PONDICHERRY UNIVERSITY

A Central University under Ministry of Education, Govt. of India

Proposed Curriculum & Syllabus for

2023-24

B.Tech

Computer Science and Engineering (Internet of Things and Cyber Security Including Blockchain Technology)

(Affiliated Engineering Colleges)

PONDICHERRY UNIVERSITY

BACHELOR OF TECHNOLOGY PROGRAMMES

(For Affiliated Colleges)

REGULATIONS 2023-24

1. Conditions for Admission:

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

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

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

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

OR

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

OR

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

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

2. AgeLimit:

As per applicable AICTE norms.

3. Duration of Programme:

The Bachelor of Technology degree programme shall extend over a period of 8 semesters spread over 4 academic years – two semesters constituting one academic year. The duration

of each semester shall normally be 15 weeks excluding examinations.

4. Program Structure

The medium of instruction is English.

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

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

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

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

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

6. Branches of Study:

Branch I - Civil Engineering

Branch II – Mechanical Engineering

Branch III - Electronics & Communication Engineering

Branch IV – Computer Science & Engineering

Branch V – Electrical & Electronics Engineering

Branch VI – Chemical Engineering

Branch VII - Electronics & Instrumentation Engineering

Branch VIII –Information Technology

Branch IX - Instrumentation & Control Engineering

Branch X– Biomedical Engineering

Branch XI - Robotics and Automation

Branch XII – Food Technology

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

Branch XIV – Artificial Intelligence and Machine Learning

Branch XV – Artificial Intelligence and Data Science

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

7. Course Structure and Subjects of Study:

Definition of Credit:

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

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

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

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

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

(ii) Basic Science Courses (BSC)

(iii) Engineering Science Courses (ESC)

(iv) Professional Core Courses (PCC)

(v) Professional Elective Courses (PEC)

(vi) Open Elective Courses (OEC)

(vii) Professional Activity Courses (PAC)

(viii) Mandatory non-Credit Courses (MCC)

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

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

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

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

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

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

8. Examinations:

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

8.1. Evaluation Scheme

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

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

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

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

8.2. Internal Assessment (Theory)

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

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

Marks for Attendance are as follows:

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

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

8.3. Internal Assessment (Practical's)

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

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

Marks for Attendance is as follows:

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

8.4. Internal Assessment (Project)

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

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

8.5 Requirement for appearing for University Examination

The Controller of Examinations (COE) of Pondicherry University schedules the End-Semester exams for all theory and practical courses based on the University academic calendar.

A detailed Exam Time Table shall be circulated to all Colleges at least 15 days before the start of exams. Question Papers shall be set externally based on BOS approved syllabus.

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

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

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

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

8.6 End Semester Exam Evaluation Pattern

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

8.7 Consolidation of Marks and PassingMinimum

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

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

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

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

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

8.8. Arrear Exams

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

8.9. Letter Grades and Calculation of CGPA

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

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

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

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

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

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

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

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

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

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

A candidate can join/rejoin the course of study of any semester only at the time of its normal

commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

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

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

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

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

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

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

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

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

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

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

b. A student is eligible to exercise this option if he has passed all the subjects offered in

the first year in the first attempt itself and has earned a CGPA of not less than 7.5.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

12. Provision for withdrawal:

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

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

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

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

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

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

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

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

   b. 50% of the program core courses

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

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

2 **B.Sc. in the relevant branch of study**

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

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

program.

(ii) 100% of the core program courses.

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

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

2.1 Award of Class in B.Sc. degree

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

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

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

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

2. Re-entry to complete the program

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

which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

3. Completion Possibility in other Institutions

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

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

14. Revision of Regulations and Curriculum:

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

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

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

B. Range of Credits: In the light of the fact that a typical Model Four-year Undergraduate degree program in Engineering has about 163 credits, the total number of credits proposed for the four-year B. Tech in Computer Science and Engineering (IoT & Cyber Security Including Blockchain Technology) is kept as 165.

C. Structure of UG Program in Computer Science and Engineering (IoT & Cyber Security Including Blockchain Technology): The structure of UG program in Computer Science and Engineering ((IoT & Cyber Security Including Blockchain Technology) shall have essentially the following categories of courses with the breakup of credits as given:

S. No	Category	Breakup of Credits
1.	Humanities & Social Science Courses Mandatory Course	**13**
2.	Basic Science Courses	**22**
3.	Engineering Science Courses	**21**
4.	Program Core Courses (Branch specific)	**73**
5.	Professional Elective Courses (Branch specific)	**12**
6.	Open Elective Courses (from Humanities, Technical Emerging or other Subjects)	**06**
7.	Project work, Seminar and Internship	**18**
8.	Audit Courses	**(non-credit)**
	TOTAL	**165**

D. Course Code and Definitions:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
C	Credits
ICBBL	Basic Science Lab Courses
ICBEL	Engineering Science Lab Courses
ICBPL	Program Core Lab Courses
ICBHS	Humanities & Social Science Courses
ICBBS	Basic Science Courses
ICBES	Engineering Science Courses
ICBPC	Program Core Courses
ICBAU	Audit Courses
ICBPROJ	Employment Enhancement Courses(Project/Summer Internship/Seminar)
ICBHR	Honor Courses
ICBMR	Minor Courses
ICBPE	Professional Elective Courses
ICBOE	Open Elective Courses

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

101, 102 … etc. for first year
201, 202 … etc. for second year
301, 302 … etc. for third year.

CATEGORY-WISE COURSE
HUMANITIES & SOCIAL SCIENCES COURSES [ICBHS]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBHL104	Design Thinking	I	0	0	2	1
2	ICBHS201	English	II	2	0	2	3
3	ICBHS205	Universal Human Values II	II	2	1	0	3
4	ICBHS406	Entrepreneurship & Start-ups	IV	3	0	0	3
5	ICBHS505	Organizational Behaviour	V	3	0	0	3
						Total Credits	13

BASIC SCIENCE COURSES [ICBBS]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBBS101	Mathematics- I	I	3	1	0	4
2	ICBBS102	Physics	I	3	0	0	3
3	ICBBL101	Physics Lab	I	0	0	4	2
4	ICBBS202	Mathematics- II	II	3	1	0	4
5	ICBBS203	Chemistry	II	3	0	0	3
6	ICBBL201	Chemistry Lab	II	0	0	4	2
7	ICBBS301	Mathematics-III	III	3	1	0	4
						Total Credits	22

ENGINEERING SCIENCE COURSES [ICBES]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBES103	Basic Electronics Engineering	I	3	0	0	3
2	ICBEL102	Basic Electronics Lab	I	0	0	4	2
3	ICBEL103	Engineering Graphics and Design Lab	I	1	0	4	3
4	ICBES204	Programming for Problem Solving	II	3	0	0	3
5	ICBEL202	Programming for Problem Solving Lab	II	0	0	4	2
6	ICBEL203	Workshop / Manufacturing Lab	II	1	0	4	3
7	ICBES303	Microprocessor & Microcontroller	III	3	0	0	3
8	ICBEL301	Microprocessor & Microcontroller Lab	III	0	0	4	2
						Total Credits	21

PROFESSIONAL CORE COURSES [ICBPC]

Sl. No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBPC302	Data Structures and Algorithms	III	3	0	0	3
2	ICBPC304	Database Management Systems	III	3	0	0	3
3	ICBPC305	Computer Networks	III	3	0	0	3
4	ICBPL302	Database Management Systems Lab	III	0	0	4	2
5	ICBPL303	Computer Networks Lab	III	0	0	4	2
6	ICBPL304	Data Structures and Algorithms Lab	III	0	0	4	2
9	ICBPC401	Theory of Computation	IV	3	0	0	3

10	ICBPC402	Internet of Things	IV	3	0	0	3
9	ICBPC403	Number Theory and Cryptography	IV	3	0	0	3
10	ICBPC404	Operating Systems	IV	3	0	0	3
11	ICBPC405	Embedded Systems	IV	3	0	0	3
12	ICBPL401	Embedded Systems Lab	IV	0	0	4	2
13	ICBPL402	Operating Systems Lab	IV	0	0	4	2
14	ICBPC501	IoT Architecture and Protocols	V	3	0	0	3
15	ICBPC502	Web Technology	V	3	0	0	3
16	ICBPC503	Big Data Analytics	V	3	0	0	3
17	ICBPC504	Blockchain Technology	V	3	0	0	3
18	ICBPL501	IoT Lab	V	0	0	4	2
19	ICBPL502	Web Technology Lab	V	0	0	4	2
20	ICBPL503	Data Analytics Lab	V	0	0	4	2
21	ICBPC601	Smart Contracts and Application Development	VI	3	0	0	3
22	ICBPC602	Ethical Hacking	VI	3	0	0	3
23	ICBPC603	Wireless Communication	VI	3	0	0	3
24	ICBPC604	Digital Forensics	VI	3	0	0	3
25	ICBPL601	Blockchain and Smart Contracts Lab	VI	0	0	4	2
26	ICBPL602	Cyber Security Lab	VI	0	0	4	2
27	ICBPL603	IoT Application Development Lab	VI	0	0	4	2
28	ICBPC701	Cloud Computing	VII	3	0	0	3
						Total Credits	73

PROFESSIONAL ELECTIVE COURSES [ICBPE]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBPEXXX	Professional Elective-I	VII	3	0	0	3
2	ICBPEXXX	Professional Elective-II	VII	3	0	0	3
3	ICBPEXXX	Professional Elective-III	VIII	3	0	0	3
4	ICBPEXXX	Professional Elective-IV	VIII	3	0	0	3
Total Credits							12

For detailed syllabus of Professional Elective Course, Refer Appendix III.

OPEN ELECTIVE COURSES [ICBOE]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBOEXXX	Open Elective-I	VI	3	0	0	3
2	ICBOEXXX	Open Elective-II	VII	3	0	0	3
Total Credits							06

For detailed syllabus of Open Elective Course, Refer Appendix IV.
Note: Open Elective Courses are offered to the students of other Departments.

PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY [ICBPROJ]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBPROJ705	Seminar	VII	0	0	2	1
2	ICBPROJ706	Capstone Project –I	VII	0	0	4	6
3	ICBPROJ803	Capstone Project –II	VIII	0	0	4	10
4	ICBPROJ804	Internship (from II year onwards)	VIII	0	0	4	1
Total Credits							18

AUDIT COURSE [ICBAU]

Sl.No	Course Code	Course Title	Semester	Hours per week			Total Credits
				L	T	P	
1	ICBAU105	IDEA Workshoop Lab	I	2	0	4	0
2	ICBAU204	Sports and Yoga	II	2	0	0	0
3	ICBAU306	Indian Constitution	III	2	0	0	0
4	ICBAU407	Environmental Science	IV	3	0	0	0
						Total Credits	0

S. No	Course Category	Credits Per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science(HS)	1	6		3	3				**13**
2	Basic Sciences (BS)	9	9	4						**22**
3	Engineering Sciences(ES)	8	8	5						**21**
4	Professional(PC)			15	19	18	18	3		**73**
5	Professional Electives(PE)							6	6	**12**
6	Open Elective(OE)						3	3		**06**
7	Project Work/ Seminar/Internship (PROJ)							7	11	**18**
8	Audit Courses (AU)	*	*	*	*					
	Total Credits	**18**	**23**	**24**	**22**	**21**	**21**	**19**	**17**	**165**

INDUCTION PROGRAM

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

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

Mandatory Visits/ Workshop/Expert Lectures:

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

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

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

Curriculum

Semester I						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Induction program			**3 weeks**			**0**
Theory						
1.	ICBBS101	Mathematics-I	3	1	0	4
2.	ICBBS102	Physics	3	0	0	3
3.	ICBES103	Basic Electronics Engineering	3	0	0	3
Practical						
4.	ICBBL101	Physics Lab	0	0	4	2
5.	ICBEL102	Basic Electronics Lab	0	0	4	2
6.	ICBEL103	Engineering Graphics and Design Lab	1	0	4	3
7.	ICBHL104	Design Thinking	0	0	2	1
8.	ICBAU105	IDEA Workshop Lab	2	0	4	0
Total			12	1	18	18

Semester II						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBHS201	English	2	0	2	3
2.	ICBBS202	Mathematics-II	3	1	0	4
3.	ICBBS203	Chemistry	3	0	0	3
4.	ICBES204	Programming for Problem Solving	3	0	0	3
5.	ICBHS205	Universal Human Values II	2	1	0	3
Practical						
6.	ICBBL201	Chemistry Lab	0	0	4	2
7.	ICBEL202	Programming for Problem Solving Lab	0	0	4	2
8.	ICBEL203	Workshop / Manufacturing Lab	1	0	4	3
9.	ICBAU204	Sports and Yoga	2	0	0	0
Total			16	2	14	23

Semester III						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBBS301	Mathematics-III	3	1	0	4
2.	ICBPC302	Data Structures and Algorithms	3	0	0	3
3.	ICBES303	Microprocessor and Microcontroller	3	0	0	3
4.	ICBPC304	Database Management Systems	3	0	0	3
5.	ICBPC305	Computer Networks	3	0	0	3
6.	ICBAU306	Indian Constitution	2	0	0	0
Practical						
7.	ICBEL301	Microprocessor and Microcontroller Lab	0	0	4	2
8.	ICBPL302	Database Management Systems Lab	0	0	4	2
9.	ICBPL303	Computer Networks Lab	0	0	4	2
10.	ICBPL304	Data Structures and Algorithms Lab	0	0	4	2
Total			17	1	16	24

Semester IV						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBPC401	Theory of Computation	3	0	0	3
2.	ICBPC402	Internet of Things	3	0	0	3
3.	ICBPC403	Number Theory and Cryptography	3	0	0	3
4.	ICBPC404	Operating Systems	3	0	0	3
5.	ICBPC405	Embedded Systems	3	0	0	3
6.	ICBHS406	Entrepreneurship & Start-ups	3	0	0	3
7.	ICBAU407	Environmental Science	3	0	0	0
Practical						
8.	ICBPL401	Embedded Systems Lab	0	0	4	2
9.	ICBPL402	Operating Systems Lab	0	0	4	2
Total			21	0	8	22

Semester V						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBPC501	IoT Architecture and Protocols	3	0	0	3
2.	ICBPC502	Web Technology	3	0	0	3
3.	ICBPC503	Big Data Analytics	3	0	0	3
4.	ICBPC504	Blockchain Technology	3	0	0	3
5.	ICBHS505	Organizational Behaviour	3	0	0	3
Practical						
6.	ICBPL501	IoT Lab	0	0	4	2
7.	ICBPL502	Web Technology Lab	0	0	4	2
8.	ICBPL503	Data Analytics Lab	0	0	4	2
Total			15	0	12	21

Semester VI						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBPC601	Smart Contracts and Application Development	3	0	0	3
2.	ICBPC602	Ethical Hacking	3	0	0	3
3.	ICBPC603	Wireless Communication	3	0	0	3
4.	ICBPC604	Digital Forensics	3	0	0	3
5.	ICBOEXXX	Open Elective – I	3	0	0	3
Practical						
7.	ICBPL601	Blockchain and Smart Contracts Lab	0	0	4	2
8.	ICBPL602	Cyber Security Lab	0	0	4	2
9.	ICBPL603	IoT Application Development Lab	0	0	4	2
Total			15	0	12	21

