

**Command and Natural Languages:** Introduction, Command organization Functionality, Strategies and Structure, Naming and Abbreviations, Natural Language in Computing Interaction Devices: Introduction, Keyboards and Keypads, Pointing Devices, Speech and Auditory Interfaces, Displays- Small and large.

### UNIT IV:

**Quality of Service:** Introduction, Models of Response-Time impacts, Expectations and attitudes, User Productivity, Variability in Response Time, Frustrating Experiences Balancing Function and



Fashion: Introduction, Error Messages, No anthropomorphic Design, Display Design, Web Page Design, Window Design, Color.

#### **UNIT V:**

##### **User Documentation and Online Help:**

Introduction, Online Vs Paper Documentation, Reading from paper Vs from Displays, Shaping the content of the Documentation, Accessing the Documentation, Online tutorials and animated documentation, Online communities for User Assistance, The Development Process.

**Information Search:** Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Searching Interfaces Information Visualization: Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization

##### **Text Books:**

- i. Designing the User Interface, Strategies for Effective Human Computer Interaction, 5ed, Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven M Jacobs, Pearson
- ii. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamaTech.

##### **Reference Books**

- i. Human Computer, Interaction Dan R.Olsan, Cengage ,2010.
- ii. Designing the user interface. 4/e, Ben Shneidermann , PEA.
- iii. User Interface Design, Soren Lauesen , PEA.
- iv. Interaction Design PRECE, ROGERS, SHARPS, Wiley.



III Year II Semester	BIG DATA ANALYTICS (Professional Elective-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Necessity of Big data analysis and challenges in Big data analysis
2. Descriptive, Predictive, Real time analysis of bigdata
3. Programming tools PIG & HIVE in Hadoop echo system

### Course Outcomes:

The students should be able to:

1. Understand and Illustrate characteristics of big data and big data challenges in different domains including social media, transportation, finance and medicine
2. Demonstrate stream processing on real time applications
3. Do Big data processing using Map reduce on Hadoop
4. Do Big data processing using PIG scripts and HiveQL queries
5. Understand Predictive analysis of bigdata.

**UNIT-I: Introduction:** Introduction to big data: Introduction to Big Data platform, Challenges of conventional systems, intelligent data analysis, Nature of data, Analytic processes and tools, Analysis vs Reporting.

**UNIT - II: Stream Processing:** Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

**UNIT - III: Introduction to Hadoop:** Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

**UNIT - IV: Frameworks and Applications:** Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

**UNIT - V: Predictive Analytics and Visualizations:** Predictive Analytics, Simple linear regression, Multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

**Text Books:**

- i. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition,2015.
- ii. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing,2012.
- iii. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012

**Reference Books:**

- i. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& sons,2012.
- ii. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, JamesGiles, David Corrigan, “Harness the Power of Big Data:The IBM Big Data Platform”, Tata McGraw Hill Publications,2012.
- iii. Arshdeep Bahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach “, VPT,2016.
- iv. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014.

**E-resources:**

- i. <https://www.edx.org/course/big-data-fundamentals>
- ii. <https://hadoop.apache.org/>
- iii. <https://pig.apache.org/>
- iv. <https://hive.apache.org/>



III Year II Semester	DISTRIBUTED SYSTEM (PROFESSIONAL ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To understand the foundations of distributed systems.
2. To learn issues related to clock Synchronization, the need for global state and remote invocation in distributed systems.
3. To learn distributed mutual exclusion and deadlock detection algorithms.

### Course Outcomes:

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

1. Understand the foundations and issues of distributed systems.
2. Illustrate the various synchronization issues, global state and remote invocation for distributed systems.
3. Develop the Mutual Exclusion and Deadlock detection algorithms in distributed systems.
4. Apply the features of peer-to-peer, distributed shared memory systems and security.
5. Analyze the distributed transactions, agreement protocols and fault tolerance mechanisms in distributed systems.

### UNIT- I:

**Characterization of Distributed Systems:** Introduction, Examples of Distributed Systems, Resource Sharing and the Web, Challenges, Relation to Computer system Components, Motivation, Relation to Parallel Systems, 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, Cuts, Past and future cones of an event, Models of Process Communications. **Logical Time:** A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization:NTP.

### UNIT –II:

**Message Ordering and Group Communication:** Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order.

**Global state and Snapshot Recording Algorithms:** Introduction, System model and definitions, Snapshot algorithms for FIFO channels. **Remote Invocation:** Introduction, Design Issues for RMI, Implementation of RMI, Distributed Garbage Collection, Remote Procedure Call, Events and Notifications, Case Study: JAVARMI.

### UNIT- III:

**Distributed Mutual Exclusion Algorithms:** Introduction, Preliminaries, Lamport's algorithm, Ricart-Agrawala algorithm, Maekawa's algorithm, Suzuki–Kasami's broadcast algorithm. **Deadlock Detection in Distributed Systems:** Introduction, System model, Preliminaries, Models of deadlocks, Knapp's Classification, Algorithms for the Single Resource Model, the AND model and the ORmodel.

### UNIT -IV:



**Peer-to-Peer Computing and Overlay Graphs:** Introduction, Data indexing and overlays, Chord distributed hash table, Content addressable networks, Tapestry. **Distributed Shared Memory:** Abstraction and advantages, Memory consistency models, Shared Memory Mutual Exclusion.

**Security:** Introduction, Overview of Security Techniques, Cryptographic Algorithms, Digital Signatures, Cryptography Pragmatics.

#### UNIT –V:

**Distributed Transactions:** Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions. **Check Pointing and Rollback Recovery:** Introduction, Background and definitions, Issues in Failure recovery, Checkpoint-based recovery, Log-based rollback recovery, coordinated check pointing algorithm, Algorithms for asynchronous and synchronous check pointing and recovery. **Consensus and Agreement Algorithms:** Problem definition, Overview of results, Agreement in a Failure-Free system (synchronous or asynchronous).

#### Text Books:

- i. Distributed computing: Principles, algorithms, and systems, Ajay D Kshemkalyani and Mukesh Singhal, Cambridge University Press,2011.
- ii. Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, 5<sup>th</sup> Edition, Pearson Education,2012.

#### Reference Books:

- i. Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall of India, 2007.
- ii. Advanced concepts in operating systems. Mukesh Singhal and Niranjana G. Shivaratri, McGraw-Hill, 1994.
- iii. Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M., Pearson Education, 2007.

#### E-Resources:

- i. <https://nptel.ac.in/courses/106/106/106106168/>



III Year II Semester	WEB SERVICES (OPEN ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objective:

1. To Understand XML concepts
2. To Understand paradigms needed for testing Web Services
3. To explore different Test Strategies for SOA-based applications

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

1. Describe and explain the relationship among HTML, XHTML, CSS, JavaScript, XML and other web technologies.
2. Create and publish advanced HTML pages with the help of frames, scripting languages, and CSS.
3. Understand and use JavaScript variables, control structures, functions, arrays, and objects. Understand and develop XML Technologies such as XML Schemas, XSLT.
4. Understand and develop Server-Side Programming using Servlets and JSP's.
5. Develop web pages using AJAX and PHP

### UNIT-I:

**INTRODUCTION TO HTML5:** New HTML5 Form input Types, Introduction to Cascading Style Sheets: Part 1: Inline Styles, Embedded Style Sheets, Conflicting Styles, and Linking External Style Sheets (Text Book: 1)

**JAVA SCRIPT:** Introduction to scripting, Control Structures-I, Control Structures-II, Functions, Arrays, Objects. (Text Book: 1).

### UNIT-II :

**XML:** Introduction, XML Basics, Structuring Data, XML Namespaces, Document Type Definitions (DTDs), W3C XML Schema Documents, XML Vocabularies, Extensible Style sheet Language and XSL Transformations, Document Object Model (DOM): Objects and Collections (Text Book : 1).

### UNIT-III:

**JDBC AND SERVLETS: DATABASE ACCESS:** Overview of JDBC, JDBC Drivers,

Connecting to a Database, the Statement Interfaces, Result Sets, Using Metadata (Text Book: 3)

**SERVLETS:** The Life Cycle of a Servlet, Using Tomcat for Servlet Development, A Simple Servlet, The Servlet API, The javax.servlet Package , Reading Servlet Parameters, The javax.servlet.http Package, Handling HTTP Requests and Responses, Cookies, Session Tracking. (Text Book : 2).

### UNIT-IV: JSP:

JSP Overview, How JSP Works , A Basic Example, JSP Syntax and Semantics: The JSP Development Model, Components of a JSP Page: Directives, Comments, Expressions, Scriptlets, Declarations, implicit objects, Standard Actions, Tag Extensions, A Complete Example (Text Book: 3).

Expressions, Scriptlets, Expression and Scriptlet Handling by the JSP Container, Implicit Objects and the JSP Environment, Initialization Parameters, Request Dispatching: Anatomy of Request Processing, include Directive, The Action, Forwarding Requests, Request Dispatcher Object (Text Book:3).



### UNIT-V: PHP:

Introduction, Simple PHP Program, Converting Between Data Types, Arithmetic Operators, Initializing and Manipulating Arrays, String Comparisons, String Processing with Regular Expressions, Form Processing and Business Logic, Reading from a Database (Text Book: 1)

**AJAX:** Traditional Web Applications vs. Ajax Applications, Rich Internet Applications (RIAs) with Ajax, History of Ajax, Ajax Example Using the XML, Http Request Object, Using XML and the DOM. (Reference Book: 6)

#### Text Books:

- i. Dietel and Dietel : “Internet and World Wide Web – How to Program”, 5th Edition, PHI/Pearson Education,2011
- ii. Herbert Schildt, “The complete Reference Java 2”, 9th Edition, TMH,2014.
- iii. Phil Hanna: “The Complete Reference JSP”, 2nd Edition, TMH,2008.