Semester VII						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBPC701	Cloud Computing	3	0	0	3
2.	ICBPE702	Professional Elective-I	3	0	0	3
3.	ICBPE703	Professional Elective-II	3	0	0	3
4.	ICBOEXXX	Open Elective – II	3	0	0	3
Practical						
5.	ICBPROJ705	Seminar	0	0	2	1
6.	ICBPROJ706	Capstone Project –I	0	0	4	6
Total			12	0	6	19

Semester VIII						
S.No	**Course Code**	**Course Title**	**Periods**			**Credits**
			L	**T**	**P**	
Theory						
1.	ICBPEXXX	Professional Elective-III	3	0	0	3
2.	ICBPEXXX	Professional Elective-IV	3	0	0	3
Practical						
3.	ICBPROJ803	Capstone Project –II	0	0	4	10
4.	ICBPROJ804	Internship (from II year onwards)	0	0	4	1
Total			6	0	8	17

APPENDIX –I

LIST OF HONOR COURSES [ICBHR]

S. No	Code No.	Semester	Name of the Subjects	Periods			Credits
				L	T	P	
1	ICBHR001	III	Internet of Things using Python	3	1	0	4
2	ICBHR002	IV	Database and Application Security	3	1	0	4
3	ICBHR003	V	Intrusion Detection and Firewall	3	1	0	4
4	ICBHR004	VI	Multimedia Security & Forensics	3	1	0	4
5	ICBHR005	VII	Security in Cloud Computing	3	1	0	4

APPENDIX –II

LIST OF MINOR COURSES [ICMR]

S. No	Code No.	Semester	Name of the Subjects	Periods			Credits
				L	T	P	
1	ICBMR001	III	Principles of Information Security	3	1	0	4
2	ICBMR002	IV	IoT Devices	3	1	0	4
3	ICBMR003	V	Malware Analysis	3	1	0	4
4	ICBMR004	VI	Applied Cryptography	3	1	0	4
5	ICBMR005	VII	Blockchain and Distributed Ledger Technology	3	1	0	4

APPENDIX –III

LIST OF PROFESSIONAL ELECTIVE COURSES [ICBPE]

S.No	Code No.	Name of the Subjects	Periods			Credits
			L	T	P	
1	ICBPE001	Distributed Computing Systems	3	0	0	3
2	ICBPE002	Information Coding Techniques	3	0	0	3
3	ICBPE003	Graph Theory and OptimizationTechniques	3	0	0	3
4	ICBPE004	Software Testing	3	0	0	3
5	ICBPE005	Object Oriented Analysis and Design	3	0	0	3
6	ICBPE006	Mathematics for Network & Cryptography	3	0	0	3
7	ICBPE007	Data Warehousing and Data Mining	3	0	0	3
8	ICBPE008	Fog and Edge Computing	3	0	0	3
9	ICBPE009	Software Project Management	3	0	0	3
10	ICBPE010	Information Security and Risk Management	3	0	0	3
11	ICBPE011	Design and Testing of Digital Systems	3	0	0	3
12	ICBPE012	Principles of Modern Cryptography	3	0	0	3
13	ICBPE013	Foundations of Modern Networking	3	0	0	3
14	ICBPE014	Network Protocols	3	0	0	3
15	ICBPE015	Communication Technologies	3	0	0	3

APPENDIX –IV

LIST OF OPEN ELECTIVE COURSES [ICBOE]

S. No	Code No.	Name of the Subjects	Periods			Credits
			L	T	P	
1	ICBOE001	IoT and Its Applications	3	0	0	3
2	ICBOE002	Drone Technologies	3	0	0	3
3	ICBOE003	5G Networks	3	0	0	3
4	ICBOE004	Cyber Laws	3	0	0	3
5	ICBOE005	Cyber Physical System	3	0	0	3

Note: Open Elective Courses are offered to the students of other Departments.

ICBBS101 MATHEMATICS - I

L	T	P	C
3	1	0	4

Course Objective:

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

Course Outcomes:

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

UNIT I (12 Hrs)

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

UNIT II (12 Hrs)

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

UNIT III (12 Hrs)

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

UNIT IV (12 Hrs)

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

UNIT V (12 Hrs)

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

Text Books:

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

References:

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

ONLINE / NPTEL Courses:

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

ICBBS102 PHYSICS

L	T	P	C
3	0	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/NPTEL Courses:

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

ICBES103 BASIC ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE / NPTEL Courses:

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

ICBBL101 PHYSICS LAB

L	T	P	C
0	0	4	2

Course Objective:

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods:45)

ICBEL102 BASIC ELECTRONICS LAB

L	T	P	C
0	0	4	2

Course Objective:

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods:45)

ICBEL103 ENGINEERING GRAPHICS AND DESIGN LAB

L	T	P	C
1	0	4	3

Course Objective:

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

Course Outcomes:

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

UNIT I

INTRODUCTION: Introduction, Conics and Special Curves.

UNIT II

PROJECTIONS: Projection of points, lines and planes.

UNIT III

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

UNIT IV

ISOMETRIC: Isometric and Orthographic projections.

UNIT V

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

Text Books:

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

References:

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

(Total Periods:45)

ICBHL104 DESIGN THINKING

L	T	P	C
0	0	2	1

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

(Total Periods:45)

ICBAU105 IDEA WORKSHOP LAB

L	T	P	C
2	0	4	0

Course Objective:

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Discussion and implementation of a mini project.

UNIT V

Documentation of the mini project (Report and video).

Laboratory Activities:

List of Lab activities and experiments

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

Text Books:

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

References:

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

ICBHS201 ENGLISH

L	T	P	C
2	0	2	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/ NPTEL Courses:

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

ICBBS202 MATHEMATICS-II

L	T	P	C
3	1	0	4

Course Objective:

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

Course Outcomes:

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

UNIT I (12 Hrs)

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

UNIT II (12 Hrs)

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

UNIT III (12 Hrs)

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

UNIT IV (12 Hrs)

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

UNIT V (12 Hrs)

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

Text Books:

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

References:

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

ONLINE / NPTEL Courses:

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

ICBBS203 CHEMISTRY

L	T	P	C
3	0	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/ NPTEL Courses:

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

ICBES204 PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
3	0	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/ NPTEL Courses:

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

ICBHS205 UNIVERSAL HUMAN VALUES II

L	T	P	C
2	1	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ICBBL201 CHEMISTRY LAB

L	T	P	C
0	0	4	2

Course Objective:

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods : 45)

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

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

ICBEL202 PROGRAMMING FOR PROBLEM SOLVING LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language

Course Objective:

- To develop a application using python libraries and packages.

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods:45)

ICBEL203 WORKSHOP/MANUFACTURING LAB

L	T	P	C
1	0	4	3

Course Objective:

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

Course Outcomes:

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

Course Content:

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

Practicals:

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

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

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

(Total Periods:45)

ICBAU204 SPORTS AND YOGA

L	T	P	C
2	0	0	0

Course Objective:

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

Postures - Yoga - Yoga & Lifestyle

UNIT IV

Training and Planning in Sports - Psychology & Sports - Doping

UNIT V

Sports Medicine - Sports/Games

References:

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

ICBBS301 MATHEMATICS -III

L	T	P	C
3	1	0	4

Pre-requisite:

- Basic Knowledge in Maths & Statistics

Course Objective:

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

Course Outcomes:

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

UNIT I (12 Hrs)

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

UNIT II (12 Hrs)

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

UNIT III (12 Hrs)

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

UNIT IV (12 Hrs)

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

UNIT IV (12 Hrs)

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

Text Books:

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

References:

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

ONLINE/ NPTEL Courses:

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

ICBPC302 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/ NPTEL Courses:

1. Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac. in/noc23 _cs95
2. Introduction to Programming, Data Structures and Algorithms Using Python: https: //onlinecourses.nptel.ac.in/noc2 3 cs15
3. Programming, Data Structures and Algorithms using Python for beginners: https: //nptel.ac.in /courses/106106145

ICBES303 MICROPROCESSOR AND MICROCONTROLLER

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To learn the fundamentals of microprocessors and applications, interfacing the external devices to the processor according to the user requirements, enabling to create novel products and solutions for real time problems.

Course Outcomes:

- To understand the inner working components of 8085 Microprocessor.
- To understand 8085 Interrupts and 8237 DMA controller.
- To understand different types of Memory mapping and Interfacing.
- To understand the components of 8086 Microprocessor.
- To understand the organization of 8051 Microcontroller and Interfacing.

UNIT I (9 Hrs)

INTEL 8085 MICROPROCESSOR: Introduction - Need for Microprocessors, Evolution, Intel 8085 Hardware - Architecture, Pin description, Internal Registers, Arithmetic and Logic Unit, Control Unit, Instruction word size - Addressing modes, Instruction Set, Assembly Language Programming - Stacks and Subroutines, Timing Diagrams, Evolution of Microprocessors, 16-bit, 32-bit microprocessors and 64 bit microprocessor.

UNIT II (9 Hrs)

INTEL 8085 INTERRUPTS AND DMA: 8085 Interrupts - Software and Hardware Interrupts - 8259 Programmable Interrupt Controller - Data Transfer Techniques - Synchronous - Asynchronous and Direct Memory Access (DMA) and 8237 DMA Controller- 8253 Programmable Interval Timer.

UNIT III (9 Hrs)

MEMORY & I/O INTERFACING: Types of memory - Memory mapping and addressing , Concept of I/O map, types - I/O decode logic, Interfacing key switches and LEDs - 8279 Keyboard/Display Interface - 8255 Programmable Peripheral Interface - Concept of Serial Communication - 8251 UART/ USART - RS232C Interface.

UNIT IV (9 Hrs)

INTEL 8086 MICROPROCESSOR: Introduction - Intel 8086 Hardware, Pin description, External memory Addressing, Bus cycles, Interrupt Processing - Addressing modes, Instruction set, Assembler Directives.

UNIT V (9 Hrs)

MICROCONTROLLER: Intel 8051 Microcontroller - Introduction Architecture, Memory Organization, Special Function Registers, Pins and Signals, Timing and control, Port Operation - Memory and I/O interfacing, Interrupts - Instruction Set and Programming.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publications, 6th Edition, 2020.
2. Krishna Kant, "Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2008.

References:

1. A. P. Godse and D.A Godse, "Microprocessors and Microcontrollers", Technical Publications, 3rd Edition, 2023.
2. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III Pentium 4 – Architecture, Programming and Interfacing", PHI, 8th Edition, 2019.
3. N. Senthil Kumar, M Saravanan and S. Jeevananthan, "Microprocessors and Microcontrollers" , Oxford University Press, 2nd Edition, 2016.
4. Ajay V Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw- Hill, 7th Edition, 2007.

ONLINE/ NPTEL Courses:

1. Microelectronics: Devices To Circuits: https://onlinecourses.nptel.ac.in/noc21_ee86
2. Microelectronics: Devices To Circuits: https://nptel.ac.in/courses/108107142
3. Basics of software defined Radios: https://onlinecourses.nptel.ac.in/noc22_ee78

ICBPC304 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Data Structures and Algorithms, Programming skills

Course Objectives:

- To comprehend the concepts of Database Management System(DBMS), relational models, SQL queries, database storage structure, transaction processing and concurrency control.

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE / NPTEL Courses:

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

ICBPC305 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in computer.

Course Objective:

- To learn the fundamental concepts of networks and OSI layers. To analyze various routing algorithms and security algorithms in networks.

Course Outcomes:

- To understand the fundamentals of network and transmission media.
- To understand the error detection, correction codes and datalink layer protocols.
- To understand the various routing algorithms and Internetworking.
- To enhance the knowledge of sockets and congestion control techniques.
- To enhance the knowledge in IDS and cryptographic techniques.

UNIT I (9 Hrs)

PHYSICAL LAYER: Introduction- Uses, Network Hardware, Software, Reference Models - Theoretical Basis for Communication - Electromagnetic Spectrum, Radio Transmission, Digital Modulation, Baseband Transmission - Transmission Media, Wireless Transmission.

UNIT II (9 Hrs)

DATALINK LAYER: Design Issues - Services, Framing, Error Control, Flow Control - Error Detection and Correction Codes, Hamming Code, Cyclic Redundancy Check - Data Link Layer Protocols, Simplex Protocol , Sliding Window Protocols - Medium Access Control Sublayer, Channel Allocation Problem, Multiple Access Protocols, ALOHA, CSMA Protocols, Collision-Free Protocols, Wireless LAN Protocols - Ethernet MAC Sublayer Protocol, 802.11 MAC Sublayer Protocol - Data Link Layer Switching, Uses of Bridges, Learning Bridges, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

UNIT III (9 Hrs)

NETWORK LAYER: Design Issues- Routing Algorithms, The Optimality Principle, Shortest Path Algorithm, Flood- ing, Distance Vector Routing, Link State Routing - Congestion Control Approaches, Traffic-Aware Routing, Admis- sion Control, Traffic Throttling, Load Shedding - Internetworking, Tunneling, Internetwork Routing, IPv4, IP Ad- dresses, IPv6.

UNIT IV (9 Hrs)

TRANSPORT LAYER: Services- Berkeley Sockets, Example - Elements of Transport Protocols Addressing, Connection Establishment, Connection Release, Flow Control and Buffering, UDP aˆ Є“ TCP Segment Header, Connection Establishment, Connection Release, Sliding Window, Timer Management - Congestion Control.

UNIT V (9 Hrs)

APPLICATION LAYER: DNS, E-Mail, WWW, Architecture, HTTP, Content Delivery, Server Farms and Web Prox- ies, Peer-To-Peer Networks, Firewalls - Intrusion Detection System - Network Security - Introduction to Cryptography, Substitution Ciphers, Transposition Ciphers, Public Key Algorithms, RSA, Symmetric Algorithm.

Text Books:

1. A.S.Tanenbaum and D.J.Wetherall, "Computer Networks" , Pearson, 6th Edition, 2021.
2. Behrouz A. Ferouzon "Data Communication and Networking with TCP/IP Protocol Suite", McGraw Hill, 6th Edition, 2022.

References:

1. J.F.Kurose and K.W. Ross, "Computer Networking: A Top-down approach", Pearson, 7th Edition , 2017.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A System Approach", Elsevier, 5th Edition, 2012.

ONLINE / NPTEL Courses:

1. Computer Networks: https://nptel.ac.in/courses/106105080
2. Emergence of Networks & Reference Models: https://nptel.ac.in/courses/106105081
3. Introduction on Computer Networks: https://nptel.ac.in/courses/106106091

ICBAU306 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite:

- Basic Knowledge of Indian History

Course Objective:

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

Course Outcomes:

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

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Text Books:

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

References:

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

ICBEL301 MICROPROCESSOR AND MICROCONTROLLER LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Electronics Engineering

Course Objective:

- To enrich assembly language programming knowledge using 8085, 8086,8051 microprocessor and microcontroller.

Course Outcomes:

- To understand the inner working components of the microprocessor and microcontrollers.
- To develop assembly language program using 8085 instruction set.
- To develop assembly language program using 8086 instruction set.
- To develop assembly language program using 8051 instruction set.
- To develop various I/O programs for 8085, 8086 and 8051.

LIST OF EXPERIMENTS

Experiment using 8085 Microprocessor:

1. Study of 8085 Microprocessor Trainer Kit
2. 8-bit Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
3. Block Operations (Move, Exchange, Compare, Insert and Delete)
4. Code Conversions
5. Digital Clock simulation
6. Moving Display
7. Serial Communication
8. Interrupt Programming
9. Elevator Simulation
10. Traffic Light Control

Experiments using 8086 Microprocessor with MASM:

11. Arithmetic Operations
12. Sorting and Searching

Experiments using 8051 Microcontroller

13. Arithmetic operations
14. ADC & DAC Interfacing
15. Stepper Motor and DC Motor Interface

(Total Periods:45)

ICBPL302 DATABASE MANAGEMENT SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Knowledge in Computer Programming.

Course Objectives:

- To design databases for an application domain using Query languages along with authorization, recovery, indexing and hashing concepts.

Course Outcomes:

- To understand and classify the size and complexity of present day and upcoming database applications.
- To understand ER Diagrams, comprehend, create a database from a real time application.
- To understand how to normalize Relationships by mapping the ER model into relations.
- To understand Domain and Referential Integrity Constraints and create a Physical Database from a Design.
- To Understand, Evaluate and Defend the most effective and efficient approach to compose an enquiry.

List of Experiments

1. Design of a Query language, processor and Query optimizer.
2. Design of Transaction and security manager.
3. Design of Front-end and database connectivity.
4. Application design and Mini-projects.
   (a) Library Information System.
   (b) Logistics Management System.
   (c) Students' Information System.
   (d) Ticket Reservation System.
   (e) Hotel Management System.
   (f) Hospital Management System.
   (g) Inventory Control.
   (h) Retail Shop Management.
   (i) Employee Information System.
   (j) Payroll System.
5. Study and Implementation of
   (a) Group By & having clause.
   (b) Order by clause.
   (c) Indexing.
6. Study & Implementation of
   (a) Sub queries.
   (b) Views 8 Study & Implementation of different types of constraints.

7. Study & Implementation of Database Backup & Recovery commands.
8. Study & Implementation of
   (a) Rollback, Commit, Savepoint.
   (b) Creating Database /Table Space.
   (c) Managing Users: Create User, Delete User.
   (d) Managing roles:-Grant, Revoke.
9. Study & Implementation of PL/SQL.
10. Study & Implementation of SQL Triggers.

(Total Periods:45)

ICBPL303 COMPUTER NETWORKS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Programming Language.

Course Objective:

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods:45)

ICBPL304 DATA STRUCTURES AND ALGORITHMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic knowledge in programming

Course Objective:

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

Course Outcomes:

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

LIST OF EXPERIMENTS

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

(Total Periods:45)

ICBPC401 THEORY OF COMPUTATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Design and Analysis of Algorithms

Course Objective:

- To learn the concepts of automata computation, decision problems with limitations of computational models, algebraic formalisms of languages.

Course Outcomes:

- To understand models and abstractions: automata as a basic model of computation
- To understand Link between languages, automata, and decision problems.
- To understand layering as a means of tackling complexity, layering applied to the Internet.
- To understand algebraic formalisms of languages such as regular expressions, context-free grammar.
- To understand algorithms and computability through the lens of Turing machines.

UNIT I (9 Hrs)

FINITE AUTOMATON: Alphabets, formal languages and problems. Regular languages and automata models- Deterministic Finite automaton, Formal argument of correctness, Regular languages -Properties of regular languages, Closure, properties, product construction, Limitations of Automata Nonregularity, Pumping Lemma, Non-Deterministic Finite Automaton, Subset construction, Equivalence with DFAs.

UNIT II (9 Hrs)

REGULAR EXPRESSIONS: Equivalence with regular languages- Algorithms for regular languages, Minimization and its algorithm. Myhill- Nerode relations, Characterization of regular languages.

UNIT III (9 Hrs)

GRAMMARS, CONTEXT-FREE LANGUAGES AND MACHINE MODELS: Grammars and the motivation from language theory- Context-free grammars, closure properties- Chomsky Normal Form for CFGs. PDAs - Empty- stack vs Final state acceptance conditions - Equivalence of PDAs and CFGs. Limitations of PDA computation, non- context-free language - Pumping Lemma for CFLs, Deterministic CFLs and PDAs, CYK Algorithm for parsing of CFLs.

UNIT IV (9 Hrs)

TURING MACHINES AND COMPUTABILITY: Modeling computation using Turing Machines - Equivalent mod- els - Church Turing Hypothesis - Decidability and Turing recognizability (i.e., recursive and recursively enumerable)- Closure properties - Undecidability by diagonalization, Reductions to show undecidability.

UNIT V (9 Hrs)

RESOURCE BOUNDED TURING MACHINES & INTRO TO COMPLEXITY: Basic complexity classes- Time bounded classes Postaˆ €™s correspondence problem, undecidable problems, Polytime reductions, NP-completeness, Cook- Levin Theorem without proof.

Text Books:

1. Michael Sipser, "Introduction to the Theory of Computation", Cengage Publications, 3rd Edition 2012.
2. John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann, "Introduction to Automata, Theory, Languages and Com- putation".Pearson Publications, 3rd Edition, 2008.

References:

1. R.B. Patel, "Theory of Computation", Khanna Book Publishing, 2020.
2. Harry Lewis, Christos Papadimitriou, "Elements of the Theory of Computation", Prentice Hall, Pearson Publisher, 2nd Edition, 1997.

ONLINE/NPTEL Courses:

1. What is theory of computation? Set membership problem, basic notions like alphabet, strings, formal languages: https://nptel.ac.in/courses/106104028
2. Introduction- Theory of Computation: https://nptel.ac.in/courses/106104148
3. Grammers and Natural Language Processing: https://nptel.ac.in/courses/106106049

ICBPC402 INTERNET OF THINGS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks

Course Objectives:

- To learn the basics of IOT, Enablers Security, Privacy Of IoT and IoT Applications.

Course Outcomes:

- To understand IoT ecosystem concepts and architectures.
- To understand IoT enablers.
- To understand IoT data and knowledge management
- To understand IoT reliability, security and privacy
- To understand IoT applications.

UNIT I (9 Hrs)

IOT ECOSYSTEM CONCEPTS AND ARCHITECTURES: Evolution –Architectures –Resource management- Data Management and Analytics – Communication, Security, Identity Management, Privacy, Standardization and Reg- ulatory Limitations. Scheduling Process and IoT Services Lifecycle- Scheduling and Resource Management - De- vice/Cloud Collaboration Framework- Applications of Device/Cloud Collaboration Module.

UNIT II (9 Hrs)

IOT ENABLERS AND SOLUTIONS: Programming Frameworks for Internet of Things - Embedded Device Programming Languages -Message Passing in Devices - Coordination Languages - Polyglot Programming - IoT Program- ming Approaches - Existing IoT Frameworks - ARM Virtualization Extensions - XEN ARM Virtualization - KVM ARM Virtualization- Container-Based Virtualization.

UNIT III (9 Hrs)

IOT DATA AND KNOWLEDGE MANAGEMENT: Stream Processing in IoT, Foundations, State-ofthe-Art and Future Directions -Continuous Logic Processing System - Challenges and Future Directions, Framework for Distributed Data Analysis for IoT.

UNIT IV (9 Hrs)

IOT RELIABILITY, SECURITY, AND PRIVACY: Security and Privacy in the Internet of Things, IoT Security Overview. Robustness and Reliability – Introduction, IoT Characteristics and Reliability Issues, Addressing Reliability. Governing Internet of Things: Issues, Approaches, and New Paradigms. Background and Related Work, IoT Gover- nance. TinyTO: Two-Way Authentication for Constrained, Devices in the Internet of Things – Introduction, Security Aspects and Solutions, Design Decisions.

UNIT V (9 Hrs)

IOT APPLICATIONS: Applied Internet of Things – Scenario, Architecture Overview, Sensor to Gateway Commu- nication, Sensors. Gateway Hardware - Gateway Software - Data Transmission, Internet of Vehicles and Applications, Network Architecture - Characteristics and Challenges, Enabling Technologies, Applications. Middleware - Sensor Allocation.

Text Books:

1. RajkumarBuyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Elsevier 2016. (UNIT I,II,III,IV,V).

References:

1. Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, 2017.

ONLINE/ NPTEL Courses:

1. Introduction to internet of things : Data Analysis And Applications: https://nptel.ac.in/courses/106105166
2. Introduction to Industry 4.0 and Industrial Internet of Things: https : //nptel.ac.in/courses/106105195

ICBPC403 NUMBER THEORY AND CRYPTOGRAPHY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge of algorithm.

Course Objectives:

- To Learn the concept of primes and divisibility, congruences, cryptography, diophantine, and elliptic cryptosys- tems.

Course Outcomes:

- To understand the basic knowledge of Primes and Divisibility.
- To understand the Congruences.
- To understand the fundamental knowledge of Cryptography.
- To understand the Diophantine equation.
- To understand the concept of Elliptic cryptosystems.

UNIT I (9 Hrs)

PRIMES AND DIVISIBILITY: Euclidean Algorithm - Primes and Factorization - Distribution of primes, Prime number theorem.

UNIT II (9 Hrs)

CONGRUENCES: Modular Arithmetic - Consequences of Fermat's Theorem -Chinese Remainder Theorem - Primality and Compositeness Testing-Groups, Rings and Felds - Primitive Roots -Prime Power Moduli and Power Residues.

UNIT III (9 Hrs)

INTRODUCTION TO CRYPTOGRAPHY: Symmetric Ciphers-Public Key Cryptography-Discrete Log Problem- RSA Cryptosystem-PARI-Breaking RSA.

UNIT IV (9 Hrs)

DIOPHANTINE EQUATIONS: Quadratic Diophantine equations -Units in quadratic number rings - Pell's equation - Unique factorization - Elliptic curves, Elliptic curves over Fp.

UNIT V (9 Hrs)

ELLIPTIC CRYPTOSYSTEMS: Elliptic curve discrete log problem (ECDLP) - Elliptic curve cryptography - Lenstra's factorization algorithm - Pairing-based cryptography - Divisors and the Weil pairing.

Text Books:

1. Stefano Spezia ”Number Theory with Applications to Cryptography”, Arcler Education Inc, 2019.
2. Douglas R. Stinson, ”Cryptography: Theory and Practice”, CRC Press, 3rd Edition, 2019.
3. Behrouz A. Forouzan, ”Dedeep Mukhopadhyay Cryptography & Network Security”, Tata McGraw Hill, New Delhi, 2nd Edition, 2010.

References:

1. Mohamed Omar, ”Number Theory Toward RSA Cryptography”, Create Space Independent Publishing Platform, 2017.
2. G. H. Hardy, E. M. Wright, D. R. Heath-Brown, Joseph Silverman, ”An Introduction to the Theory of Numbers”, OUP Oxford 2008.

ONLINE/NPTEL Courses:

1. Foundations of Cryptography: https://archive.nptel.ac.in/courses/106/105/106105162/

ICBPC404 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Programming Languages, Data Structures and Algorithms, Computer Organization and Architecture.

Course Objective:

- To learn the details of the abstractions, interfaces provided by the OS for program execution and execution requirements, processes, threads, memory management, files. To analyse concurrency and related synchronization based solutions.

Course Outcomes:

- To understand the role, functionality of the layering systems software components
- To understand the design and usage of the OS API and OS services.
- To understand process management, concurrency and thread introduction.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To have Hands-on practical experience with usage of the OS API and basics of OS mechanisms.

UNIT I (9 Hrs)

INTRODUCTION TO OPERATING SYSTEMS: Application requirements, The systems stack and role of OS, resources, abstractions and interfaces, Components overview of an OS, Examples of different types of OS - Basic organization of hardware components, Von Neumann architecture -Processes: Process abstraction, Process Control Block (PCB),Design of system calls - Invocation and basic OS handling, Process control system calls, fork, wait, getpid, getppid and variants, The limited direct execution model.

UNIT II (9 Hrs)

MEMORY MANAGEMENT: Address bus and memory access, Memory view of a process, heap, stack, code, data - Process memory usage requirements, virtual memory and related system calls (mmap, munmap, sbrk, mprotect) -Address translation mechanisms: static mapping, segmentation, paging Page faults, page sharing, read/write permissions, swapping, process vs OS memory - Memory bookkeeping and management - motivation and mechanisms (process and OS) - Case studies: malloc and role of OS for program to process.

UNIT III (9 Hrs)

PROCESS MANAGEMENT AND CONCURRENCY: The process lifecycle, source code to execution, The OS mode of execution, limited direct execution recap, interrupts, system calls, switch mechanism and PCB state- Schedul- ing policies, scheduling metrics, goals and examples (interactive vs. real-time, priority)- Motivation, application, process and OS use cases- Introduction to threads and the pthread API.

UNIT IV (9 Hrs)

SYNCHRONIZATION: Synchronization primitives, limitations of software solutions, atomic Instructions, test-and- set, spinlocks, mutexes, condition variables, semaphores- Introduction to the pthread synchronization API- Case stud- ies, producer-consumer, reader, writers, barriers- Discussion on issues with concurrency: race conditions, deadlocks, order violation.

UNIT V (9 Hrs)

FILE SYSTEMS: Persistence and the File abstraction, Hardware view- Hard disk architecture and its interfacing, Process view - System calls for file handling, Roles and responsibilities of file system, File system design details- file and file system metadata, directory structure, caching optimizations, File System case study (the Unix file system etc.).

Text Books:

1. Andrew S. Tannenbaum and Herbert Bos, "Modern Operating Systems", Pearson Education India, 4th Edition 2014.
2. Avi Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", Wiley India; John Wiley & Sons, 9th Edition, 2013.

References:

1. William Staling, "Operating Systems: Internals and Design Principles", Prentice Hall, 7th Edition, 2012.
2. D M Dhamdhere, "Operating Systems:A Concepts Based Approach", McGraw-Hill Education, 3rd Edition, 2017.

ONLINE/NPTEL Courses:

1. Introduction to Operating Systems: https://nptel.ac.in/courses/106106144
2. Operating System Fundamentals: https://nptel.ac.in/courses/106105214
3. Operating Systems: https://nptel.ac.in/courses/106108101

ICBPC405 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Digital Circuit and Microprocessor.

Course Objectives:

- To learn the concept of embedded systen, ARM Programming and Real Time Operating Systems.

Course Outcomes:

- To explain the architecture of embedded processors.
- To understand the overview of ARM programming.
- To understand the basic concepts of Thumb Instruction Set.
- To understand the overview of ARM programming using C.
- To understand the real time operating systems.

UNIT I (9 Hrs)

INTRODUCTION TO EMBEDDED CONCEPTS: Introduction to Embedded Systems - Processor in Embedded System – Other Hardware Units in the Embedded System - Software Embedded into a System - ARM Architecture: ARM Design Philosophy - Registers - Program Status Register - Instruction Pipeline - Interrupts and Vector Table - Architecture Revision - ARM Processor Families.