#### References:

- i. Hans Bergsten : “Java Server Pages”, 3rdEdition, O’Reillypublication,2008.
- ii. Raj Kamal, “Internet & Web technologies”, 8th Edition, Tata McGraw-Hill,2007.
- iii. Chris Bates, “Web Programming, building internet applications”, 2ndEdition, WILEY, Dreamtech,2008.
- iv. Xavier. C, “Web technology and design”, 1stEdition, New Age International,2011.
- v. Marty Hall and Larry Brown, “Core servlets and java Server pages volume 1: core technologies”, 2nd Edition, Pearson Education,2007.
- vi. Thomas A Powel, “The Complete Reference: AJAX”, 1st Edition, Tata McGraw Hill,2008.

#### Web References:

- i. [www.w3schools.com](http://www.w3schools.com)
- ii. [www.tutorialspoint.com](http://www.tutorialspoint.com)



III Year II Semester	COMPUTER NETWORKS (OPEN ELECTIVE-II)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To introduce the fundamental various types of computer networks.
2. To understand state-of-the-art in network protocols, architectures, and applications.
3. To explore the various layers of OSI Model.

### Course Outcomes:

The students can

1. Understand OSI and TCP/IP reference models with an emphasis to Physical Layer, Data Link Layer and Network Layer.
2. Analyze the issues related to data link, medium access and transport layers by using channel allocation and connection management schemes. Analyze MAC layer protocols and LAN technologies.
3. Solve problems related to Flow control, Error control, Congestion control and Network Routing.
4. Design and compute subnet masks and addresses for networking requirements.
5. Understand how internetworks,

### UNIT-I:

**Introduction:** Network Hardware and software Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, Examples of Networks: Novell Networks, Arpanet, Internet, Network Topologies WAN, LAN, MAN.

**Physical Layer:** Guided Transmission Media, Digital Modulation and Multiplexing: frequency division multiplexing, wavelength division multiplexing, synchronous time division multiplexing, statistical time division multiplexing.

### UNIT-II:

**The Data Link Layer** - Design Issues, Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols, Sliding Window Protocols.

**Channel allocation methods:** TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision Free protocols – IEEE standard 802 for LANS – Ethernet, Token Bus, Token ring, Bridges and IEEE 802.11 and 802.16. Data link layer switching, virtual LANs.

### UNIT-III:

**Network layer Routing Algorithms:** Design Issues, Routing Algorithms-Shortest path, Flooding, Flow based Distance vector, Link state, Hierarchical, Broadcast routing, Congestion Control algorithms-General principles of congestion control, Congestion prevention policies, Choke packets, Load shedding, and Jitter Control.

**Internet Working:** Tunnelling, internetworking, Fragmentation, Network layer in the internet

– IP protocols, IP address, Subnets, Internet control protocols, OSPF, BGP, Internet multicasting, Mobile IP, IPV6.

**UNIT IV:**

**The Transport Layer:** Elements of transport protocols – addressing, establishing a connection, releasing connection, flow control and buffering and crash recovery, End to end protocols: UDP, Real Time Transport Protocol.

**The Internet Transport Protocol: TCP-** reliable Byte Stream (TCP) end to end format, segment format, connection establishment and termination, sliding window revisited, adaptive retransmission, TCP extension, Remote Procedure Call.

**UNIT – V:**

**Application Layer:** WWW and HTTP: Architecture- Client (Browser), Server, Uniform Resource Locator HTTP: HTTP Transaction, HTTP Operational Model and Client/Server Communication, HTTP Generic Message Format, HTTP Request Message Format, HTTP Response Message Format.

**The Domain Name System:** The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery.

**Text Books:**

- i. Data Communications and Networks – Behrouz A. Forouzan, Third Edition TMH.
- ii. Computer Networks, 5ed, David Patterson, Elsevier
- iii. Computer Networks: Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI
- iv. Computer Networks, Mayank Dave, CENGAGE

**References:**

- i. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010
- ii. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education
- iii. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education  
Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson The TCP/IP Guide, by Charles M. Kozierok, Free online Resource, <http://www.tcpipguide.com/free/index.htm>.



III Year II Semester	<b>OBJECT ORIENTED PROGRAMMING THROUGH JAVA (OPEN ELECTIVE-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

1. The objective of the course is to teach the basic concepts and techniques which form the object oriented programming paradigm
2. To understand skills in writing programs using exception handling techniques and multithreading
3. Well equipped with Java SDK environment to create, debug and run simple Java programs

### Course Outcomes:

By the end of this course the student will be able to:

1. Understand the structure and model of the Java programming language
2. Explain the concept of class and objects with access control to represent real world entities
3. Demonstrate the implementation of inheritance and polymorphism.
4. Illustrate different techniques on creating and accessing packages (fully qualified name and import statements)
5. Understand the impact of exception handling to avoid abnormal termination of program using checked and unchecked exceptions

### Unit-I

**Introduction to Java:** Evolution of Java, Java Buzzwords, The Java Virtual Machine, An overview of Java- Simple Java Program, Naming Conventions in Java, Data types, Variables, Expressions, Automatic type Conversion, Operators, Control Statements , Arrays, Strings

### Unit-II

**Classes & Objects:** Class fundamentals, Declaring Objects, Initializing the instance variables, Access Control, Constructors, Methods in Java, Overloading Methods and constructors, Static Methods, Recursion, final keyword, this keyword, garbage collection, finalize() method

### Unit-III

**Inheritance:** Inheritance Basics, Types of Inheritance, use of 'super', 'final' keywords in inheritance.

**Polymorphism:** Method Overriding, Dynamic Method Dispatch, Abstract Classes.

**Interfaces:** Def, Multiple Inheritance using Interface, Abstract Classes vs. Interfaces

### Unit-IV

**Packages:** Packages, Different Types of Packages, Access Protection, Importing Packages.

**Exception Handling:** Exception-handling basics, throw Clause, throws Clause. Types: Built-in Exception, User Defined Exception.

### Unit – V

**Threads:** Java Thread Model, Main Thread, Creating a Thread and Running it, terminating the Thread, Creating Multiple Threads, Thread Synchronization, and Thread Priorities.



### **Text Books:**

1. Herbert Schildt, "Java The complete reference", 9thEdition, McGrawHill, 2017.
2. Timothy Budd, "An introduction to object-oriented programming", 3rdEdition, Pearson Education, 2009.

### **Reference Books**

- 1 E.Balaguruswamy, "Programming with Java A Primer", 5th Edition, TataMcGraw-Hill, 2017.
2. Y. Daniel Liang, "Introduction to Java programming", 9thEdition, Pearson education, 2012

### **Reference Link**

1. [http://en.wikibooks.org/wiki/Java\\_Programming](http://en.wikibooks.org/wiki/Java_Programming) - Java Learning WikiBook
2. <http://www.javabeginner.com> - Java Beginner Tutorial



III Year II Semester	<b>FUNDAMENTALS OF CLOUD COMPUTING (OPEN ELECTIVE-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objective:

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.

### Course Outcomes

Upon completion of the course, it is expected that student will be able to:

1. Understand and analyze different computing paradigms
2. Understand the basics of cloud computing and different cloud deployment models.
3. Understand different cloud implementation and management strategies.
4. Understand and evaluate different cloud service models.
5. Identify, analyze and use different cloud services/applications/tools available from key cloud providers.

### UNIT-I:

**Computing Paradigms:** High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing..

### UNIT-II:

**Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud Computing, Cloud Computing is a Service, Cloud Computing is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models

### UNIT-III:

**Cloud Computing Architecture and Management:** Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

### UNIT-IV:

**Cloud Service Models:** Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

**UNIT-V:**

**Cloud Providers and Applications:** EMC, EMC IT, Captiva Cloud Toolkit, Google Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud Platform, Virtualization Services Provided by SAP, Sales force, Sales Cloud, Service Cloud: Knowledge as a Service, Rack space, VMware, Manjra soft, AnekaPlatform.

**Text Book:**

- i. Essentials of Cloud Computing, K. Chandrasekhran, CRCpress.

**Reference Books:**

- i. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley.
- ii. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier.
- iii. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, SubraKumaraswamy, ShahedLatif, O'Reilly.



III Year II Semester	<b>FUNDAMENTALS OF INFORMATION SECURITY (OPEN ELECTIVE-II)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objective:

1. Formulate information security objectives of privacy (confidentiality), data integrity, authentication, and non-repudiation.
2. Describe the fundamental axioms and concepts in abstract algebra and number theory that form the foundation of network and computer security solutions.
3. Design and implement cryptosystems based on the design principles of symmetric-key and asymmetric-key algorithms.

### Course Outcomes

Upon completion of the course, it is expected that student will be able to:

1. Understand the basics and need for information security
2. Identify, analyze, and evaluate infrastructure and network vulnerabilities.
3. Understand and analyze different access control and authentication methods.
4. Identify and assess current and anticipated security risks and vulnerabilities with vulnerability assessment and auditing methods.
5. Learn the fundamentals of cryptography and how cryptography serves as the central language of information security..

#### UNIT-I:

**Introduction to Security:** Challenges of Securing Information, Definition of Information Security, Attackers, Attacks and Defenses.

**Systems Threats and Risks:** Software-Based Attacks, Hardware-Based Attacks, Attacks on Virtualized Systems, Hardening the Operating System, Preventing Attacks that Target the Web Browser, Hardening Web Servers, Protecting Systems from Communications-Based Attacks, Applying Software Security Applications.

#### UNIT-II:

**Network Vulnerabilities and Attacks:** Network Vulnerabilities, Categories of Attacks, Methods of Network Attacks.

**Network Defences:** Crafting a Secure Network, Applying Network Security Devices, Host and Network Intrusion Prevention Systems (HIPS/NIPS), Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware.