UNIT II (9 Hrs)

ARM PROGRAMMING: Instruction Set - Data Processing Instructions - Addressing Modes - Branch, Load, Store Instructions - PSR Instructions - Conditional Instructions.

UNIT III (9 Hrs)

THUMB INSTRUCTION SET: Register usage - Branch Instructions - Data Processing Instructions - Single-Register - Multi Register Load - Store Instructions - Stack - Software Interrupt Instructions.

UNIT IV (9 Hrs)

ARM PROGRAMMING USING C: Pointers – Structures - Integer and Floating Point Arithmetic - Assembly Code using Instruction Scheduling – Register Allocation - Conditional Execution and Loops.

UNIT V (9 Hrs)

REAL TIME OPERATING SYSTEMS: History of OS - RTOS - The Scheduler - Objects – Services - Characteristics of RTOS - Defining a Task - Tasks States and Scheduling - Task Operations – Structure – Synchronization - Communication and Concurrency. Semaphores - Operations and Use - Message Queue - States – Content – Storage - Operations.

Text Books:

1. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill, 1st Edition, 2009.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides- Designing & Optimizing System Software", Elsevier, 2008.
3. Qing Li, "Real Time Concepts for Embedded Systems", Elsevier, 2011.

References:

1. Santanu Chattopadhyay, "Embedded System Design", PHI, 2nd Edition, 2013.
2. Andrew N Sloss, D. Symes and C. Wright, Morgan Kaufmann, "ARM System Developers Guide", Elsevier, 2006.
3. Wayne Wolf, "Computer as Components: Principles of Embedded Computer System Design", Elsevier, 2006

ONLINE/NPTEL Courses:

1. Embedded Systems: https://nptel.ac.in/courses/108102045

ICBHS406 ENTREPRENEURSHIP & START-UPS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- LSRW

Course Objectives:

- To learn the basic knowlege of Entrepreneurship, Digital Technology, Management, Start-Up Environment and Strategy Management.

Course Outcomes:

- To understand the concept of Entrepreneurship.
- To understand the Digital Technologies as an Open Innovation's Environment.
- To understand the Organization and Management of Open Innovation Projects.
- To understand and create Start-Up Environment.
- To understand the concept of Operational and Strategy Management.

UNIT I (9 Hrs)

INTRODUCTION TO ENTREPRENEURSHIP: Strategy from Ideation to Exit, Identifying the Trade-offs, Intellectual Activity & Knowledge Economy, sharing Economy, Approach to construct Social, Economic Models.

UNIT II (9 Hrs)

DIGITAL TECHNOLOGIES AS AN OPEN INNOVATION'S ENVIRONMENT: Transaction costs, Trust and Reviewing system (personification), Hardware & Software - Robotics and Intelligence, Computing Recognition and Decision Making, Infrastructure Building - Cyberphysical Systems as a Product and as an Infrastructure.

UNIT III (9 Hrs)

ORGANIZATION AND MANAGEMENT OF OPEN INNOVATION PROJECTS: History the Emergence of Open Innovation - Analysis of Elements of Open Innovation in the Traditional Management - Agile, Flexible Project Management - Methodologies within Agile Approach, From Project to Product, Steps of converting Ideas into Goods - Stakeholders of Open Innovation Project, Customers, Investors, Employees. Indicators of Effectiveness for the various Groups of Stakeholders.

UNIT IV (9 Hrs)

START-UP ENVIRONMENT: Institutions support and finance innovation projects-Types of Financing - Infrastruc- ture supporting Small Innovative Enterprises and Start-Ups.

UNIT V (9 Hrs)

OPERATIONAL AND STRATEGY MANAGEMENT): Operations Analysis, Coordination and Planning, Quality Management, Project Management, and Logistics and Supply Chain Management, Strategy Management, Technolog- ical Strategy.

Text Books:

1. Peter F. Drucker, ”Innovation and Entrepreneurship”, Classic Drucker Collection, 2007.
2. Vasant Desai, ”Entrepreneurship: Development and Management”, Himalaya Publishing House, 2015.

References:

1. Greg Caldwell , ”Lean Startup: How to Apply the Lean Startup Methodology to Innovate, Accelerate, and Create Successful Businesses”, Alakai Publishing LLC, 2020.
2. RIES ERIC,”The Lean Startup: How Constant Innovation Creates Radically Successful Businesses”, Portfolio Penguin, 2011.

ONLINE/NPTEL Courses:

1. Entrepreneurship Essesntials : https://archive.nptel.ac.in/courses/127/105/127105007/

ICBAU407 ENVIRONMENTAL SCIENCE

L	T	P	C
3	0	0	0

Course Pre-requisite:

- Basic Science Courses

Course Objective:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/NPTEL Courses:

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

ICBPL401 EMBEDDED SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Digital system and microprocessor

Course Objectives:

- To learn implementation of simple programs to demonstrate ARM based programs using IDE Enviro.

Course Outcomes:

- To understand the Assembly Program.
- To understand the overview of Interrupt handler program.
- To understand the Interface 8 Bit LED and Switch Interface.
- To understand the overview of I2C Interface.
- To understand the basic Audio Processing on IDE environment

List of Experiments

The Programs can be implemented on ARM based Processors/Equivalent:

1. Simple Assembly Program for Addition, Subtraction, Multiplication and Division
2. Simple Assembly Program for System Calls and Interrupts, Loops and Branches
3. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) port pins.
4. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.
5. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment.
6. Program to demonstrate a simple interrupt handler and setting up a timer.
7. Program to Interface 8 Bit LED and Switch Interface.
8. Program to demonstrate I2C Interface on IDE environment.
9. Serial Port on IDE environment use debug terminal to trace the program.

Write the following programs to understand the use of RTOS with ARM Processor on IDE Environment using ARM Tool chain and Library:

1. Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task.
2. Write an application that creates a two task to Blinking two different LEDs at different timings.
3. Write an application that creates a two task displaying two different messages in LCD display in two lines.
4. Sending message to PC through serial port by three different tasks on priority Basis.
5. Basic Audio Processing on IDE environment.

(Total Periods:45)

ICBPL402 OPERATING SYSTEMS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Programming language, Data Structures and Algorithms

Course Objective:

- The program execution and requirements processes, threads, memory management, files and to impart Hands-on practical experience in different OS concepts.

Course Outcomes:

- To understand the role, functionality and layering of the system software components.
- To understand the design and usage of OS API and OS services.
- To understand the details of the abstractions and interfaces provided by the OS for program.
- To understand problems arising due to concurrency and related synchronization based solutions.
- To demonstrate the usage of OS API and basics of OS services.

LIST OF EXPERIMENTS

1. Usage of tools — unix shell commands (file commands, ps, ls, top), text editor (nano, vi, gedit, emacs)
2. C programming language refresher — header files, compilation and linking using GCC, program execution, functions, argument passing, structures, pointers, file handling.
3. Usage of tools — GCC, GDB, Objdump, shell scripts
4. Simple strace usage to showcase different interfaces (stdlib, system call)
5. Tools usage — ps, pstree, top
6. Usage of process control system calls to identity process identifiers, create process hierarchies, launch new executables, control exit sequence of parent and child processes.
7. Familiarity with files in the / proc / pid/ directory
8. (Virtual) addresses of variables and initialized pointers.
9. Use of malloc() and demonstration of per-process virtual addresses
10. Tools usage — strace, free, top, htop, vmstat, /proc/pid/maps
11. Free memory statistics correlated with malloc(). Number of system calls and malloc() usage.
12. Implement a custom memory allocator using system calls
13. User mode programs to demonstrate LDE
14. Demonstration of process execution interleaving in different orders
15. Simulation based analysis of scheduling policies
16. Tools usage — nice/proc/pid/status
17. Creation of threads using the pthread API and modification of shared variables with and without Synchronization
18. Using spinlock, mutexes and condition variables to implement semaphores, barriers (using the threads API)

19. Implement solutions to the producer-consumer, readerwriters problems using the different synchronization primitives
20. Develop synchronization solutions for applications that use shared data (e.g., ordering of threads, concurrent hash tables, etc.)
21. Using shared memory and semaphores implement synchronized access to a shared memory area across processes (e.g., a message queue).
22. Command line tools usage - state, file, du, df, fsck
23. Implementation of file utilities (e.g., find, grep) using the system call API.
24. Implement a simple file system to handle files on an emulated disk (via a large file) — file system API, superblock, inode and data block management.

(Total Periods:45)

ICBPC501 IOT ARCHITECTURE AND PROTOCOLS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks.

Course Objectives:

- To learn the Architectural Overview of IoT, IoT Reference Architecture and Real World Design Constraints.

Course Outcomes:

- To understand to apply basic knowledge and understanding of Architecture and protocols.
- To understand the IoT Reference Architecture and Real World Design Constraints.
- To understand about network and data connection layer protocols.
- To understand about session connection and transport protocols.
- To understand the service layer protocols and security.

UNIT I (9 Hrs)

INTRODUCTION: IoT Architectural - Standards Considerations - M2M and IoT Technology Fundamentals - Devices and Gateways, Local and Wide Area networking, Data Management, IoT Business processes, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT II (9 Hrs)

REFERENCE ARCHITECTURE: Reference Model and Architecture, IoT Reference Model - IoT Reference Architecture- Functional View, Information View, Deployment and Operational View. Real World Design Constraints - Technical Design constraints, Data representation and visualization, Interaction and remote control.

UNIT III (9 Hrs)

IoT DATA LINK LAYER & NETWORK LAYER PROTOCOLS: PHY/MAC Layer, WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7. Network Layer - IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP.

UNIT IV (9 Hrs)

TRANSPORT & SESSION LAYER PROTOCOLS: Transport Layer - TCP, MPTCP, UDP, DCCP, SCTP. Session Layer- HTTP, CoAP, XMPP, AMQP, MQTT.

UNIT V (9 Hrs)

SERVICE LAYER PROTOCOLS & SECURITY: Service Layer - oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.

Text Books:

1. BK Tripathy and J Anuradha, ”Internet of Things (IoT) Technologies Applications Challenges And Solutions”, Taylor & Francis 1st Edition, Taylor & Francis, 2017.
2. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, ”Internet of Things: Architectures, Protocols and Standards”, Wiley 1st Edition 2018.

References:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, ”Internet of Things” 1st Edition, Academic Press, 2014.
2. Peter Waher, ”Learning Internet of Things”, PACKT publishing, Birmingham, Mumbai, 5th Edition, 2015.
3. Bernd Scholz-Reiter, Florian Michahelles, ”Architecting the Internet of Things”, Springer, 1st Edition, 2011.

ONLINE/NPTEL Courses:

1. Introduction to Internet of Things: https://nptel.ac.in/courses/106105166

ICBPC502 WEB TECHNOLOGY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Programming.
- JAVA programming.

Course Objectives:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

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

ONLINE/NPTEL Courses:

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

ICBPC503 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basis of Programming
- Database Management System

Course Objectives:

- To learn the concepts of data analytics, data management and practice in various applications like HDFS, MapReduce, Hadoop, YARN etc.,

Course Outcomes:

- To describe big data and use cases from selected business domains
- To explore NoSQL big data management
- To install, configure, and run Hadoop and HDFS
- To perform map-reduce analytics using Hadoop
- To use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT I (9 Hrs)

UNDERSTANDING BIG DATA: Introduction to Big Data - Convergence of key trends, Unstructured Data, Industry Examples of Big Data, Web Analytics, Big Data Applications, Big Data Technologies. Introduction to Hadoop aˆ Є“ Open Source Technologies, Cloud and Big Data, Mobile Business Intelligence, Crowd Sourcing Analytics, Inter and Trans Firewall Analytics.

UNIT II (9 Hrs)

NoSQL DATA MANAGEMENT: Introduction to NoSQL - Aggregate Data Models, Key-Value and Document Data Models, Relationships, Graph databases, Schemaless Databases, Materialized Views. Distribution Models - Master- Slave Replication, Consistency. Cassandra - Cassandra Data Model, Cassandra Examples, Cassandra Clients

UNIT III (9 Hrs)

MAPREDUCE APPLICATIONS: MapReduce Workflows - Unit Tests with MRUnit, Test Data and Local Tests, Anatomy of MapReduce Job Run, classic Map-reduce, YARN, Failures in Classic Map-Reduce and YARN, Job Scheduling, Shuffle and Sort, Task Execution, MapReduce Types, Input Formats, Output Formats.

UNIT IV (9 Hrs)

BASICS OF HADOOP: Data Format- Analyzing Data with Hadoop, Scaling out, Hadoop Streaming, Hadoop Pipes, Design of Hadoop Distributed File system (HDFS),HDFS Concepts, Java Interface, Data Flow, Hadoop I/O, Data Integrity, Compression, Serialization, Avro-File-Based Data Structures, Cassandra, Hadoop Integration. Introducing Apache Spark - Spark Shell, Spark Context.

UNIT V (9 Hrs)

HADOOP RELATED TOOLS: Hbase-Data Model and Implementations, HBase clients, HBase Examples, Praxis.Pig-Grunt, Pig Data Model, Pig Latin, Developing and Testing Pig Latin scripts.Hive, Data types and File Formats, HiveQL Data Definition, HiveQL Data Manipulation, HiveQL Queries.

Text Books:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", O'Reilley, 3rd Edition, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

References:

1. Seema Acharya, Subashini Chellappan " Big Data and Analytics", Wiley India Pvt. Ltd, 2nd Edition 2019.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

ONLINE/NPTEL Courses:

1. Big Data Concepts: https://archive.nptel.ac.in/courses/106/104/106104189/

ICBPC504 BLOCKCHAIN TECHNOLOGY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Data Structures and algorithm.
- Cryptography.

Course Objectives:

- To learn the concept of blockchain, fundamentals of cryptographic, bit Coin, ethereum and block chain-recent trend.

Course Outcomes:

- To understand emerging abstract models for Block chain Technology.
- To understand the fundamentals of cryptographic functions and its algorithms.
- To understand cryptocurrencies and difference with bit coins.
- To deploy application in ethereum framework.
- To understanding of latest advances and its applications in Block Chain Technology.

UNIT I (9 Hrs)

INTRODUCTION: Distributed systems - Blockchain systems, characteristics of Blockchain systems, Elements of Blockchain, Blockchain architecture, Blockchain Structure, Merkel tree - How Blockchain Works, Types of Blockchain, Blockchain ecosystem, Challenges, Applications - The consensus problem, Nakamoto Consensus on Permission-lees, nameless, Peer-to-peer network - Types of consensus algorithm in Blockchain, Asynchronous Byzantine Agreement - Tires of Blockchain Technology.

UNIT II (9 Hrs)

CRYPTOGRAPHIC FUNDAMENTALS: Introduction, cryptographic primitives, public key cryptography, overview of hashing - Cryptographic Algorithm, SHA 256, Elliptic Curve Cryptography - Introduction to Hyperledger, Hyper- ledger framework, public and private ledgers, Identities and Policies, Membership and Access Control, Channels, Transaction Validation.