#### UNIT-III:

**Access Control:** Access Control Models and Practices, Logical Access Control Methods, Physical Access Control.

**Authentication:** Definition of Authentication, Authentication Credentials, Extended Authentication Protocols, Remote Authentication and Security.

**UNIT-IV:**

**Vulnerability Assessment:** Risk Management, Assessment, and Mitigation, Identifying Vulnerabilities.  
**Security Audit:** Privilege Auditing, Usage Auditing, Monitoring Methodologies and Tools.

**UNIT-V:**

**Cryptography:** Introduction to Cryptography, Cryptographic Algorithms, Using Cryptography on Files and Disks, Digital Certificates, Public Key Infrastructure, Key Management.

**Text Book:**

- i. Security+ Guide to Network Security Fundamentals, Third Edition, Mark Ciampa, Cengage Learning.

**Reference Books:**

- i. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, CengageLearning.
- ii. Information Security: The Complete Reference, Rhodes-Ousley, Mark, Second Edition, McGraw-Hill.
- iii. Information Security: Principles and Practices, Mark S. Merkow, Jim Breithaupt, 2nd Edition, PearsonEducation



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### Course Objectives:

This course is introduced to

1. Learn the fundamentals of most widely used Python packages NumPy, Pandas and Matplotlib, and then apply them to Data Analysis and Data Visualization projects.
2. To introduce the fundamental techniques and principles of Neural Networks
3. Teach students the leading trends and systems in natural language processing

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

1. Apply the tools of AI in the field of Engineering.
2. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
3. design and implement solutions to classification, regression, and clustering problems
4. Implement deep learning algorithms and solve real-world problems
5. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods

### List of Experiments:

1. **Numpy:** Illustrate the concepts multi-dimensional arrays and matrices, along with a large library of high-level mathematical functions to operate on these arrays using numpy
2. **Pandas:** Visualize New York Motor Vehicle Crash Data Using Python, Pandas, and Matplotlib.

### Datasets Details:

- <https://data.ny.gov/Transportation/Motor-Vehicle-Crashes-Case-Information-Three-Year-/e8ky-4vqe>
- <https://data.ny.gov/Transportation/Motor-Vehicle-Crashes-Individual-Information-Three/ir4y-sesj>
- <https://data.ny.gov/Transportation/Motor-Vehicle-Crashes-Violation-Information-Three-/abfj-y7uq>
- <https://data.ny.gov/Transportation/Motor-Vehicle-Crashes-Vehicle-Information-Three-Ye/xe9x-a24f>
3. **Tensor-Flow:** Learn simple data curation by creating a pickle with formatted datasets for training, development and testing in Tensor Flow and develop visualizations in tensorboard.
  4. Create convolutional neural networks in Tensor Flow.
  5. **Image recognition** (or image classification) : identifying images and categorizing them in one of several predefined distinct classes using neural network models.
  6. **OpenCV:** Develop an online writing Whiteboard with minimal features for online classes
  7. **Keras:** Recognize handwritten digits from MNIST using Keras
  8. **Scikit-learn :** Write a Python program using Scikit-learn to split the iris dataset into 70% train data and 30% test data. Out of total 150 records, the training set will contain 120 records and the test set contains 30 of those records. Print both datasets
  9. Design a perceptron classifier to classify handwritten numerical digits (0-9). Implement using scikit or Weka.
  10. **NLP:** Program to illustrate the concepts sentence segmentation, word tokenization, stemming and lemmatization, Hidden markov model (HMM) for Parts of speech (PoS)tag.



**References:**

- i. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press,2012
- ii. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw HillEducation
- iii. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media,Inc.2018

**Web Resources:**

- i. [https://scikit-learn.org/stable//\\_downloads/scikit-learn-docs.pdf](https://scikit-learn.org/stable//_downloads/scikit-learn-docs.pdf)
- ii. [docs.python.org](https://docs.python.org) > library
- iii. <https://opencv.org/>
- iv. <https://matplotlib.org/>



III Year II Semester	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	3	1.5

### Course Objectives:

1. Understand and apply different network commands
2. Analyze different networking functions and features for implementing optimal solutions Apply different networking concepts for implementing network solution
3. Implement different network protocols

### Course Outcomes:

1. Apply the basics of Physical layer in real time applications
2. Apply data link layer concepts, design issues, and protocols
3. Apply Network layer routing protocols and IP addressing
4. Implement the functions of Application layer and Presentation layer paradigms and Protocols

### Experiments:

- 1) Implement the data link layer framing methods such as character stuffing and bit stuffing.
- 2) Write a C program to develop a DNS client server to resolve the given hostname.
- 3) Implement on a data set of characters the three CRC polynomials – CRC-12, CRC-16 and CRC-CCIP.
- 4) Implement Dijkstra's algorithm to compute the shortest path in a graph.
- 5) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table at each node using distance vector routing algorithm
- 6) Take an example subnet of hosts. Obtain broadcast tree for it.
- 7) Write a client-server application for chat using UDP
- 8) Implement programs using raw sockets (like packet capturing and filtering)
- 9) Write a C program to perform sliding window protocol.
- 10) Get the MAC or Physical address of the system using Address Resolution Protocol.
- 11) Simulate the Implementing Routing Protocols using border gateway protocol(BGP)
- 12) Simulate the OPEN SHORTEST PATH FIRST routing protocol based on the cost assigned to the path.
- 13) Install Wireshark Tool on PC and use into:
  - a) Capture network traffic
  - b) Determine default gateway address of your network
  - c) Examine frame format and contents of Ethernet frames
  - d) Filter and examine only ICMP traffic
  - e) Run various network services like ping, ssh, dns .etc and examine the traffic captured by Wire shark
- 14) Simulate a three nodes point-to-point network with duplex links between them. Set the queue



size vary the bandwidth and find the number of packets dropped.

- 15) Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1- n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets by TCP/UDP.
- 16) Simulate the transmission of ping message over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
- 17) Simulate an Ethernet LAN using N-nodes (6-10), change error rate and data rate and compare the through put.
- 18) Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source/destination.

\* ns2/ns3/CISCO Packet Tracer/OPNET/any other network simulator may be used for simulation experiments.



III Year II Semester	SOFT SKILLS (SKILL ENHANCEMENT COURSE)	L	T	P	C
		0	1	2	2

**Course Objectives:**

1. To equip the students with the skills to effectively communicate in English
2. To train the students in interview skills, group discussions and presentation skills
3. To motivate the students to develop confidence

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

1. Apply effective communication techniques including verbal expression and non-verbal cues
2. Apply self-management skills including stress, anger, and time management
3. Demonstrate proficiency in standard operational communication methods
4. Develop job-oriented skills by effectively participating in group discussions
5. Understand the importance and types of interpersonal relationships

**UNIT – I**

**Analytical Thinking & Listening Skills:** Self-Introduction, Shaping Young Minds - A Talk by AzimPremji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

**Communication Skills:** Verbal Communication; Non Verbal Communication (Body Language)

**UNIT – II**

**Self-Management Skills:** Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

**Etiquette:** Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

**UNIT – III**

**Standard Operation Methods :**Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

**UNIT-IV**

**Job-Oriented Skills:** Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

**UNIT-V**

**Interpersonal relationships:** Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

**Text books:**

- i. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
- ii. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

**Reference books:**

- i. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
- ii. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.



**E-resources:**

1. [https://swayam-plus.swayam2.ac.in/courses/course-details?id=P\\_CAMBR\\_01](https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01)



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### Course Objective :

1. To develop the ability to write clear, concise, and well-structured technical documents, including reports, summaries, and proposals, suitable for academic and professional contexts.
2. To enhance understanding of grammar, syntax, and technical vocabulary necessary for effective communication in technical writing.
3. To introduce students to the process of planning, drafting, revising, and presenting technical papers, using tools like MS Word for formatting, referencing, and collaboration.

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

1. Demonstrate the ability to write effective technical reports by constructing clear technical sentences,
2. Apply effective drafting techniques in technical report writing
3. Demonstrate proficiency in proofreading and summarizing technical content
4. Demonstrate advanced proficiency in using Microsoft Word for technical documentation
5. Describe the process of patenting from innovation to development

### Unit I:

**Introduction:** An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

**Planning and Structuring:** Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

### Unit II:

**Drafting report and design issues:** The use of drafts, Illustrations and graphics.

**Final edits:** Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

### Unit III:

**Proofreading and summaries:** Proofreading, summaries, Activities on summaries. **Presenting final reports:** Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

### Unit IV: Using word processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes , Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

### Unit V:



**Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

**Text Books:**

- i. KompalBansal&ParshitBansal, “Fundamentals of IPR for Beginner’s”, 1<sup>st</sup> Ed., BS Publications, 2016.
- ii. William S. Pfeiffer and Kaye A. Adkins, “Technical Communication: A Practical Approach”, Pearson.
- iii. Ramappa,T., “Intellectual Property Rights Under WTO”, 2<sup>nd</sup> Ed., S Chand, 2015.

**Reference Books:**

- i. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
- ii. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press(2006)

**E-resources:**

- i. <https://www.udemy.com/course/reportwriting/>
- ii. <https://www.udemy.com/course/professional-business-english-and-technical-report-writing/>
- iii. <https://www.udemy.com/course/betterbusinesswriting/>



### B.Tech. IV Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Machine Learning	2	1	0	3
2	Management Course- II	Human Resources & Project Management	2	0	0	2
3	Professional Elective-IV	1. Software Architecture & Design Patterns 2. Blockchain Technology 3. Internet of Things 4. Quantum Computing 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
4	Professional Elective-V	1. Soft Computing 2. Digital Image Processing 3. Natural Language Processing 4. Mobile Adhoc Networks 5. 12 week MOOC Swayam/NPTEL course recommended by the BoS	3	0	0	3
5	Open Elective-III	1.Big Data Analytics 2. Block Chain Technologies 3.CyberSecurity 4.Devops 5. Quantum Computing	3	0	0	3
6	Open Elective-IV	1.Fundamentals of Optimization Techniques 2.Computer Forensics and Law Protection 3.Ethical Hacking 4.Augmented Reality &Virtual Reality 5.Biometrics	3	0	0	3
7	Skill Enhancement Course	Prompt Engineering/ SWAYAM Plus - Certificate program in Prompt Engineering and ChatGPT	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
<b>Total</b>			<b>18</b>	<b>2</b>	<b>02</b>	<b>21</b>



IV Year I Semester	MACHINE LEARNING	L	T	P	C
		3	0	0	3

The objectives of the course is to

1. Define machine learning and its different types (supervised and unsupervised) and understand their applications.
2. Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
3. Implement unsupervised learning techniques, such as K-means clustering.

### Course Outcomes:

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

1. Recognize the characteristics of machine learning that make it useful to real-world problems.
2. Design decision tree to solve classification problems.
3. Design neural network to solve classification and function approximation problems.
4. Comprehend probabilistic methods for learning.
5. Build optimal classifiers using genetic algorithms.

**UNIT-I: Introduction to Machine Learning:** Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

**UNIT-II: Nearest Neighbor-Based Models:** Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

**UNIT-III: Models Based on Decision Trees:** Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes’ Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC)

**UNIT-IV: Linear Discriminants for Machine Learning:** Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Back propagation for Training an MLP.

**UNIT-V: Clustering :** Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering,



Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

**Text Books:**

- i. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

**Reference Books:**

- i. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
- ii. "Machine Learning in Action", Peter Harrington, DreamTech
- iii. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7<sup>th</sup> Edition, 2019.



IV Year I Semester	HUMAN RESOURCES & PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

### Course Objectives:

The main objectives of the course are to

1. Provide knowledge about HR planning, recruitment, selection, and job design.
2. Develop skills in managing HR functions such as performance appraisal, compensation, and employee relations.
3. Emphasize the importance of ethical practices and HR audits in maintaining organizational health.

### Course Outcomes:

1. Identify and manage the roles and responsibilities within a project team.
2. Implement strategies for team development, motivation, and performance management.
3. Develop and manage project plans, schedules, budgets, and risk assessments.
4. Apply appropriate management strategies tailored to each project type to ensure successful outcomes.
5. Evaluate the impact of organizational structure on project communication, decision-making, and resource allocation.

**UNIT –I:** HRM: Nature, Scope, Concept of HRM, Functions of HRM, Role of HR manager, emerging trends in HRM, E-HRM, HR audit models, ethical aspects of HRM. HR Planning, Demand and Supply forecasting of HR, Job Design, Recruitment, Sources of recruitment, Selection-Selection Procedure.

**UNIT –II:** HRD, HR accounting, Models, Concept of Training and Development, Methods of Training. Performance Appraisal: Importance Methods of performance appraisal, Career Development and Counseling, group interaction.

**UNIT –III:** Basics of Project Management, Concept, resource management, Project environment, Types of Projects, project networks-DPR, Project life cycle, Project proposals, Monitoring project progress, Project appraisal and Project selection, 80-20 rules, production technology, communication matrix

**UNIT-IV:** Identify various project types and their unique management challenges and apply appropriate management strategies for each. Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

**UNIT-V:** Project Implementation and Review: Forms of project organization, project planning, project control, human aspects of project management, prerequisites for successful project implementation, project review, performance evaluation, abandonment analysis

### Text Books:



- i. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.
- ii. Sharon Pande and Swapnalekha Basak, Human Resource Management, Text and Cases, Vikas Publishing, 2e, 2016.
- iii. Stewart R. Clegg, Torgeir Skyttermoen, Anne Live Vaagaasar, Project Management, Sage Publications, 1e, 2021.
- iv. K. Nagarajan, Project Management, New Age International Publishers, 8e, 2017.

**Reference Books :**

- i. Subba Rao P, “Personnel and Human Resource Management-Text and Cases”, Himalaya Publications, Mumbai, 2013.
- ii. K Aswathappa, “Human Resource and Personnel Management”, Tata McGraw Hill, New Delhi, 2013.
- iii. Prasanna Chandra, “Projects, Planning, Analysis, Selection, Financing, Implementation and Review”, Tata McGraw Hill Company Pvt. Ltd., New Delhi, 1998.
- iv. Vasanth Desai, “Project Management”, 4th edition, Himalaya Publications, 2018.
- v. Lalitha Balakrishnan, Gowri, “Project Management”, Himalaya publishing house, New Delhi, 2022.



IV Year I Semester	SOFTWARE ARCHITECTURE & DESIGN PATTERNS (PROFESSIONAL ELECTIVE-IV)	L	T	P	C
		3	0	0	3

**Course Objectives:**

1. Define software architecture and design patterns.
2. Understand the conceptual classes and relationships using object-oriented modeling techniques.
3. Implement patterns such as Adapter, Bridge, Composite, Decorator, Facade, Flyweight, and Proxy.

**Course Outcomes:**

1. Understand the basic concepts to identify state behavior of real world objects.
2. Apply Object Oriented Analysis and Design concepts to solve complex problems.
3. Construct various UML models using the appropriate notation for specific problem context.
4. Design models to Show the importance of systems analysis and design in solving complex problems using case studies.
5. Study of Pattern Oriented approach for real world problems.

**UNIT - I**

**Introduction:** What is a design pattern? Describing design patterns, the catalog of design pattern, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern, What is object oriented development? key concepts of object oriented design other related concepts, benefits and drawbacks of the paradigm

**UNIT – II**

**Analysis a System:** Overview of the analysis phase, stage 1 gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain Design and Implementation, discussions and further reading

**UNIT – III**

**Design Pattern Catalog:** Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.

**UNIT – IV**

**Interactive systems and the MVC architecture:** Introduction The MVC architectural pattern, analyzing a simple drawing program designing the system, designing of the subsystems, getting into implementation, implementing undo operation drawing incomplete items, adding a new feature pattern based solutions



## **UNIT – V**

**Designing with Distributed Objects:** Client server system, java remote method invocation, implementing an object oriented system on the web, Web services (SOAP, Restful), Enterprise Service Bus

### **Text Books:**

- i. Object oriented analysis, design and implementation, brahma dathan, sarnathrammath , universities press,2013
- ii. Design patterns, Erich Gamma, Richard helan , Ralph johman , john vlissides, PEARSON Publication,2013

### **Reference Books:**

- i. Frank Bachmann, Regine Meunier, Hans Rohnert “Pattern Oriented Software Architecture” Volume 1, 1996.
- ii. William J Brown et al., "Anti Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998



IV Year I Semester	BLOCK CHAIN TECHNOLOGY (PROFESSIONAL ELECTIVE-IV)	L	T	P	C
		3	0	0	3

### Course Objective:

1. To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
2. To understand the structure of a Blockchain and why/when it is better than a simple distributed database
3. To make students understand the technological underpinnings of Blockchain operations as distributed data structures and decision making systems.

### Course Outcomes:

Upon completion of the course, it is expected that student will be able to:

1. Define and explain the fundamentals of Block chain.
2. Understand decentralization and the role of Block chain init.
3. Understand and analyze Bitcoin Crypto currency and underlying Block chain Network.
4. Understand Ethereum currency and platform, and develop applications using Solidity.
5. Understand Hyper ledger project and its components; critically analyze the challenges and future opportunities in Block chain technology.

### UNIT-I:

**Introduction:** History and basics, Types of Blockchain, Consensus, CAP Theorem.

**Cryptographic Hash Functions:** Properties of hash functions, Secure Hash Algorithm, Merkle trees, Patricia trees.

### UNIT-II:

**Decentralization:** Decentralization using Blockchain, Methods of decentralization, decentralization framework, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platforms for decentralization.

### UNIT-III:

**Bitcoin:** Introduction to Bitcoin, Digital keys and addresses, Transactions, Blockchain, The Bitcoin network, Bitcoin payments, Bitcoin Clients and APIs, Alternatives to Proof of Work, Bitcoin limitations.

### UNIT-IV:

**Ethereum:** Smart Contracts, Introduction to Ethereum, The Ethereum network, Components of the Ethereum ecosystem, Blocks and Blockchain, Fee schedule, Ethereum Development Environment, Solidity.



**UNIT-V:**

**Hyperledger:** Introduction, Hyperledger Projects, Protocol, Architecture, Hyperledger Fabric, Sawtooth Lake, Corda.

**Challenges and Opportunities:** Scalability, Privacy, Blockchain for IoT, Emerging trends

**Text Book:**

- i. Mastering Blockchain, Imran Bashir, Second Edition, PacktPublishing.

**Reference Books:**

- i. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas Antonopoulos,O'Reilly.
- ii. Blockchain Blueprint for a New Economy, Melanie Swan,O'Reilly.
- iii. Mastering Bitcoin: Programming the Open Blockchain, Antonopoulos, Andreas M. O'Reilly.
- iv. Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford UniversityPress.



IV Year I Semester	INTERNET OF THINGS (PROFESSIONAL ELECTIVE-IV)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. What IoT is and how it works today and to Understand the Architectural Overview of IoT
2. To Understand the IoT Reference Architecture and Real World Design Constraints
3. To understand the various IoT Protocols.

### Course Outcomes:

The students should be able to:

1. Recognize the factors that contributed to the emergence of IoT
2. Design and program IoT devices like Microcontrollers, sensors and actuators.
3. Use real IoT protocols for communication.
4. Define the infrastructure for supporting IoT deployment.
5. Design an IoT device to work with a Cloud Computing infrastructure and Transfer IoT data to the cloud and in between cloud providers.

### UNIT-I: Introduction to IOT

Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT , Overview of IoT components and IoT Communication Technologies, Challenges in IOT.

### UNIT - II: Arduino Simulation Environment

Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD.