UNIT III (9 Hrs)

BIT COIN: Introduction to Bitcoin, Mining Pools , Elements of bitcoin, Transactions - life cycle, fees, data structure, Types of Transaction – P2PKH, P2SH, Multisig, Transaction Verification, Bitcoin network, Wallets, Bitcoin Payments, Alternative coins.

UNIT IV (9 Hrs)

ETHEREUM: Introduction to Ethereum, components, Ethereum and Turing Completeness - Accounts, Types of Accounts - Ethereum Currency - Wallets for Ethereum, Ethereum Virtual Machine (EVM) – Architecture, instruction set, state, Gas, Oracle - Ethereum framework Truffle.

UNIT V (9 Hrs)

BLOCK CHAIN-RECENT TREND: Blockchain Implementation Challenges, Business model challenges, Zero Knowledge proofs - Attacks on Blockchains, Sybil attacks, selfish mining, 51% attacks , advent of algorand, and Sharding based consensus algorithms - Enterprise application of Blockchain, Cross border payments, Know Your Customer (KYC), Food Security.

Text Books:

1. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, 2nd Edition – 2018.
2. Melanie Swan, "Block Chain: Blueprint for a New Economy", O Reilly, 1st Edition – 2015.
3. Daniel Drescher, "Block Chain Basics", Apress; 1st Edition, 2017

References:

1. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi, 2018.

ONLINE/NPTEL Courses:

1. Blockchain and its Applications: https://nptel.ac.in/courses/106104220

ICBHS505 ORGANIZATIONAL BEHAVIOUR

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic knowledge in organization and management

Course Objectives:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, “Essentials of Organizational Behaviour”, Pearson, 2019.

References:

1. K. Aswathappa, “Organizational Behavior”, Himalaya Publishing House, 2018.
2. Richard L, “Organization Theory and Design”, South Western College Publishing, 11th Edition, 2012.
3. S.TrevisCerto, “Modern Management Concepts and Skills”, Pearson Education, 2018.

ONLINE/NPTEL Courses:

1. Understanding Organizational Behaviour: https://nptel.ac.in/courses/110105033
2. Organizational Behaviour: https://nptel.ac.in/courses/110106145
3. Organizational Behaviour - II: https://nptel.ac.in/courses/110105154

ICBPL501 IOT LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Basic Knowledge of sensor and device.

Course Objectives:

- To implement wireleww access point, raspberry Pi and a Pi camera and 10's IoT core.

Course Outcomes:

- To understand the way to use Controlling Raspberry Pi
- To understand IoT Wireless Access Point using Raspberry Pi.
- To understand the Raspberry Pi and a Pi camera to track visits.
- To understanding the internet of things and learning about it through putting together projects for the Respberry Pi.
- To understand the way to install windows 10's IoT core.

List of Experiments

1. Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.
2. Raspberry Pi Based Oscilloscope
3. Controlling Raspberry Pi with WhatsApp.
4. Setting up Wireless Access Point using Raspberry Pi
5. Fingerprint Sensor interfacing with Raspberry Pi
6. Raspberry Pi GPS Module Interfacing.
7. IoT based Web Controlled Home Automation using Raspberry Pi
8. Visitor Monitoring with Raspberry Pi and Pi Camera.
9. Interfacing Raspberry Pi with RFID.
10. Building Google Assistant with Raspberry Pi.
11. Installing Windows 10 IoT Core on Raspberry Pi.

(Total Periods:45)

ICBPL502 WEB TECHNOLOGY LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Computer Programming.
- JAVA programming.

Course Objectives:

- To learn and program features of web programming languages using HTML, DHTML, CSS, Client side scripts and Server side scripts.

Course Outcomes:

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

List of Experiments

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

(Total Periods:45)

ICBPL503 DATA ANALYTICS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- DataBase Management System.
- Computer Networks.

Course Objectives:

- To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce and to enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes:

- To understand the Hadoop and HDFS
- To understand big data analytics including Map Reduce.
- To understand the Linear and logistic Regression.
- To understand the application that stores big data.
- To understand the data analysis and able to apply R machine language.

List of Experiments

Hadoop

1. Install, configure and run Hadoop and HDFS
2. Implement word count / frequency programs using MapReduce
3. Implement an MR program that processes a weather dataset.

R

1. Implement Linear and logistic Regression
2. Implement SVM / Decision tree classification techniques.
3. Implement clustering techniques.
4. Visualize data using any plotting framework
5. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop /R.

(Total Periods:45)

ICBPC601 SMART CONTRACTS AND APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Block Chain Technology.
- Data Structures and Algorithm.
- Computer Programming.
- Network Security.

Course Objectives:

- To understand the basics of smart contracts, decentralized apps, decentralized anonymous organizations (DAOs) and Create new crypto-currency (token/coin).

Course Outcomes:

- To understanding the basic concepts of smart contracts.
- To understanding the programming concepts for smart contracts.
- To understand the solidity coding language and concept for smart contracts.
- To understand the way to use solidity to implement smart contracts with ethereum.
- To understand the way to connect to the blockchain and use smart constracts.

UNIT I (9 Hrs)

INTRODUCTION TO ETHEREUM: Concepts of Smart Contracts - Dapps and DAOs - Ethereum Virtual Machine (EVM), Ethereum Technology Overview, Architectural Overview - Ethereum Block chain Platform, Current and Potential Uses of Ethereum.

UNIT II (9 Hrs)

INTRODUCTION TO PROGRAMMING SMART CONTRACTS: A Simple Smart Contract, Account Types, Gas, and Transactions - Accessing Contracts and Transactions, Mix, Dapps, Developer Tools, Ethereum Tests - Web3 Base Layer Services, Installing, Building, Testing, & Deploying Ethereum nodes.

UNIT III (9 Hrs)

INTRODUCTION TO SOLIDITY PROGRAMMING: Layout of a Solidity Source File - Structure of a Contract, Types, Units and Globally Available Variables, Input Parameters and Output Parameters, Control Structures, Function Calls, Creating Contracts via new, Order of Evaluation of Expressions, Assignment, Scoping and Declarations - Error handling, Assert, Require, Revert and Exceptions.

UNIT IV (9 Hrs)

SOLIDITY PROGRAMMING: Contracts, Creating Contracts, Visibility and Getters, Function Modifiers, Constant State Variables, Functions, Inheritance, Abstract Contracts, Interfaces, Libraries.

UNIT V (9 Hrs)

INTRODUCTION TO DECENTRALIZED APPS (DAPPS): Decentralized Application Architecture, Connecting to the Block chain and Smart Contract - Decentralized Apps, Coding Details, Voting Contract and App, Blind Auction Contract and App, Coding Style Guide, Design Patterns, Coding Style Guide, Code Layout - Naming Conventions, Common Design Patterns, Withdrawal from Contracts, State Machine.

Text Books:

1. Andreas M. Antonopoulos, Dr.Gavin wood, "Mastering Ethereum", O'Reilly Media Inc, 2019

References:

1. Draft version of S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 1st edition -2019.
2. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space", Independent Publishing Platform, 1st Edition - 2017

Online/ NPTEL Courses:

1. Blockchain Technology and Applications: https://archive.nptel.ac.in/courses/106/105/106105235/

ICBPC602 ETHICAL HACKING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer networking
- Information Security

Course Objective:

- To learn the basics of computer based vulnerabilities and to practice tools to perform ethical hacking to expose the vulnerabilities.

Course Outcomes:

- To express knowledge on basics of computer based vulnerabilities.
- To gain understanding on different foot printing, reconnaissance and scanning methods.
- To demonstrate the enumeration and vulnerability analysis methods.
- To gain knowledge on hacking options available in Web and wireless applications.
- To acquire knowledge on the options for network protection.

UNIT I (9 Hrs)

INTRODUCTION: Ethical Hacking Overview - Role of Security and Penetration Testers, Penetration-Testing Method- ologies, Laws of the Land - Overview of TCP/IP, The Application Layer, The Transport Layer, The Internet Layer, IP Addressing , Network and Computer Attacks, Malware, Protecting Against Malware Attacks, Intruder Attacks, Addressing Physical Security.

UNIT II (9 Hrs)

FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS: Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Foot- printing through Social Engineering, Footprinting Tools, Network Scanning Concepts, Port-Scanning Tools, Scanning Techniques, Scanning Beyond IDS and Firewall.

UNIT III (9 Hrs)

ENUMERATION AND VULNERABILITY ANALYSIS: Enumeration Concepts - NetBIOS Enumeration, SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts,Desktop and Server OS Vulnera- bilities, Windows OS Vulnerabilities, Tools for Identifying Vulnerabilities in Windows, Linux OS Vulnerabilities, Vulnerabilities of Embedded Oss.

UNIT IV (9 Hrs)

SYSTEM HACKING: Hacking Web Servers - Web Application Components, Vulnerabilities, Tools for Web At-tackers and Security Testers Hacking Wireless Networks, Components of a Wireless Network, Wardriving, Wireless Hacking, Tools of the Trade .

UNIT V (9 Hrs)

NETWORK PROTECTION SYSTEMS: Access Control Lists - Cisco Adaptive Security Appliance Firewall, Con- figuration and Risk Analysis Tools for Firewalls and Routers, Intrusion Detection and Prevention Systems, Network- Based and Host-Based IDSs and IPSs, Web Filtering, Security Incident Response Teams, Honeypots.

Text Books:

1. Patrick Engebretson, "The Basics of Hacking and Penetration Testing" SYNGRESS, Elsevier, 2013.
2. Dafydd Stuttard and Marcus Pinto"The Web Application Hackers Handbook: Finding and Exploiting Security Flaws", Wiley,2011.
3. Michael T. Simpson, Kent Backman, and James E. Corley, "Hands-On Ethical Hacking and Network Defense, Course Technology", Delmar Cengage Learning, 2010.

References:

1. Justin Seitz, "Black Hat Python: Python Programming for Hackers and Pentesters", No Starch Press, 2014.

ONLINE/ NPTEL Courses:

1. Ethical Hacking- https://nptel.ac.in/courses/106105217/
2. Computer Networks and internet protocol- https://archive.nptel.ac.in/courses/106 105/106105183/

ICBPC603 WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks.

Course Objectives:

- To learn the concept of sensor networks, communication and deployment mechanisms, MAC Layer, wireless sensor networks, middleware and security issues.

Course Outcomes:

- To Understand and Recognize the technological trends of sensor networks.
- To Understand the concept of Communication and Deployment Mechanisms.
- To Understand the basic concept of Wireless Sensor Network through available technologies.
- To understand the MAC Layer.
- To understand the concept of Middleware and Security Issues.

UNIT I (9 Hrs)

FUNDAMENTALS OF SENSOR NETWORKS: Introduction to wireless sensor Networks - Network of Wireless Sensor nodes, Sensing and sensors, Challenges and Constraints, Node architecture, sensing subsystem, processor subsystem communication interfaces, prototypes - Application of Wireless sensors - Introduction of Tiny OS Programming and TOSSIM Simulator.

UNIT II (9 Hrs)

COMMUNICATION AND DEPLOYMENT MECHANISMS: Wireless Transmission Technology and systems- Radio Technology Primer - Available Wireless Technologies, Hardware, Telosb, Micaz motes- Time Synchronization Clock and the Synchronization Problem, Basics of time synchronization, Time Synchronization protocols, Localiza- tion - Ranging Techniques, Range based Localization, Range Free Localization, Event driven Localization.

UNIT III (9 Hrs)

MAC LAYER OVERVIEW: Wireless Mac Protocols, Characteristics of MAC protocols in Sensor networks - Con- tention free MAC Protocols, characteristics - Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clus- tering - Contention based MAC Protocols Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC, Data gathering MAC- Case study, Implementation and Analysis of MAC player protocol in TinyOS.

UNIT IV (9 Hrs)

ROUTING IN WIRELESS SENSOR NETWORKS: Design Issues in WSN routing, Data Dissemination and Gath- ering, Routing Challenges in WSN, Flooding-Flat Based Routing. SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing, Geographical Based Routing- Transport layer. **Case study:** Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS.

UNIT V (9 Hrs)

MIDDLEWARE AND SECURITY ISSUES: WSN middleware principles, Middleware architecture, Existing mid- dleware - Operating Systems for Wireless Sensor Networks, Performance and Traffic Management - Fundamentals of Network Security, Challenges and Attacks - Protocols and Mechanisms for Security. Case study- Handling attacks in Tiny OS.

Text Books:

1. William Stallings, "Wireless Communications & Networks", pearson, 2nd edition, 2009.
2. Vijay K. Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009.

References:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley, 1st Edition, 2011.
2. Kazem Sohraby, Daniel manoli, "Wireless Sensor networks- Technology, Protocols and Applications", Wiley InterScience Publications, 2010.
3. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge University Press, 2005.
4. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati, "Wireless Sensor Networks", Springer Science, 2004.

Online/ NPTEL Courses:

(a) Introduction to Wireless and Cellular Communications: https://archive.nptel.ac.in/courses/108/106/106106167/

ICBPC604 DIGITAL FORENSICS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Cyber Security
- Basics of Knowledge Programming

Course Objective:

- To understand the basics of digital forensics, techniques, crime investigation, forensic readiness, iOS forensics and android forensics.

Course Outcomes:

- To obtain the knowledge on digital forensics.
- To know about digital crime and investigations.
- To understand the origins of forensics science.
- To obtain the knowledge on application forensics, tools and report Writing.
- To understand the concept of counter measures.

UNIT I (9 Hrs)

INTRODUCTION TO DIGITAL FORENSICS: Forensic Science- Digital Forensics, Digital Evidence. Digital Forensics Process- Introduction, Identification phase, Collection phase, Examination phase, Analysis phase, Presenta- tion phase

UNIT II (9 Hrs)

DIGITAL CRIME AND INVESTIGATION: Digital Crime- Substantive Criminal Law, General Conditions, Offenses, Investigation Methods for Collecting Digital Evidence, International Cooperation to Collect Digital Evidence.

UNIT III (9 Hrs)

DIGITAL FORENSIC READINESS: Introduction - Law Enforcement versus Enterprise Digital Forensic Readiness, Rationale for Digital Forensic Readiness, Frameworks, Standards and Methodologies, Enterprise Digital Forensic Readiness, Challenges in Digital Forensics.

UNIT IV (9 Hrs)

APPLICATION FORENSICS, TOOLS AND REPORT WRITING: – Application Forensics, Email and Social Media Investigations - Cloud Forensics, Current Digital Forensic Tools. Report Writing for Investigations.

UNIT V (9 Hrs)

COUNTER MEASURES: Defensive Strategies for Governments and Industry Groups-Tactics of the Military, Tactics of Private Companies-Information Warfare Arsenal and Surveillance Tools.

Text Books:

1. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", 1st Edition, CRC Press, 2022
2. Andre Arnes, "Digital Forensics", Wiley, 2018.

References:

1. Vacca, J, "Computer Forensics, Computer Crime Scene Investigation", Charles River Media, 2nd Edition, 2005.

Online/ NPTEL Courses:

1. ACM Summer School in Information Security and Forensics-https://nptel.ac.in/courses/128106006

ICBPL601 BLOCKCHAIN AND SMART CONTRACTS LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Block Chain Technology.
- Data Structures and Algorithm.
- Computer Programming.
- Network Security.