### Sensor & Actuators with Arduino

Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino. Interfacing of Relay Switch and Servo Motor with Arduino.

### UNIT - III: Raspberry Pi Programming

Installing and **Configuring** the Raspberry Pi, Getting Started with the Raspberry Pi, Using the Pi as a Media Centre, Productivity Machine and Web Server, Remote access to the Raspberry Pi. Preparing

### Raspberry Pi for IoT Projects.

Creating the Sensor Projects, Creating the actuator Projects, Creating a IoT controller, creating a camera and working with HTTP protocol.

### UNIT - IV: Basic Networking with ESP8266 WiFi module

Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration, Posting sensor(s) data to web server .IoT Protocols ,M2M vs. IOT Communication Protocols.

### UNIT -V:Cloud Platforms for IOT

Virtualization concepts and Cloud Architecture , Cloud computing, benefits ,Cloud services -- SaaS, PaaS, IaaS , Cloud providers & offerings ,Study of IOT Cloud platforms , Thing Speak API and MQTT , interfacing ESP8266 with Web services

**Text Books:**

- i. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition McGraw- Hill Education
- ii. Peter Waher, Learning Internet of Things, Packt publishing.
- iii. Ovidiu Vermesan, Peter Friess, IoT-From Research and Innovation to Market deployment, River Publishers

**Reference Books:**

- i. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
- ii. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
- iii. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer.



IV Year I Semester	QUANTUM COMPUTING (Professional Elective-IV)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. Cultivate the fundamental understanding of electromagnetism.
2. Deliver the knowledge about Fourier and nonlinear optics.
3. Develop elementary problem-solving capability of quantum optics

### Course Outcomes:

By the end of this course, the student is able to

1. Analyze the behavior of basic quantum algorithms
2. Implement simple quantum algorithms and information channels in the quantum circuit model
3. Simulate a simple quantum error-correcting code
4. Prove basic facts about quantum information channels
5. Know about Quantum Computing Models

### UNIT –I:

Introduction: Quantum Measurements Density Matrices, Positive-Operator Valued Measure, Fragility of quantum information: Decoherence, Quantum Superposition and Entanglement, Quantum Gates and Circuits.

### UNIT –II:

Quantum Basics and Principles: No cloning theorem & Quantum Teleportation, Bell's inequality and its implications, Quantum Algorithms & Circuits.

### UNIT -III:

Algorithms: Deutsch and Deutsch–Jozsa algorithms, Grover's Search Algorithm, Quantum Fourier Transform, Shore's Factorization Algorithm.

### UNIT –IV:

Performance, Security and Scalability: Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

### UNIT -V:

Quantum Computing Models: NMR Quantum Computing, Spintronics and QED MODEL, Linear Optical MODEL, Nonlinear Optical Approaches; Limits of all the discussed approaches, Future of Quantum computing.

### Text Books:

- i. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms And Code Samples, SHROFF/O'Reilly.
- ii. Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition PacktV.K Sahni, Quantum Computing (with CD), TATAMcGraw-Hill.



IV Year I Semester	SOFT COMPUTING (Professional Elective-V)	L	T	P	C
		3	0	0	3

**Course Objectives:**

1. Introduce students to soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.
2. Introduce students to fuzzy systems, fuzzy logic and its applications.
3. Explain the students about Artificial Neural Networks and various categories of ANN.

**Course Outcomes:**

1. Student can be able to build intelligent systems through soft computing techniques.
2. Student should be able to understand the concept of artificial neural networks, fuzzy arithmetic, and fuzzy logic with their day-to-day applications.
3. Understand fuzzy logic and reasoning to handle and solve engineering problems.
4. Perform various operations of genetic algorithms, Rough Sets.
5. Comprehend various techniques to build model for various applications

**UNIT-I:**

**Introduction:** What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

**UNIT-II:**

**Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications

**UNIT-III:**

**Fuzzy Systems:** Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification

**UNIT-IV:**

**Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

**UNIT-V:**

**Hybrid Systems:** Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

**GA based Back propagation Networks:** GA based Weight Determination, K - factor determination in Columns.

**Fuzzy Back propagation Networks:** LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks.



**Text Books:**

- i. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley India, 2007.
- ii. Soft Computing and Intelligent System Design -Fakhreddine O Karray, Clarence D Silva, Pearson Edition, 2004.

**Reference Books:**

- i. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
- ii. Genetic Algorithms: Search and Optimization, E. Goldberg.
- iii. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
- iv. Build\_Neural\_Network\_With\_MS\_Excel\_sample by Joe choong



IV Year I Semester	DIGITAL IMAGE PROCESSING (Professional Elective-V)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To become familiar with digital image fundamentals
2. To get exposed to simple image enhancement techniques in Spatial and Frequency domain
3. To learn concepts of degradation function and restoration techniques

### Course Outcomes:

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

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Use the restoration concepts and filtering techniques
4. Illustrate the basics of segmentation
5. Understand Image Compression and Recognition techniques

### UNIT- I:

Digital Image Fundamentals: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels.

### UNIT -II:

Image Enhancement: Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering.

### UNIT –III:

Image Restoration: Image Restoration - degradation model, Properties, Noise models– Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

### UNIT -IV:

Image Segmentation: Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

### UNIT –V:

Image Compression and Recognition: Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Patternclasses - Recognition based on matching.



**Text Books:**

- i. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition,2010.
- ii. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson,2002.

**Reference Books:**

- i. Kenneth R. Castleman, Digital Image Processing, Pearson,2006.
- ii. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing, Prentice Hall Professional Technical Reference,1990.
- iii. William K. Pratt, Digital Image Processing, John Wiley, New York,2002.



IV Year I Semester	NATURAL LANGUAGE PROCESSING (Professional Elective-V)	L	T	P	C
		3	0	0	3

### Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

1. Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
2. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
3. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

### Course Outcomes:

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

1. Explain the origins and challenges of Natural Language Processing
2. Apply word-level analysis techniques in NLP using unsmoothed and smoothed N-gram models,
3. Apply grammar normal forms, feature structures, and unification techniques to resolve syntactic ambiguity.
4. Implement word sense disambiguation and word similarity methods using supervised, dictionary-based, and distributional approaches.
5. Analyze discourse structure and reference phenomena in text

### UNIT I:

**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:

**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:

**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:

**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:**

**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).

#### **Text Books:**

- ii. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2<sup>nd</sup> Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.
- iii. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media, 2009.

#### **Reference Books:**

- i. Language Processing with Java and Ling Pipe Cookbook, 1<sup>st</sup> Edition, Breck Baldwin, Atlantic Publisher, 2015.
- ii. Natural Language Processing with Java, 2<sup>nd</sup> Edition, Richard M Reese, OReilly Media, 2015.
- iii. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010. Edition
- iv. Natural Language Processing and Information Retrieval, 3<sup>rd</sup> Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.



IV Year I Semester	MOBILE ADHOC NETWORKS (Professional Elective-V)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To learn about the issues and challenges in the design of wireless ad hoc networks.
2. To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
3. To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.

### Course Outcomes:

1. Know the basics of Ad hoc networks and Wireless Sensor Networks.
2. Identify the issues and challenges in providing QoS.
3. To know how the resources are managed in the network.
4. To get an idea about various types of mesh networks.
5. Specify and identify deficiencies in existing wireless protocols for MAC layer and Network layer, and then go onto formulate new and better protocols.

### UNIT-I: Routing:

Cellular and Ad hoc wireless networks, Issues of MAC layer and Routing, Proactive, Reactive and Hybrid Routing protocols, Multicast Routing, Tree based and Mesh based protocols, Multicast with Quality of Service Provision

### UNIT-II: Quality of Service:

Real-time traffic support , Issues and challenges in providing QoS , Classification of QoS Solutions ,MAC layer classifications ,QoS Aware Routing Protocols ,Ticket based and Predictive location based QoS Routing Protocols

### UNIT-III:

#### Energy Management Ad Hoc Networks:

Need for Energy Management, Classification of Energy Management Schemes, Battery Management and Transmission Power Management Schemes, Network Layer and Data Link Layer Solutions, System power Management schemes.

### UNIT-IV:

#### Mesh Networks:

Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Opportunistic Routing, Self Configuration and Auto Configuration, Capacity Models, Fairness, Heterogeneous Mesh Networks, Vehicular Mesh Networks

**UNIT -V:****Sensor Networks:**

Introduction – ,Sensor Network architecture , Data Dissemination ,Data Gathering ,MAC Protocols for sensor Networks, Location discovery, Quality of Sensor Networks ,Evolving Standards ,Other Issues, Recent trends in Infrastructure less Networks.

**Text Books:**

- i. C.Siva Ram Murthy and B.S.Manoj, Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education.
- ii. Holger Karl, Andreas Willing, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, Inc.

**Reference Books:**

- i. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, Ad Hoc Mobile Wireless Networks, Auerbach Publications.
- ii. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing.
- iii. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks Theory and Practice, John Wiley and Sons.



IV Year I Semester	BIG DATA ANALYTICS (OPEN ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

The objectives of this course is to acquire knowledge on the

1. Necessity of Big data analysis and challenges in Big data analysis
2. Descriptive, Predictive, Real-time analysis of bigdata
3. Programming tools PIG & HIVE in Hadoop echo system

### Course Outcomes:

The students should be able to:

1. Understand and Illustrate characteristics of big data and big data challenges in different domains including social media, transportation, finance and medicine
2. Demonstrate stream processing on real time applications
3. Do Big data processing using Map reduce on Hadoop
4. Do Big data processing using PIG scripts and HiveQL queries
5. Understand Predictive analysis of big data.

**UNIT-I: Introduction:** Introduction to big data: Introduction to Big Data platform, Challenges of conventional systems, Intelligent data analysis, Nature of data, Analytic processes and tools, Analysis vs Reporting.