Course Objectives:

- To learn the concept of Blockchain, Smart Contracts, Ethereum, Bootstapping Networks and Hyperledger.

Course Outcomes:

- To understand the fundamental of Ethereum.
- To understand the API model
- To understand the Crypto Material.
- To understand the Bootstrapping Network implementation.
- To understand the Hyperledger Explorer and Hyperledger Composer.

List of Experiments

1. Create a simple Ethereum network model.
2. Write a simple chaincode API model.
3. Generate the crypto material for the various participants in the bootstrapping network.
4. Generate the genesis block for the Orderer node and start ordering service (solo node) in the bootstrapping network.
5. Generated the configuration transaction block to create a new channel in the bootstrapping network.
6. Sign the configuration block and create the new channel.
7. Make peers of all the organizations join the channel that we created in the bootstrapping network.
8. Study of Hyperledger Explorer and Hyperledger Composer Solution.

(Total Periods:45)

ICBPL602 CYBER SECURITY LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Computer Networks.
- Ethical Hacking & Information Security.
- Network Security and cryptography.

Course Objectives:

- To learn the Ethical Hacking and Cyber Forensic.

Course Outcomes:

- To understand the Network communication and security attacks.
- To understand several strategies for locating an attacker.
- To understand about forensic tools in practice.
- To understand about Malware - Keylogger, Trojans, Keylogger counter measures through practical experience.
- To understand the ways to deploy a web data extractor and website watches.

List of Experiments

Part A: Ethical Hacking:

1. Working with Trojans, Backdoors and sniffer for monitoring network communication.
2. Denial of Service and Session Hijacking using Tear Drop, DDOS attack.
3. Penetration Testing and justification of penetration Testing through risk analysis.
4. Password guessing and Password Cracking.
5. Malware – Keylogger, Trojans, Keylogger countermeasures.
6. Windows Hacking – NT LAN Manager, Secure 1 password recovery
7. Implementing Web Data Extractor and Web site watcher.
8. Email Tracking.
9. Firewalls, Packet Analyzers, Filtering methods.

Part B: Cyber Forensic

1. Study of different wireless network components and features of any one of the Mobile Security Apps.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Study of different types of vulnerabilities for hacking a websites / Web Applications.
4. Analysis the Security Vulnerabilities of E-commerce services.

(Total Periods:45)

ICBPL603 IOT APPLICATION DEVELOPMENT LAB

L	T	P	C
0	0	4	2

Course Pre-requisite:

- Computer Networks.
- Ethical Hacking & Information Security.
- Network Security and cryptography.

Course Objectives:

- Learn the security issues network layer and transport layer, security issues of the application layer and to Learn computer forensics, tools and to analyze and validate forensics data.

Course Outcomes:

- To understand the basic knowledge of microcontroller like Arduino or Raspberry Pi and a sensor module.
- To understand the control interface to manage the devices.
- To understand the IoT devices.
- To understand about IoT-Based Security System.
- To understand the communicates with IoT devices .

List of Experiments

1. IoT Data Collection with Sensors: Set up IoT devices equipped with sensors (e.g., temperature, humidity) and collect data. Use a microcontroller like Arduino or Raspberry Pi and a sensor module. Display the collected data on a dashboard.
2. IoT Device Control via Mobile App: Develop a mobile application that communicates with IoT devices. Create a simple control interface to turn on/off a device remotely, such as a light bulb or a fan.
3. Smart Home Automation: Design a prototype of a smart home system. Integrate multiple devices like lights, temperature sensors, and door locks. Develop a control interface to manage these devices remotely.
4. IoT-Based Health Monitoring: Build a health monitoring system using IoT devices. Gather data from wearable sensors (heart rate, step count) and transmit it to a cloud platform. Develop a web application to visualize the health data.
5. Indoor Positioning System: Develop an indoor positioning system using IoT devices. Use techniques like triangulation or Bluetooth beacons to determine a device's location indoors.
6. IoT-Based Environmental Monitoring: Create an environmental monitoring system that measures parameters like air quality, noise levels, and light intensity. Transmit data to a cloud platform and visualize trends over time.
7. IoT-Based Home Security System: Create a home security system using IoT devices like cameras, motion sensors, and door/window sensors. Develop alerts and notifications for security events.

(Total Periods:45)

ICBPC701 CLOUD COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System.
- Data Structures.
- Operating Systems.
- Computer Networks.

Course Objectives:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

1. Buyya R., Broberg J. and Goscinski A., "Cloud Computing- Principles and Paradigm", John Wiley & Sons, 1st Edition, 2013.
2. Sosinsky B., "Cloud Computing Bible", Wiley Edition, 1st Edition, 2011.
3. Miller Michael, "Cloud Computing- Web Based Applications that Change the Way You Work and Collaborate Online", Pearson Education India, 2008.

References:

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

ONLINE/NPTEL Courses:

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

ICBPROJ705 SEMINAR

L	T	P	C
0	0	2	1

Course Objectives:

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

Course Outcomes:

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

ICBPROJ706 CAPSTONE PROJECT-I

L	T	P	C
0	0	4	6

Course Pre-requisite:

- Mini Project, Programming skills

Course Objectives:

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

Course Outcomes:

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

Project Guidelines:

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

ICBPROJ803 CAPSTONE PROJECT-II

L	T	P	C
0	0	4	10

Course Objectives:

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

Course Outcomes:

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

Project Guidelines:

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

ICBPROJ804 INTERNSHIP

L	T	P	C
0	0	4	1

Course Objectives:

- The course is designed so as to expose the students to industry environment and to take up on- site assignment as trainees or interns.

Course Outcomes:

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

Procedure to be followed :

1. Four weeks of work at industry site from 2nd Semester onwards during the summer vocations.
2. Supervised by an expert at the industry.
3. The student should submit a report on completion.

APPENDIX –I

LIST OF HONOR COURSES [ICBHR]

S.No	Code No.	Semester	Name of the Subjects	L	T	P	C
1	ICBHR001	III	Internet of Things using Python	3	1	0	4
2	ICBHR002	IV	Database and Application Security.	3	1	0	4
3	ICBHR003	V	Intrusion Detection and Firewall	3	1	0	4
4	ICBHR004	VI	Multimedia Security & forensics	3	1	0	4
5	ICBHR005	VII	Security in Cloud Computing	3	1	0	4

ICBHR001 INTERNET OF THINGS USING PYTHON

L	T	P	C
3	1	0	4

Course Objectives:

- To learn Internet of Things using python.

Course Outcomes:

- To understand and setting up the base IoT hardware
- To understand the python on Intel Galileo Gen 2.
- To understand the digital outputs with python.
- To understand the RESTful API and pulse width modulation
- To understand the digital Inputs, polling and interrupts

UNIT I (12 Hrs)

IOT HARDWARE: - Intel Galileo Gen 2 board, components -Input/Output, Arduino 1.0 pinout -Additional expansion and connectivity capabilities -Buttons, LEDs-Checking and upgrading firmware.

UNIT II (12 Hrs)

PYTHON ON INTEL GALILEO GEN 2: -Setting Python as the programming language -Retrieving IP address -Connecting operating system -Installing and upgrading libraries. -Installing pip and additional libraries -Invoking the python interpreter.

UNIT III (12 Hrs)

DIGITAL OUTPUTS WITH PYTHON: -Turning on and off an onboard component -Prototyping with breadboards -Wire digital outputs -Counting from 1 to 9 with LEDs, Python code, mraa library -Advantage of object-oriented code to control digital outputs -Isolating pin numbers -Controlling digital outputs with the wiring-x86 library.

UNIT IV (12 Hrs)

RESTFUL API AND PULSE WIDTH MODULATION: -LEDs with a RESTful API -Composing and sending HTTP requests -Wiring pins with PWM capabilities -PWM to generate analog values -analog values via HTTP requests -RESTful API for Web application -PWM plus a RESTful API -PWM with the wiring-x86 library.

UNIT V (12 Hrs)

DIGITAL INPUTS, POLLING AND INTERRUPTS: -Pushbuttons and Pullup Resistors -Digital Input Pins with Pushbuttons -Pushbutton statuses with Digital Inputs- -Digital Inputs with the wiring-x86 library -Interrupts to detect pressed Pushbuttons.

Text Books:

1. Gasto´n C. Hillar, “Internet of Things with Python”, Packt Publishing, 2016.
2. P K PANDEY, “IOT (Internet of things) and Its Application ”, Prentice Hall, 2020.

References:

1. Dr Kamlesh Lakhwani , Dr Hemant Kumar Gianey , Joseph Kofi Wireko, “Internet of Things (IoT) ”, Inc.,BPB Publications, 1st Edition, 2020.

ONLINE/NPTEL Courses:

1. Introduction to Internet of Things: https://archive.nptel.ac.in/courses/106/105/106105166/

ICBHR002 DATABASE AND APPLICATION SECURITY

L	T	P	C
3	1	0	4

Course Objectives:

- To learn security policies on databases, understand authentication and password security, to Know about Appli- cation Vulnerabilities and understand about auditing techniques.

Course Outcomes:

- To understand the database security.
- To understand the authentication and authorization.
- To understand the securing database to database communication.
- To understand the encrypting and auditing the data.
- To understand the various application security and vulnerabilities in database.

UNIT I (12 Hrs)

DATABASE SECURITY: Introduction to database Security – Security in Information Technology – importance of data – data review – identity theft – levels of security – Human level: Corrupt/careless user, Network/User Interface, Database application program, Database system, Operating System, Physical level.

UNIT II (12 Hrs)

AUTHENTICATION AND AUTHORIZATION : Passwords, Profiles, Privileges and Roles - Authentication – Operating System authentication, Database Authentication, Network or Third-party authentication, Database vector password policies -Authorization – User Account authorization - Database/Application Security - Limitations of SQL Authorization – Access Control in Application Layer - Oracle Virtual Private Database – Privacy.

UNIT III (12 Hrs)

SECURING DATABASE TO DATABASE COMMUNICATIONS: Monitor and limit outbound communications – Secure database links – Protect link usernames and passwords – Usage of database links – Secure replication mecha- nisms - Map and secure. Trojans –Types of database Trojans.

UNIT IV (12 Hrs)

ENCRYPTING AND AUDITING THE DATA: Encrypting data in transit – Encrypting data at rest – Auditing architectures – Audit trail – External audit systems architectures - Auditing information – Secure auditing information – Audit system.

UNIT V (12 Hrs)

APPLICATION SECURITY & VULNERABILITIES: Application Security – Application Vulnerabilities - OWASP Web Security Vulnerabilities - Unvalidated input, Broken access control, Broken account/session management, Cross-site scripting (XSS) flaws, Buffer overflows - SQL Injection flaws, Improper error handling, Insecure storage, Denial-of service, Insecure configuration management – Insecure File Handling

Text Books:

1. Ron Ben-Natan, "Implementing Database Security and Auditing: A Guide for DBAs, Information Security Administrators and Auditors", Published by Elsevier, 2005.
2. Silvana Castano, "Database Security", Published by Addison-Wesley, 1994.
3. Alfred Basta, Melissa Zgola, Dana Bullaboy, Thomas L. Witlock SR, "Database Security", google books, 2011.
4. Silberschatz, Korth and Sudarshan, "Database System Concepts", 6th Edition, 2010.

ONLINE/NPTEL Courses:

1. Database Design:https://nptel.ac.in/courses/106106093

ICBHR003 INTRUSION DETECTION AND FIREWALL

L	T	P	C
3	1	0	4

Course Objectives:

- To learn concept of intrusion detection, intrusion prevention, ACID, firewall technologies and building firewalls.

Course Outcomes:

- To understand the history of intrusion detection.
- To understand the intrusion prevention system and snort.
- To understand the snort rules and ACID.
- To understand the firewall technologies.
- To understand the building firewalls.

UNIT I (12 Hrs)

HISTORY OF INTRUSION DETECTION: Audit, Concept and definition, Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT II (12 Hrs)

INTRUSION PREVENTION SYSTEM AND SNORT: Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis- Incident Responses – Incident Response Process – IDS ad IPS response Phases Forensics –Corporate Issues - Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes.

UNIT III (12 Hrs)

SNORT RULES AND ACID: Rule Headers, Rule Options, the Snort Configuration File etc. Plugins, Preprocessors and Output Modules, Using Snort with MySQL - Using ACID and Snort Snarf with Snort -Agent development for intrusion detection - Architecture models of IDs and IPs.

UNIT IV (12 Hrs)

FIREWALL INTRODUCTION AND TECHNOLOGIES: Why Internet Firewalls - Internet Services - Security Strategies - Building Firewalls - Packets and Protocols - What Does a Packet Look Like? - IP - Protocols Above IP - Protocols Below IP - Application Layer Protocols - IP Version - Non-IP Protocols - Attacks Based on Low-Level Protocol Details - Firewall Technologies - Some Firewall Definitions - Packet Filtering - Proxy Services - Network Address Translation - Virtual Private Networks

UNIT V (12 Hrs)

BUILDING FIREWALLS: Firewall Architectures - Firewall Design - Packet Filtering - Proxy Systems - Bastion Hosts - UNIX and Linux Bastion Hosts 176 - Windows NT and Windows 2000 Bastion Hosts.

Text Books:

1. RafeeqRehman , " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID", Prentice Hall, 1st Edition, 2003.
2. Carl Endorf, Eugene Schultz and Jim Mellander"Intrusion Detection & Prevention", Tata McGraw-Hill, 1st Edition, 2004.
3. Elizabeth D. Zwicky, Simon Cooper & D. Brent Chapman , "Building Internet Firewalls" O'Reilly, 2nd Edition, 2000.

References:

1. Christopher Kruegel,FredrikValeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", Springer, 1st Edition, 2005.
2. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", New Riders Publishing, 3rd Edition, 2002.
3. T. Fahringer, R. Prodan, "A Text book on Grid Application Development and Computing Environment", Khan- naPublihsers, 6th Edition, 2012.

ONLINE/NPTEL Courses:

1. Cryptography and Network Security:https://nptel.ac.in/courses/106105031

ICBHR004 MULTIMEDIA SECURITY & FORENSICS

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the concepts of multimedia security and forensics and perform multimedia forensics.

Course Outcomes:

- To understand, Design and develop various applications of digital watermarking.
- To understand and Analyze the main properties and classifications of digital watermarking systems.
- To understand the design of digital watermarking systems modelling.
- To understand the selected digital watermarking algorithms (e.g. LSB based approach and those in DCT domain).
- To understand the security of digital watermarking systems.

UNIT I (12 Hrs)

DIGITAL RIGHTS MANAGEMENT (DRM) FRAMEWORK: Requirements of a DRM system, Architectures, Dimensions to content protection: Tracing (fingerprinting), authentication, Encryption, Key management and access control.

UNIT II (12 Hrs)

DIGITAL WATERMARKING: Information Theory: Mutual Information and Channel Capacity - Watermarking with Side Information - Using Perceptual Models – Robust Watermarking - Affine-Resistant Watermarking. Image Watermarking, Video Watermarking, Audio Watermarking, Watermarking for CG-models, Watermarking for Binary Images, Watermarking for 3D Contents, Data Hiding through watermarking techniques.

UNIT III (12 Hrs)

CONTENT AUTHENTICATION TECHNIQUES: Data authentication, One way hash functions, Message authen- tication codes (MACs); Multimedia authentication: Perceptual hashes; Parameterization; Watermarking based authen- tication: Notion of semi-fragility, Construction and design of semi-fragile watermarks, Privacy preserving protocols: Zero knowledge protocols, Anonymous fingerprinting, Public key watermarking, Non-perfect secret sharing construc- tions for anonymous fingerprinting with shared access control.

UNIT IV (12 Hrs)

FORENSICS : Multimedia encryption - Digital Watermarking Security Attacks - Digital Forensics taxonomy - goals/ requirements - Forensic Data Acquisition - Forensics Analysis and Validation.

UNIT V (12 Hrs)

CRYPTOGRAPHY AND MULTIMEDIA ENCRYPTION: Introduction to Cryptography, Multimedia Processing in the Encryption Domain, Privacy preserving Information Processing, Information Theory and Digital Forensics, Forgeries Detection, New ways for making Forgeries.

Text Books:

1. Frank Y. Shih, ”Multimedia Security”, CRC Press, 2017.
2. Cox, Miller, Bloom, Fridrich, and Kalker Michael, ”Digital Watermarking and Steganography”, Elsevier, UK, 2nd Edition, 2008.
3. W. Zeng, H. Yu and C. Lin, ”Multimedia Security Technologies for Digital Rights Management”, Elsevier, UK, 2006.

References:

1. BorkoFurht, DarkoKirovski, ”Multimedia Security Handbook”, CRC Press, 2004.
2. WenjunZeng, Heather Yu, Ching-Yung Lin, ”Multimedia Security Technologies for Digital Rights Management”, Elsevier, 2006.

ONLINE/NPTEL_Courses:

1. Multimedia processing:https://nptel.ac.in/courses/117105083

ICBHR005 SECURITY IN CLOUD COMPUTING

L	T	P	C
3	1	0	4

Course Objectives:

- To learn modern security concepts as they are applied to cloud computing, assess the security of virtual systems, evaluate the security issues related to multi-tenancy and appraise compliance issues that arise from cloud computing.

Course Outcomes:

- To understand and able to evaluate the security measures in cloud.
- To understand the various architectural aspects of cloud.
- To understand and analyze data classification and security.
- To understand and analyse the various application of cloud.
- To understand and able to Investigate legal and compliance issues in cloud

UNIT I (12 Hrs)

ARCHITECTURAL CONCEPTS: Business Requirements - Cloud Evolution, Vernacular, and Definitions - Roles and Responsibilities - Definitions - Foundational Concepts - Business Requirements Analysis - Boundaries of Cloud Models - Protecting Sensitive Data.

UNIT II (12 Hrs)

DATA CLASSIFICATION AND SECURITY: Data Inventory and Discovery - Jurisdictional Requirements - Data Rights Management - Cloud Data Life Cycle - Cloud Storage - Cloud Data Security Foundational Strategies - Security in the Cloud - Virtualization - Cloud Attack Surface - Disaster Recovery (DR).

UNIT III (12 Hrs)

RESPONSIBILITIES AND APPLICATION SECURITY: Foundations of Managed Services - Business Require- ments - Shared Responsibilities by Service Type - Shared Administration of OS - Share Responsibilities - Lack of Physical Access - Training and Awareness - Common Cloud Application Deployment Pitfalls – Cloud SDLC - 148 ISO/IEC 27034-1 - Cloud Application Architecture - Assurance and Validation.

UNIT IV (12 Hrs)

OPERATIONS: Physical/Logical - Security Training and Awareness - Basic Operational Application Security - Mon- itoring, Capacity, and Maintenance - Change and Configuration - Business Continuity and Disaster Recovery.

UNIT V (12 Hrs)

LEGAL AND COMPLIANCE ISSUES: Legal Requirements and Unique Risks in the Cloud Environment Potential Personal and Data Privacy Issues in the Cloud Environment Audit Processes, Methodologies, and Cloud - The Impact of Diverse Geographical Locations and Legal Jurisdictions - Business Requirements - Cloud Contract Design and Management for Outsourcing. Text

Text Books:

1. Brian T. O'Hara , "Certified Cloud Security Professional", Sybex, 2nd Edition, 2017.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security", Wiley, 1st Edition, 2010.

References:

1. John Rittinghouse, James Ransome, "Cloud Computing", CRC Press, 2010.

ONLINE/NPTEL Courses:

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

APPENDIX –II

LIST OF MINOR COURSES [ICBMR]

S.No	Code No.	Semester	Name of the Subjects	L	T	P	C
1	ICBMR001	III	Principles of Information Security	3	1	0	4
2	ICBMR002	IV	IoT Devices	3	1	0	4
3	ICBMR003	V	Malware Analysis	3	1	0	4
4	ICBMR004	VI	Applied Cryptography	3	1	0	4
5	ICBMR005	VII	Blockchain and Distribution Ledger Technology	3	1	0	4

ICBMR001 PRINCIPLES OF INFORMATION SECURITY

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the principles of Information Security

Course Outcomes:

- To understand the security management concepts and principles.
- To understand the change control management and data classification.
- To understand the risk management.
- To understand security awareness training.
- To understand the various access control techniques.

UNIT I (12 Hrs)

SECURITY MANAGEMENT CONCEPTS AND PRINCIPLES: Bits to Bytes to Boardroom, Information Security Governance, Corporate Governance, IT Governance Institute Overview, Top Management Support Essential for Effective Information Security, Managing Security by the Standards, Information Security for Mergers and Acquisitions, Information Security Governance, The Human Side of Information Security, Security Management.

UNIT II (12 Hrs)

CHANGE CONTROL MANAGEMENT AND DATA CLASSIFICATION: Patch Management 101, Security Patch Management, Configuration Management. Data classification: Information Classification, Ownership and Cus- tody of Data

UNIT III (12 Hrs)

RISK MANAGEMENT: Information Security Risk Assessment, Developing and Conducting a Security Test and Evaluation, Enterprise Security Management Program, Technology Convergence and Security, The Role of Information Security in the Enterprise Risk Management Structure, A matter of Trust, New Trends in Information Risk Management, Cyber-Risk Management.

UNIT IV (12 Hrs)

SECURITY AWARENESS TRAINING: Change That Attitude, Maintaining management's Commitment, Making Security Awareness Happen, Beyond Information Security Awareness Training, security management planning. Ethics and the Internet, Computer Ethics.

UNIT V (12 Hrs)

ACCESS CONTROL: Access Control Techniques, RFID security, Smart Card, Access Control Administration, Identify Management, Blended Thread Analysis, Identification and Authentication Techniques, Access Control methodologies and Implementation, Methods of Attack.

Text Books:

1. Micki Krause and Harold F. Tipton, "Handbook of Information Security Management A Handbook", 6th Edition, Auerbach Publication, Volume 2, 2018 (UNIT I,II,III,IV,V).
2. Michael E Whitman and Herbert J Mattord," Principles of Information Security", 6th Edition, Vikas Publishing House, New Delhi, 2018.

References:

1. Richard E. Smith, "Elementary Information Security", Jones and Bartlett Publishers, Inc, 2nd Edition, 2015.
2. David Kim and Michael G. Solomon, "Fundamentals of Information Systems Security", Jones and Bartlett Publishers, Inc, 4th Edition, 2021.
3. Jason Andress, "Foundations of Information Security: A Straight forward Introduction", No Starch Press,US, 2019.

ONLINE/NPTEL Courses:

1. Introduction to Information Security:https://archive.nptel.ac.in/noc/courses/noc15/SEM1/noc15-cs03/

ICBMR002 IOT DEVICES

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the terminology, technology and its applications and to introduce the concept of M2M (machine to machine) with necessary protocols.

Course Outcomes:

- To understand IoT value chain structure (device, data cloud), application areas and technologies involved.
- To understand IoT and M2M.
- To understand the IoT device.
- To understand the Sensors
- To understand the IoT Physical Servers and Cloud Offerings

UNIT I (12 Hrs)

INTRODUCTION TO INTERNET OF THINGS: Definition and Characteristics of IoT, Sensors, Actuators, Physi- cal Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT II (12 Hrs)

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEERUNIT.

UNIT III (12 Hrs)

IOT PHYSICAL DEVICES AND ENDPOINTS: Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C) Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors.

UNIT IV (12 Hrs)

SENSORS: Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC - Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Em- bedded Sensors, Distance Measurement with ultrasound sensor.

UNIT V (12 Hrs)

IOT PHYSICAL SERVERS AND CLOUD OFFERINGS: Introduction to Cloud Storage models and communica- tion APIs Web Server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, ”Internet of Things - A Hands-on Approach”, Universities Press, 2015.
2. Matt Richardson & Shawn Wallace, ”Getting Started with Raspberry Pi”, O’Reilly (SPD), 2014.
3. Simon Monk, ”Raspberry Pi Cookbook, Software and Hardware Problems and solutions”, O’Reilly (SPD), 2016.

References:

1. Peter Waher, ”Learning Internet of Things”, Packt Publishing, 2015.
2. Ovidiu Vermesan & Peter Friess, ”Internet of Things – From Research and Innovation to Market Deployment”, River Publishers, 2014.
3. N. Ida, Sensors, ”Actuators and Their Interfaces”, SciTech Publishers, 2014.

ONLINE/NPTEL Courses:

1. Introduction to Internet of Things: https://archive.nptel.ac.in/courses/106/105/106105166/

ICBMR003 MALWARE ANALYSIS

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the types of malware through analysis methods, to learn basic and advanced malware analysis techniques and to practice the android malware analysis techniques for real world applications.

Course Outcomes:

- Identify various malwares and understand the behavior of malwares in real world applications.
- Understand the purpose of malware analysis.
- Identify the various tools for malware analysis.
- Implement different malware analysis techniques.
- Analyze the malware behavior in windows and android.

UNIT I (12 Hrs)

INTRODUCTION: Malware Analysis, Techniques of Static and Dynamic Analysis, Malware Analysis in Virtual Machines, Basic Dynamic Analysis.

UNIT II (12 Hrs)

ADVANCED STATIC ANALYSIS: A Crash Course in X86 Disassembly, IDA Pro, Recognizing C Code Constructs in Assembly, Analyzing C Code Constructs in Assembly, Analyzing Malicious Windows Programs. Debugging, OlyDbg, Kernal Debugging with WinDbg,

UNIT III (12 Hrs)

ADVANCED DYNAMIC ANALYSIS: Debugging, OlyDbg, Kernal Debugging with WinDbg.,

UNIT IV (12 Hrs)

ANTI-REVERSE ENGINEERING: Anti-Disassembly, Anti Debugging, Anti-Virtual Machine Techniques, Packers and Unpacking.

UNIT V (12 Hrs)

MALWARE FUNCTIONALITY: malware Behavior, Covert Malware Launching, Data Encoding, Malware-Focused Network Signatures.

Text Books:

1. Alexey Kleymenov,"Mastering Malware Analysis: A malware analyst's practical guide to combating malicious software, APT, cybercrime, and IoT attacks", Packt Publishing Limited, 2nd Edition 2022.
2. Michael Sikorski and Andrew Honi, "Practical Malware Analysis, Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software", No Starch Press,US, 2012.

References:

1. Gerardus Blokdyk, ”Malware Detection”, 5STARCooks, 2nd Edition, 2021.

ONLINE/NPTEL Courses:

1. Ethical Hacking:https://nptel.ac.in/courses/106105217

ICBMR004 APPLIED CRYPTOGRAPHY

L	T	P	C
3	1	0	4

Course Objectives:

- To learn OSI security architecture and classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory.

Course Outcomes:

- To understand the OSI security architecture and classical encryption techniques.
- To understand the concept of Block Ciphers and Modes of Operation
- To understand the principles of public key cryptograpy.
- To understand the hash functions and digital signature.
- To understand various Authentication and Intrusion Detection System.

UNIT I (12 Hrs)

INTRODUCTION & MATHEMATICAL FOUNDATION: Definitions – Cryptography, cryptanalysis, cryptology, classical cryptosystem- shift cipher, affine cipher, vignere cipher, substitution, transposition techniques, Types of attacks in OSI security architecture-Number Theory concepts – Modular Arithmetic , Properties, Euclidean algorithm, Fermat's and Euler's theorem, Chinese Remainder Theorem, Primitive roots, Discrete Logarithms.

UNIT II (12 Hrs)

BLOCK CIPHERS AND MODES OF OPERATION: Simplified DES - Data Encryption Standard-Block cipher principles-block cipher modes of operationAES-TripleDES-Blowfish-RC5.

UNIT III (12 Hrs)

PUBLIC KEY CRYPTOGRAPHY: Principles and characteristics - Need for public key cryptography - Primality Testing - Miller Rabin Test - Diffie Hellman Key Exchange-MITM Attack -RSA, Fast Modular Exponentiation Algo- rithms, RandomNumberGeneration-FiniteFields–PolynomialArithmetic-ECC-KeyManagement.

UNIT IV (12 Hrs)

HASH FUNCTIONS AND DIGITAL SIGNATURES: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 - SHA- HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr -Blind Signatures for unreachable payments.

UNIT V (12 Hrs)

APPLICATIONS: Authentication – Kerberos , Zero Knowledge Proofs, System Security - Firewalls, Types, Design considerations, Intrusion Detection Systems, IP Security - IPSec (AH and ESP),Web Security - SSL, TLS, Secure Electronic Transaction, Bitcoin, Email Security - PGP, Tor(The Onion Router)

Text Books:

1. William Stallings, ”Cryptography and Network Security”, Pearson Education, 6th Edition, March 2013. (UNIT I,II,III,IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, ”Network Security”, Prentice Hall of India, 2002. (UNIT V)

References:

1. Bruce Schneier and Neils Ferguson, ”Practical Cryptography”, Wiley Dreamtech India Pvt Ltd, 1st Edition, 2003.

ONLINE/NPTEL Courses:

1. Introduction to Cryptology:https://nptel.ac.in/courses/106107155

ICBMR005 BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGY

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the development in blockchain functionalities and to identify alternative techniques to proof of work for blockchain protocols, proof of stake/space

Course Outcomes:

- To Comprehend the functionality of blockchain.
- To Choose a blockchain implementation based on real time scenario.
- To Examine the techniques for anonymity preservation.
- To Determine the Blockchain challenges.
- To Identify the use cases of distributed ledger technology.

UNIT I (12 Hrs)

BLOCKCHAIN AND DISTRIBUTED LEDGER FUNDAMENTALS: Blockchain - Distributed Ledger - Crypto- graphic basics for cryptocurrency - signature schemes, encryption schemes and elliptic curve cryptography - CAP the- orem - Categories of Blockchain: Public blockchain, Private blockchain, Permissioned Ledger, Tokenized blockchain, Tokenless blockchain, and Sidechains.

UNIT II (12 Hrs)

BLOCKCHAIN FUNCTIONALITY: Distributed identity: Public and private keys, Digital identification and wallets - Decentralized network - Permissioned distributed Ledger - Blockchain data structure - Double spending - Network consensus - Sybil attacks - Block rewards and miners - Forks and consensus chain - Finality in Blockchain Consensus - Limitation of proof-of-work - Alternatives to Proof of Work.