**UNIT - II: Stream Processing:** Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis - Stock Market Predictions.

**UNIT - III: Introduction to Hadoop:** Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analysing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

**UNIT - IV: Frameworks and Applications:** Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

**UNIT - V: Predictive Analytics and Visualizations:** Predictive Analytics, Simple linear regression, Multiple linear Regressions, Interpretation of regression coefficients, Visualizations, Visual data analysis



techniques, interaction techniques, Systems and application

**Text Books:**

- i. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, Fourth Edition,2015.
- ii. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing,2012.
- iii. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, CUP, 2012

**References:**

- i. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley& sons,2012.
- ii. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, JamesGiles, David Corrigan, “Harness the Power of Big Data:The IBM Big Data Platform”, Tata McGraw Hill Publications,2012.
- iii. ArshdeepBahga and Vijay Madisetti, “Big Data Science & Analytics: A Hands On Approach “, VPT,2016.
- iv. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014.

**E-resources:**

- i. <https://www.edx.org/course/big-data-fundamentals>
- ii. <https://hadoop.apache.org/>
- iii. <https://pig.apache.org/>
- iv. <https://hive.apache.org/>



IV Year I Semester	BLOCK CHAIN TECHNOLOGIES (OPEN ELECTIVE-III)	L	T	P	C
		3	0	0	3

**Course Objective:**

1. To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
2. To understand the structure of a Blockchain and why/when it is better than a simple distributed database
3. To make students understand the technological underpinnings of Blockchain operations as distributed data structures and decision making systems.

**Course Outcomes:**

Upon completion of the course, it is expected that student will be able to:

1. Define and explain the fundamentals of Blockchain.
2. Understand decentralization and the role of Blockchain in it.
3. Understand and analyze Bitcoin in Cryptocurrency and underlying Blockchain network.
4. Understand Ethereum currency and platform, and develop applications using Solidity.
5. Understand Hyper ledger project and its components; critically analyze the challenges and future opportunities in Block chain technology.

**UNIT-I:**

**Introduction:** History and basics, Types of Blockchain, Consensus, CAP Theorem.

**Cryptographic Hash Functions:** Properties of hash functions, Secure Hash Algorithm, Merkle trees, Patricia trees.

**UNIT-II:**

**Decentralization:** Decentralization using Blockchain, Methods of decentralization, decentralization framework, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platforms for decentralization.

**UNIT-III:**

**Bitcoin:** Introduction to Bitcoin, Digital keys and addresses, Transactions, Blockchain, The Bitcoin network, Bitcoin payments, Bitcoin Clients and APIs, Alternatives to Proof of Work, Bitcoin limitations.

**UNIT-IV:**

**Ethereum:** Smart Contracts, Introduction to Ethereum, The Ethereum network, Components of the Ethereum ecosystem, Blocks and Blockchain, Fee schedule, Ethereum Development Environment, Solidity.



#### **UNIT-V:**

**Hyperledger:** Introduction, Hyperledger Projects, Protocol, Architecture, Hyperledger Fabric, Sawtooth Lake, Corda.

**Challenges and Opportunities:** Scalability, Privacy, Blockchain for IoT, Emerging trends

#### **Text Book:**

- i. Mastering Block chain, Imran Bashir, Second Edition, PacktPublishing.

#### **References:**

- i. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas Antonopoulos,O'Reilly.
- ii. Blockchain Blueprint for a New Economy, Melanie Swan,O'Reilly.
- iii. Mastering Bitcoin: Programming the Open Blockchain, Antonopoulos, Andreas M. O'Reilly.
- iv. Blockchain Technology: Cryptocurrency and Applications, S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford UniversityPress.



IV Year I Semester	CYBER SECURITY (OPEN ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objective:

1. To introduce keywords and jargons involved in securing browser
2. Understanding network basic and familiarize on security of network protocols
3. Awareness and understanding on cyber-attacks and data privacy

### Course Outcomes:

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

1. Understand the basics and need for information security
2. Identify, analyze, and evaluate infrastructure and network vulnerabilities.
3. Understand and analyze different access control and authentication methods.
4. Identify and assess current and anticipated security risks and vulnerabilities with vulnerability assessment and auditing methods.
5. Learn the fundamentals of cryptography and how cryptography serves as the central language of information security.

### UNIT-I:

**Introduction to Security:** Challenges of Securing Information, Definition of Information Security, Attackers, Attacks and Defenses.

**Systems Threats and Risks:** Software-Based Attacks, Hardware-Based Attacks, Attacks on Virtualized Systems, Hardening the Operating System, Preventing Attacks that Target the Web Browser, Hardening Web Servers, Protecting Systems from Communications-Based Attacks, Applying Software Security Applications.

### UNIT-II:

**Network Vulnerabilities and Attacks:** Network Vulnerabilities, Categories of Attacks, Methods of Network Attacks.

**Network Defenses:** Crafting a Secure Network, Applying Network Security Devices, Host and Network Intrusion Prevention Systems (HIPS/NIPS), Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware.

### UNIT-III:

**Access Control:** Access Control Models and Practices, Logical Access Control Methods, Physical Access Control.

**Authentication:** Definition of Authentication, Authentication Credentials, Extended Authentication Protocols, Remote Authentication and Security.

**UNIT-IV:**

**Vulnerability Assessment:** Risk Management, Assessment, and Mitigation, Identifying Vulnerabilities.

**Security Audit:** Privilege Auditing, Usage Auditing, Monitoring Methodologies and Tools.

**UNIT-V:**

**Cryptography:** Introduction to Cryptography, Cryptographic Algorithms, Using Cryptography on Files and Disks, Digital Certificates, Public Key Infrastructure, Key Management.

**Text Book:**

- i. Security+ Guide to Network Security Fundamentals, Third Edition, Mark Ciampa, Cengage Learning.

**References:**

- i. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning.
- ii. Information Security: The Complete Reference, Rhodes-Ousley, Mark, Second Edition, McGraw-Hill.
- iii. Information Security: Principles and Practices, Mark S. Merkow, Jim Breithaupt, 2nd Edition, Pearson Education.



IV Year I Semester	DEVOPS (OPEN ELECTIVE-III)	L	T	P	C
		3	0	0	3

**Course Objectives:**

1. To understand the DevOps Concepts and DevOps Tools
2. DevOps improves collaboration and productivity by automating infrastructure and
3. Workflows and continuously measuring applications performance.

**Course Outcomes:**

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

1. Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility
2. Describe DevOps & DevSecOps methodologies and their key concepts
3. Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
4. Set up complete private infrastructure using version control systems and CI/CD tools
5. Know about DevOps maturity model.

**UNIT- I:**

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

**UNIT –II:**

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

**UNIT –III:**

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

**UNIT –IV:**

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

**UNIT -V:**

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



### Text Books:

- i. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. It is written by Gene Kim, Jez Humble, Patrick Debois, and John Willis.
- ii. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, is by Jez Humble and David Farley
- iii. Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale by Jennifer Davis & Ryn Daniels.

### References/Web Links:

- i. <https://www.udacity.com/course/intro-to-devops--ud611> - Good online course with sample exercises.
- ii. <http://www.edureka.co/devops> - Online Training covering high level process and tools. (Needs Registration)
- iii. [https://www.edx.org/course?search\\_query=devops](https://www.edx.org/course?search_query=devops) – Has no. of courses from MS and Redhat.
- iv. <https://www.codementor.io/devops/tutorial> - Basic Tutorial on DevOps.
- v. <https://mva.microsoft.com/training-topics/devops#!lang=1033> – Lists no. of courses related to DevOps and various tools, methods used.
- vi. <http://devops.com/> - A good blog, has lots of contents.
- vii. <https://dzone.com/devops-tutorials-tools-news> - Lots of links and tutorials



IV Year I Semester	QUANTUM COMPUTING (OPEN ELECTIVE-III)	L	T	P	C
		3	0	0	3

### Course Objectives:

- 1.To understand the components of computing in a Quantum world
- 2.To gain knowledge on mathematical representation of quantum physics and operations.
- 3.To write computations in the real world (standard) in a Quantum computer and simulator.

### Course Outcomes:

By the end of this course, the student is able to

1. Analyze the behavior of basic quantum algorithms
2. Implement simple quantum algorithms and information channels in the quantum circuit model
3. Simulate a simple quantum error-correcting code
4. Prove basic facts about quantum information channels
5. Know about Quantum Computing Models

### UNIT –I:

Introduction: Quantum Measurements Density Matrices, Positive-Operator Valued Measure, Fragility of quantum information: Decoherence, Quantum Superposition and Entanglement, Quantum Gates and Circuits.

### UNIT –II:

Quantum Basics and Principles: No cloning theorem & Quantum Teleportation, Bell’s inequality and its implications, Quantum Algorithms & Circuits.

### UNIT -III:

Algorithms: Deutsch and Deutsch–Jozsa algorithms, Grover’s Search Algorithm, Quantum Fourier Transform, Shore’s Factorization Algorithm.

### UNIT –IV:

Performance, Security and Scalability: Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

### UNIT -V:

Quantum Computing Models: NMR Quantum Computing, Spintronics and QED MODEL, Linear Optical MODEL, Nonlinear Optical Approaches; Limits of all the discussed approaches, Future of Quantum computing.

### Text Books:

- i. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia “Programming Quantum Computers: Essential Algorithms And Code Samples, SHROFF/O’Reilly.
- ii. Dr. Christine Corbett Moran, Mastering Quantum Computing with IBM QX: Explore the world of quantum computing using the Quantum Composer and Qiskit, Kindle Edition Packt



IV Year I Semester	<b>FUNDAMENTALS OF OPTIMIZATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>TECHNIQUES (OPEN ELECTIVE-IV)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### Course Objectives:

1. Introduction to optimization techniques using both linear and non-linear programming.
2. The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization too.
3. After an adequate introduction to linear algebra and probability theory, students will learn to frame engineering minima maxima problems in the framework of optimization problems.

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

1. Comprehend the techniques and applications of engineering optimization.
2. Analyze characteristics of a general linear programming problem
3. Apply basic concepts of mathematics to formulate an optimization problem
4. Analyze various methods of solving the unconstrained minimization problem
5. Analyze and appreciate variety of performance measures for various optimization problems.

### UNIT-I

Introduction to optimization Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers.

### UNIT-II

Linear Programming Problem Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

### UNIT-III

Single Variable Optimization Problems Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.

### UNIT-IV

Multivariable and Constrained Optimization Techniques Multi Variable and Constrained Optimization Technique, Optimality criteria , Direct search Method, Simplex search methods, Hooke-Jeeve's pattern search method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent



method, Newton's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.

## UNIT-V

Intelligent Optimization Techniques Introduction to Intelligent Optimization, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO), Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

### Textbooks:

- i. S. S. Rao, Engineering Optimisation: Theory and Practice , Wiley, 2008.
- ii. K. Deb, Optimization for Engineering design algorithms and Examples , Prentice Hall, 2 nd edition 2012.

### References:

- i. C.J. Ray, Optimum Design of Mechanical Elements , Wiley, 2007.
- ii. R. Saravanan, Manufacturing Optimization through Intelligent Techniques , Taylor & Francis Publications, 2006. 3. D. E. Goldberg, Genetic algorithms in Search, Optimization, and Machine Learning , Addison-Wesley Longman Publishing, 1989.



IV Year I Semester	COMPUTER FORENSICS AND LAW PROTECTION (OPEN ELECTIVE-IV)	L	T	P	C
		3	0	0	3

### Course Objectives:

1. To correctly define and cite appropriate instances for the application of computer forensics  
Correctly collect and analyze computer forensic evidence
2. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics
3. Designing procedures at a suspected crime scene which helps you to ensure that the digital evidence obtained is not corrupted.

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

1. Understand the concept of Cyber security, issues and challenges associated with it.
2. Understand the cybercrimes, their nature, legal remedies and reporting the crimes through available platforms and procedures.
3. Appreciate various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of social media platforms.
4. Understand the basic concepts related to E-Commerce and digital payments.
5. Familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

### UNIT-I

Introduction: Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Computer Forensics Systems – Vendor and Computer Forensics Services.

### UNIT-II

Computer forensics evidence and capture: Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence E-Computer Image Verification and Authentication.

Current Digital Forensics Tools: Evaluating Digital Forensics Tool Needs, Digital Forensics Software Tools, Command-Line Forensics Tools, Digital Forensics Hardware Tools, Validating and Testing Forensics Software.

### UNIT-III

Computer forensic analysis: Discover of Electronic Evidence E Identification of Data – Reconstructing Past Events – Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies.



E-mail and Social Media Investigations: Exploring the Role of E-mail in Investigations, Exploring the Roles of the Client and Server in E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, Using Specialized E-mail Forensics Tools, Applying Digital Forensics Methods to Social Media Communications.

#### **UNIT-IV**

Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime E-Identity Theft and Identity Fraud – Organized Crime & Terrorism – Avenues Prosecution and Government Efforts – Applying the First Amendment to Computer Related Crime-The Fourth Amendment and other Legal Issues.

#### **UNIT-V**

Computer forensic cases: Developing Forensic Capabilities –Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.

Basics of Law and Technology, Introduction to Indian Laws, Scope and Jurisprudence, Digital Signatures, ECommerce-an Introduction, possible crime scenarios, law coverage, data interchange, mobile communication development, smart card and expert systems

#### **Text Books:**

- i. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18).(UNIT I – IV)
- ii. Nelson, Phillips, Steuart, “Guide to Computer Forensics and Investigations, 6e”, Cengage.
- iii. Marjie T Britz, “Computer Forensics and Cyber Crime: An Introduction”, Pearson Education, 2nd Edition, 2008. (CHAPTERS 3 – 13). (UNIT IV – V)\
- iv. Doctrine of IT Act of India, Government of India Publication (2000)

#### **Reference Books:**

- i. MariE-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett Learning; 2nd Edition, 2014.
- ii. Eamon P.Doherty, “Digital Forensics for Handheld Devices”, CRC Press.
- iii. Chad Steel, “Windows Forensics”, Wiley, 1st Edition, 2006.
- iv. Majid Yar, “Cybercrime and Society”, SAGE Publications Ltd, Hardcover,2nd Edition, 2013.
- v. Robert M Slade, “Software Forensics: Collecting Evidence from the Scene of a Digital Crime”, Tata McGraw Hill, Paperback, 1st Edition, 2004.



IV Year I Semester	ETHICAL HACKING (OPEN ELECTIVE-IV)	L	T	P	C
		3	0	0	3

**Course Objectives:**

1. Learn aspects of security, importance of data gathering, foot printing and system hacking.
2. Learn tools and techniques to carry out a penetration testing.
3. Explain Intrusion Detection, Policy Creation, Social Engineering, DDoS Attacks, Buffer

**Course Outcomes:**

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

1. Demonstrate an understanding of the importance of security and ethical hacking
2. Explain the significance of buffer overflow vulnerabilities
3. Describe the concepts of active and passive sniffing
4. Analyze SQL injection and related web application attacks
5. Explain core web application security defense mechanisms

**UNIT-I:**

**Introduction:** Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking, Foot printing, Scanning, System Hacking, Session Hijacking.

**UNIT-II:**

**Buffer Overflows:** Significance of Buffer Overflow Vulnerability, Why Programs/Applications are vulnerable. Reasons for Buffer Overflow Attacks. Methods of ensuring that buffer overflows are trapped.

**UNIT-III:**

**Sniffers:** Active and passive sniffing. ARP poisoning and countermeasures. Man in the middle attacks, Spoofing and Sniffing attacks. Sniffing countermeasures.

**UNIT-IV:**

**SQL Injection:** Attacking SQL Servers, Sniffing, Brute Forcing and finding Application Configuration Files, Input validation attacks. Preventive Measures. Web Application Threats, Web Application Hacking, Cross Site Scripting / XSS Flaws / Countermeasures Correct Web Application Set-up.

**UNIT-V:**

**Web Application Security:** Core Defence Mechanisms. Handling User Access, Authentication, Session Management, Access Control.

**Web Application Technologies:** HTTP Protocol, Requests, Responses and Methods. Encoding schemes. Server side functionality technologies (Java, ASP, PHP).

**Text books:**

- i. Patrick Engebretson, The Basics of Hacking and Penetration Testing, Elsevier, 2013.
- ii. Network Security and Ethical Hacking, Rajat Khare, Luniver Press, 2006.



**Reference books:**

- i. Network intrusion alert: an ethical hacking guide to intrusion detection, Ankit Fadia, Manu Zacharia, Thomson Course Technology PTR, 2007.
- ii. Ethical Hacking, Thomas Mathew, OSB Publisher, 2003.
- iii. Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill, 2005.



IV Year I Semester	AUGMENTED REALITY & VIRTUAL REALITY (OPEN ELECTIVE-IV)	L	T	P	C
		3	0	0	3

**Objectives:**

1. Provide a foundation to the fast growing field of AR and make the students aware of the various AR concepts.
2. To give historical and modern overviews and perspectives on virtual reality.
3. Describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

**Course Outcomes:**

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

- 1.Explain the principles of AR displays, visual perception, and tracking systems
- 2.Apply computer vision techniques for augmented reality
3. Explain the geometric, optical, and physiological principles
4. Analyze visual perception aspects such as depth, motion, and color, and apply visual rendering techniques
5. Analyze motion dynamics in real and virtual environments

**UNIT - I**

**Introduction to Augmented Reality:** Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields

**Displays:** Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays

**Tracking:** Tracking, Calibration, and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors

**UNIT - II**

**Computer Vision for Augmented Reality:** Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking.

**Interaction:** Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction

**Software Architectures:** AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs

**UNIT - III**

**Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception

**The Geometry of Virtual Worlds:** Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations



**Light and Optics:** Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays

#### UNIT - IV

**The Physiology of Human Vision:** From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR

**Visual Perception:** Visual Perception - Perception of Depth, Perception of Motion, **Perception of Color**

**Visual Rendering:** Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos

#### UNIT - V

**Motion in Real and Virtual Worlds:** Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection

**Interaction:** Motor Programs and Remapping, Locomotion, Social Interaction

**Audio:** The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

#### Text Books:

- i. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494
- ii. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

#### Reference Books:

- i. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
- ii. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
- iii. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009
- iv. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN:9781491962381
- v. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
- vi. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005



IV Year I Semester	BIOMETRICS (OPEN ELECTIVE-IV)	L	T	P	C
		3	0	0	3

**Course Objective:**

1. To understand the technologies of fingerprint, iris, face and speech recognition
2. To understand the general principles of design of biometric systems and the underlying trade-offs.
3. To recognize personal privacy and security implications of biometrics based identification technology.

**Course Outcomes:**

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

1. Understand basic concepts of biometric technology.
2. Analyze fingerprint technology
3. Analyze face recognition systems
4. Understand voice based biometric recognition
5. Understand Multi-biometric systems

**UNIT-I: INTRODUCTION TO BIOMETRICS**

Introduction and background – biometric technologies – passive biometrics – active biometrics - Biometrics Vs traditional techniques – Benefits of biometrics - Operation of a biometric system– Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, FTA rate and rate- Need for strong authentication – Protecting privacy and biometrics and policy – Biometric applications.

**UNIT-II: FINGERPRINT IDENTIFICATION TECHNOLOGY**

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges -Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

**UNIT-III: FACE RECOGNITION**

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition, Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Space, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

**UNIT-IV: VOICE SCAN**

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.



## UNIT-V: FUSION IN BIOMETRICS

Introduction to Multibiometric - Advantages of multimodal system, Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics – Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples – gait based biometric systems.

### Text Books:

- i. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, —Biometric Systems, Technology Design and Performance Evaluation, Springer.
- ii. David D. Zhang, —Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers, New Delhi.
- iii. Arun A. Ross, Karthik Nandakumar, A.K. Jain, —Handbook of Multibiometrics, Springer, New Delhi.

### References:

- i. Paul Reid, —Biometrics for Network Security, Pearson Education, 2004.
- ii. Nalini K Ratha, Ruud Bolle, —Automatic fingerprint Recognition System, Springer.
- iii. L C Jain, I Hayashi, S B Lee, U Halici, —Intelligent Biometric Techniques in Fingerprint and Face Recognition, CRC Press, 1999.
- iv. John Chirillo, Scott Blaul, —Implementing Biometric Security, John Wiley, 2003.
- v. S.Y. Kung, S.H. Lin, M.W. Mak, —Biometric Authentication: A Machine Learning Approach, Prentice Hall, 2005



IV Year I Semester	PROMPT ENGINEERING (SKILL ENHANCEMENT COURSE)	L	T	P	C
		0	1	2	2

### Course Objectives:

The main objectives of the course are to

1. Apply iterative prompting for clarity and context.
2. Create varied prompts to steer model outputs.
3. Construct chain-of-thought and structured prompts.

### Course Outcomes:

1. Understand prompt engineering as the process of crafting inputs to elicit desired outputs from large language models (LLMs).
2. Design prompts that include contextual details and explicit output formats to guide the model towards desired responses.
3. Understand the Importance of Structured Outputs and Reasoning Techniques in Real-World Applications.
4. Recognize the constraints of large language models (LLMs) regarding static knowledge and the necessity for integrating external data sources to enhance their capabilities.
5. Understand the concept of using LLMs for automated evaluation of prompts.

**Unit I: Foundations of Prompt Engineering:** Definition of prompt engineering, Distinction between prompt engineering and model fine-tuning, Motivation and benefits of prompt engineering, Core principles of effective prompt design, Anatomy of a prompt, Setting up the Python environment for LLM interaction, Iterative prompting lifecycle, Common prompt pitfalls and remediation

### Lab Experiments:

1. Environment & Connectivity: Install required packages (e.g., transformers, openai); securely configure the API key; run a simple “Hello, world” prompt to verify model access.
2. Baseline vs. Enhanced Prompts: Execute a naïve prompt (“Write a one-paragraph bio of Ada Lovelace.”) and an enhanced prompt that adds role framing, specificity, and explicit format instructions; compare both outputs for relevance, completeness, and style.
3. Iterative Refinement on a Simple Task: Summarize the plot of the Shakespearean play Romeo and Juliet in two sentences through three rounds of prompt tweaking:
  - a. Minimal instruction.
  - b. Addition of length and style constraints
  - c. Specification of key content elements (setting and theme)
 Document how each iteration changes and improves the result.
4. Diagnosing Prompt Failures & Edge Cases: Craft a vague or contradictory prompt; analyze the failure mode (ambiguity, missing context, or format errors); refine the prompt by adding examples or clarifying instructions.

**Unit II: Advanced Prompt Patterns & Techniques:** Enhanced prompt anatomy: contextual detail and explicit output specifications, Few-shot in-context prompting, Prompt structuring and template design, Role-based prompting to establish personas or system behavior, Negative prompting to filter or suppress undesired content, Constraint specification and instruction enforcement (e.g., length, format), Iterative prompt refinement and optimization



### Lab Experiments:

1. Few-Shot vs. Zero-Shot Comparison: Design and execute a zero-shot prompt and a few-shot prompt (with 2–3 exemplar input-output pairs) for a chosen text task (e.g., sentiment classification or translation); compare outputs for accuracy, consistency, and adherence to examples.
2. Role-Based & Negative Prompting: Craft a role-based prompt to establish a specific persona (e.g., “You are a financial advisor...”); then create a negative prompt to suppress undesired content (e.g., “Do not mention any brand names”); evaluate how each influences the model’s response.
3. Constraint Specification & Iterative Refinement: Select an open-ended task (e.g., summarizing a technical article); issue a basic prompt; identify failures in length or format; refine the prompt by adding explicit constraints (word count, bullet format, etc.); document improvements over two refinement cycles.

**Unit III: Structured Output & Reasoning Techniques:** Importance of structured outputs for real-world applications, Prompting for specific formats (lists, tables, Markdown), Generating valid JSON and YAML via explicit instructions, Eliciting chain-of-thought reasoning in zero-shot prompts, Decomposing complex tasks into manageable sub-tasks

### Lab Experiments:

1. Structured Format Prompting: Instruct the model to output information as bullet lists and Markdown tables (e.g., “List three benefits of daily exercise in a Markdown table with columns ‘Benefit’ and ‘Description.’”); verify the output matches the requested structure.
2. JSON/YAML Generation: Provide a brief dataset description (e.g., three books with title, author, publication year) and prompt the model to produce valid JSON or YAML; use a parser to validate syntax and refine the prompt if errors occur.
3. Chain-of-Thought & Task Decomposition: Present a multi-step problem (e.g., a logic puzzle) and apply zero-shot CoT prompting (e.g., “Let’s think step by step. Explain your reasoning before the final answer.”); separately, decompose the problem into sequential sub-questions, collect partial answers, combine them, and compare accuracy against a direct-answer baseline.

**Unit IV: Retrieval-Augmented Generation & LangChain Workflows:** Limitations of LLM internal knowledge, Need for external data sources, Introduction to Retrieval-Augmented Generation (RAG), Overview of RAG architecture (indexing vs. retrieval + generation), Getting started with LangChain for LLM applications, Basics of LangChain Expression Language (LCEL), Simplified indexing pipeline: document loading & text splitting, Fundamentals of embeddings and vector stores, Building a basic retrieval-generation pipeline with an LCEL chain

### Lab Experiments:

1. Building a Simple LCEL Chain: Create a minimal LCEL script that accepts a fixed instruction (e.g., “Summarize this text: ...”), passes it to an LLM, and prints the result; verify end-to-end execution.
2. Basic Data Indexing for RAG: Load a small collection of documents; split into uniform chunks (e.g., 200 tokens); generate embeddings for each chunk; store them in an in-memory vector store; inspect for consistency.
3. Constructing & Running a Basic RAG Chain: Build a pipeline that:
  - a. Receives a user query
  - b. Retrieves the top-k relevant chunks



- c. Constructs a combined prompt with context + query
- d. Send it to the LLM
- e. Returns the answer

Test with sample queries and compare factual accuracy against a prompt without retrieval.

**Unit V: Agents, Multimodal AI & Ethical Evaluation:** Introduction to LLM agents and their basic architecture, Overview of multimodal AI models (VLMs), Prompting for text-to-image generation and image understanding, Importance of prompt evaluation beyond subjective judgment, Manual evaluation techniques (heuristic checks for accuracy, relevance, format), Introduction to “LLM-as-Judge” for automated evaluation, Security considerations (prompt injection, sensitive-information risks), Prompt-based mitigation strategies for safety and robustness, Ethical concerns (bias, misinformation, data privacy), Brief exploration of UI frameworks (Streamlit/Gradio) for deploying prompt-driven apps, Adapting to the evolving nature of prompt engineering through continuous learning

### Lab Experiments:

1. Building a Simple LLM Agent: Register a tool (e.g., a calculator function) and craft prompts that instruct the agent to invoke it when required; implement using Lang Chain or a function-calling API; test on queries requiring tool execution.
2. Multimodal Prompting Exploration: Generate images from detailed text prompts; feed one generated image into an image-understanding model or API with an appropriate prompt; compare the returned caption to the original prompt to evaluate alignment.
3. Prompt Evaluation & Ethics Workshop:
  - a. Select two existing prompts and generate multiple outputs; apply manual heuristic checks for accuracy, relevance, and format compliance.
  - b. Use an “LLM-as-Judge” prompt (e.g., “Rate these outputs on a scale of 1–5 for clarity and correctness.”) to automate evaluation.
  - c. Design a prompt- injection test (e.g., “Ignore previous instructions...”), observe the response, then refine system prompts to mitigate the vulnerability.



IV Year I Semester	Constitution of India (AUDIT COURSE)	L	T	P	C
		2	0	0	-

### Course Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

### Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
3. Understand the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
  1. Know the sources, features, and principles of Indian Constitution.
  2. Learn about Union Government, State government and its administration.
  3. Get acquainted with Local administration and Panchayati Raj.
  4. Be aware of basic concepts and developments of Human Rights.
  5. Gain knowledge on roles and functioning of Election Commission

**UNIT-I: History of Making of the Indian Constitution:** History, Drafting Committee, (Composition & Working)

**Philosophy of the Indian Constitution-** Preamble, Salient, Features

**UNIT-II: Contours of Constitutional Rights & Duties:** Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.



**UNIT–III: Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, **Executive-** President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

**UNIT–IV: Local Administration:** District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**UNIT–V: Election Commission:** Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

**Text Books:**

- i. The Constitution of India, 1<sup>st</sup> Edition, (Bare Act), Government Publication, 1950
- ii. Framing of Indian Constitution, 1<sup>st</sup> Edition, Dr. S. N. Busi, Dr. B. R. Ambedkar 2015

**Reference Books:**

- i. Indian Constitution Law, 7<sup>th</sup> Edition, M. P. Jain, Lexis Nexis, 2014.

**B.Tech IV Year II Semester**

<b>S.No.</b>	<b>Category</b>	<b>Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	Internship & Project Work	Full semester Internship & Project Work	0	0	24	12

**Note : Student need to do at least ONE MOOC/NPTEL Course (of 3 credits out of 160 credits) to meet the mandatory requirement (11<sup>th</sup> criteria, as per R23 Regulations); they are allowed to register one semester in advance**