UNIT III (12 Hrs)

BLOCKCHAIN IMPLEMENTATION: Bitcoin and Merkle Root - Eventual Consistency and Bitcoin - Byzantine Fault Tolerance -Bitcoin and Secure Hashing - Bitcoin block-size - Bitcoin Mining - Blockchain Collaborative Im- plementations: Hyperledger, Corda - Ethereum's ERC 20 and token explosion. Decentralization using Blockchain, Blockchain and full ecosystem decentralization: Smart contract, Decentralized autonomous organization (DAO), De- centralized applications - Platforms for decentralization.

UNIT IV (12 Hrs)

BLOCKCHAIN GOVERNANCE CHALLENGES: Bitcoin Blocksize Debate, The Ethereum DAO Fork, Ethereum's Move to PoS and Scaling Challenges - Blockchain Technical Challenges: Denial-of-Service Attacks, Security in Smart Contracts, Scaling, Sharding. Blockchain Challenges, Blockchain Governance Challenges: Bitcoin Blocksize De- bate, The Ethereum DAO Fork, Ethereum's Move to PoS and Scaling Challenges - Blockchain Technical Challenges: Denial-of-Service Attacks, Security in Smart Contracts, Scaling, Sharding.

UNIT V (12 Hrs)

DISTRIBUTED LEDGER TECHNOLOGY IN ALTERNATIVE BLOCKCHAIN: Kadena, Ripple, Stellar, Root-stock, Drivechain, Quorum – Decentralized Network manager: Tezos, Maidsafe, BigChainDB - Decentralized Cloud Storage.

Text Books:

1. Goldfeder, S., Bonneau, J., Miller, A., Felten, E., Narayanan, A. ”Bitcoin and Cryptocurrency Technologies”,Princeton University Press, New Jersey, 1st edition, 2016.

References:

1. Iyer, Kedar, et al. ”Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions”, McGraw-Hill Education, United Kingdom, 1st edition, 2018.
2. Wattenhofer, R. ”Distributed Ledger Technology: The Science of the Blockchain”, CreateSpace Independent Publishing Platform, United States, 1st edition, 2017,

ONLINE/NPTEL Courses:

1. Introduction to Blockchain Technology and Applications: https://archive.nptel.ac.in/courses/106/105/106105235/

APPENDIX –III

LIST OF PROFESSIONAL ELECTIVE COURSES [ICBPE]

S.No.	Code No.	Name of the Subjects	L	T	P	C
1	ICBPE001	Distributed Computing Systems	3	0	0	3
2	ICBPE002	Information Coding Techniques	3	0	0	3
3	ICBPE003	Graph Theory and Optimization Techniques	3	0	0	3
4	ICBPE004	Software Testing	3	0	0	3
5	ICBPE005	Object Oriented Analysis and Design	3	0	0	3
6	ICBPE006	Mathematics for Networks & Cryptography	3	0	0	3
7	ICBPE007	Data Warehousing and Data Mining	3	0	0	3
8	ICBPE008	Fog and Edge Computing	3	0	0	3
9	ICBPE009	Software Project Management	3	0	0	3
10	ICBPE010	Information Security and Risk Management	3	0	0	3
11	ICBPE011	Design and Testing of Digital Systems	3	0	0	3
12	ICBPE012	Principles of Modern Cryptography	3	0	0	3
13	ICBPE013	Foundations of Modern Networking	3	0	0	3
14	ICBPE014	Network Protocols	3	0	0	3
15	ICBPE015	Communication Technologies	3	0	0	3

ICBPE001 DISTRIBUTED COMPUTING SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Operating Systems.
- Computer Networks.

Course Objectives:

- To learn foundations of distributed systems and the idea of communication between distributed objects and file system.

Course Outcomes:

- To understand the characteristics of a distributed system along with its and design challenges.
- To understand the mechanism of communication between distributed objects.
- To understand and illustrate synchronization in distributed environment.
- To understand the concurrency control and fault tolerance in distributed transactions.
- To understand the distributed file systems and file service architecture.

UNIT I (9 Hrs)

INTRODUCTION: Goals – Types of Distributed Systems – Architecture Styles – System Architecture. Architectures Versus Middleware – Self Management in Distributed Systems - Processes – Threads– Virtualization – Clients–Servers – Code Migration.

UNIT II (9 Hrs)

COMMUNICATION: Fundamentals - Remote Procedure Call – Stream Oriented Communication – Message Oriented Communication – Multicast Communication. Naming – Names, Identifiers and Addresses – Flat Naming - Structured Naming – Attribute Based Naming.

UNIT III (9 Hrs)

SYNCHRONIZATION: Clock Synchronization – Logical Clocks - Mutual Exclusion – Global Positioning of Nodes - Election Algorithms. Consistency and Replication: Introduction – Data centric consistency models, Client centric consistency models , Replica management, Consistency protocols.

UNIT IV (9 Hrs)

FAULT TOLERANCE: Introduction – Process Resilience – Reliable Client server Communication –Reliable Group Communication – Distributed Commit - Recovery Security – Introduction – Secure Channels – Access Control – Security Management.

UNIT V (9 Hrs)

DISTRIBUTED FILE SYSTEMS: Distributed Web Based Systems – Distributed Object Based Systems. File Mod- els, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication, Atomic Transaction.

Laboratory/ Practicals:

1. Implement concurrent echo client-server application.
2. Program to implement Remote Procedure Call.
3. Increment a counter in shared memory.
4. Create CORBA based server client application.
5. Implement Reliable group communication

Text Books:

1. Andrew S.Tanenbaum and Maarten Van Steen, "Distributed Systems – Principles and Paradigms", Prentice-Hall of India, Pvt. Ltd, 2nd edition, 2016.

References:

1. Pradeep K Sinha, "Distributed Operating Systems", Prentice-Hall of India, NewDelhi, 2009.
2. Maarten van Steen, Andrew S. Tanenbaum, "Distributed Systems, Prentice Hall India Learning, 4th edition, 2023.

ONLINE/NPTEL Courses:

1. Distributed Systems: https://archive.nptel.ac.in/courses/106/106/106106168/

ICBPE002 INFORMATION CODING TECHNIQUES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Digital System and Design.
- Graphics and Multimedia.

Course Objectives:

- To learn error–control coding, encoding and decoding of digital data streams, methods for the generation of these codes and their decoding techniques and the concepts of multimedia communication.

Course Outcomes:

- To understand the coding techniques.
- To understand and implement code modulation.
- To understand and Study the code generation process.
- To understand the compression techniques.
- To understand the Linear and Predictive coding.

UNIT I (9 Hrs)

INFORMATION ENTROPY FUNDAMENTALS: Uncertainty, Information and Entropy – Source Coding Theorem – Huffman Coding –Shannon Fano Coding – Discrete Memory Less Channels – Channel Capacity – Channel Coding Theorem – Channel capacity Theorem.

UNIT II (9 Hrs)

DATA AND VOICE CODING: Differential Pulse Code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive Subband Coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III (9 Hrs)

ERROR CONTROL CODING: Linear Block Codes – Syndrome Decoding – Minimum distance consideration – Cyclic Codes – Generator Polynomial – Parity Check Polynomial – Encoder for Cyclic Codes – Calculation of Syndrome – Convolutional Codes.

UNIT IV (9 Hrs)

COMPRESSION TECHNIQUES: Principles – Text Compression – Static Huffman Coding – Dynamic Huffman Coding – Arithmetic Coding – Image Compression – Graphics Interchange Format – Tagged Image File Format – Digitized Documents – Introduction to JPEG Standards.

UNIT V (9 Hrs)

AUDIO AND VIDEO CODING: Linear Predictive Coding – Code Excited LPC – Perceptual coding, MPEG Audio Coders – Dolby Audio Coders – Video Compression – Principles – Introduction to H.261 & MPEG Video Standards.

Laboratory/ Practicals:

1. Huffman coding algorithm.
2. Hamming code error detected and correction.
3. Run - length encoding (RLE).
4. Lempel-Ziv-Welch(LZW) compression.
5. Parity check polynomial.

Text Books:

1. Sanjay Sharma , ”Communication Systems”, S.K. Kataria & Sons, 4th Edition, 2013.
2. Kamisetty Rao, Zoran Bojkovic, Dragorad Milovanovic, ”Introduction to Multimedia Communications: Appli- cations, Middleware, Networking”, Wiley-Interscience, 2006.

References:

1. Colt McAnlis, Aleks Haecky, ”Understanding Compression Data Compression for Modern Developers”, O’Reilly Media, 1st Edition, 2016.
2. Khalid Sayood, ”Introduction to Data Compression”, 5th Edition, 2017.
3. Watkinson J, ”Compression in Video and Audio”, Focal Press, London, 1995.

ONLINE/NPTEL Courses:

1. Introduction to Information Theory and Coding:https://nptel.ac.in/courses/117101053

ICBPE003 GRAPH THEORY AND OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basic Knowledge of Mathematics and Statistics

Course Objectives:

- To learn graph, linear programming problems and statistical concepts.

Course Outcomes:

- To understand the various types of graph algorithms and graph theory properties.
- To understand and analyze the various types of graphs.
- To implement various graph and tree algorithms.
- To understand and analyze the linear programming and optimization.
- To understand the various types of graphical methods.

UNIT I (9 Hrs)

BASICS OF GRAPH THEORY: Graphs - Data structures for graphs - Subgraphs - Operations on Graphs Connectivity – Networks and the maximum flow - Minimum cut theorem - Trees - Spanning Trees - Rooted Trees – Matrix Representation of Graphs.

UNIT II (9 Hrs)

CLASSES OF GRAPHS: Eulerian Graphs and Hamiltonian Graphs - Standard Theorems - Planar Graphs - Euler's formula - Five Colour Theorem - Coloring of Graphs - Chromatic Number (vertex and edge) Properties and Examples
- Directed Graphs

UNIT III (9 Hrs)

GRAPH ALGORITHM: Computer Representation of Graphs - Basic Graph Algorithms - Minimal Spanning Tree Algorithm - Kruskal and Prim's Algorithm - Shortest Path Algorithms - Dijsktra's Algorithm - DFS and BFS Algorithms

UNIT IV (9 Hrs)

OPTIMIZATION TECHNIQUES: Linear programming – Graphical Methods – Simplex Method (Artificial variables not included) – Transportation and Assignment Problems

UNIT V (9 Hrs)

STATISTICS: Tchebyshev's Inequality – Maximum likelihood estimation – Correlation – Partial correlation – Mul- tiple correlations.

Laboratory/ Practicals:

1. Matrix representation of graphs.
2. Hamiltonian graphs.
3. Planar graphs.
4. Kruskal and Prim's algorithm.
5. DFS and BFS algorithm.

Text Books:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", PHI1974, 2016.

References:

1. Rao S.S., "Engineering Optimization: Theory and Practice", New Age International Pvt. Ltd., 3rd Edition 1998.

ONLINE/NPTEL Courses:

1. Introduction to Graph Theory :https://archive.nptel.ac.in/courses/111/106/111106102/

ICBPE004 SOFTWARE TESTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Software Engineering, Object Oriented analysis and Design.

Course Objectives:

- To learn software testing, test cases, design level of testing and to learn how to manage test cases and test automation.

Course Outcomes:

- To understand and design test cases suitable for a software development for different domains.
- To understand and determine suitable tests case to be carried out.
- To understand and prepare test planning based on the document and test cases designs.
- To understand utilization of automatic testing tools and validate a test plan.
- To understand the Software test automation.

UNIT I (9 Hrs)

INTRODUCTION: Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions – Software Testing Principles – The Tester"s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention strategies.

UNIT II (9 Hrs)

CASE DESIGN: Test case Design Strategies – Using Black Bod Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – Statebased testing – Cause- effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria.

UNIT III (9 Hrs)

LEVELS OF TESTING: The need for Levers of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing –Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Test- ing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

UNIT IV (9 Hrs)

TEST MANAGEMENT: People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V (9 Hrs)

TEST AUTOMATION: Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

Laboratory/ Practicals:

1. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.
2. Write the test cases for any known application (e.g. Banking application).
3. Write the test cases for GMAIL.
4. Write the test cases for FACEBOOK,TWITTER etc.,
5. Create a test plan document for any application (e.g. Library Management System).
6. Test case for calculator in windows application.

Text Books:

1. by Dorothy Graham, Rex Black, Erik van Veenendaal, "Foundations of Software Testing: ISTQB Certification", Cengage Learning India Pvt. Ltd., 4th Edition, 2020.
2. Ron Patton, "Software Testing", Sams Publishing, Pearson Education, 2nd Edition, 2007.

References:

1. Srinivasan Desikan , "Software Testing", Pearson Education, 2005.
2. Aditya P. Mathur, "Foundations of Software Testing_ Fundamental Algorithms and Techniques", Dorling Kinder- sley (India) Pvt. Ltd., Pearson Education, 2008.
3. Roger S. Pressman, "Software Engineering. A Practitioners Approach", McGraw Hill International Edition, 7th edition, 2009.

ONLINE/NPTEL Courses:

1. Software Testing: https://archive.nptel.ac.in/courses/106/101/106101163/

ICBPE005 OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Object Oriented Programming.
- Software Engineering.

Course Objectives:

- To learn the fundamentals of object modeling, differentiate Unified Process from other approaches, design with static UML diagrams with design patterns.

Course Outcomes:

- To understand and express software design with UML diagrams and Design software using OO concepts.
- To understand and identify various scenarios based on software requirements.
- To understand the way to convert UML based software design into pattern.
- To apply the design pattern for use cases.
- To develop code and Testing environment.

UNIT I (9 Hrs)

UNIFIED PROCESS AND USE CASE DIAGRAMS: Introduction to OOAD with OO Basics – Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.

UNIT II (9 Hrs)

STATIC UML DIAGRAMS: Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes –Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition – Relationship between sequence diagrams and use cases – When to use Class Diagrams.

UNIT III (9 Hrs)

DYNAMIC AND IMPLEMENTATION UML DIAGRAMS: Dynamic Diagrams – UML interaction diagrams – System sequence diagram – Collaboration diagram – When to use Communication Diagrams – State machine diagram and Modelling –When to use State Diagrams – Activity diagram – When to use activity diagrams Implementation Diagrams – UML package diagram – When to use package diagrams – Component and Deployment Diagrams – When to use Component and Deployment diagrams.

UNIT IV (9 Hrs)

APPLYING DESIGN PATTERNS: System sequence diagrams – Relationship between sequence diagrams and use cases Logical architecture and UML package diagram – Logical architecture refinement – UML class diagrams – UML interaction diagrams – Applying GoF design patterns.

UNIT V (9 Hrs)

CODING AND TESTING: Mapping design to code – Testing: Issues in Testing – Class Testing – Integration Testing – GUI Testing – System Testing.

Laboratory/ Practicals:

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams.

Text Books:

1. Brahma Dathan, Sarnath Ramnath, ”Object-Oriented Analysis, Design and Implementation”, Universities Press, 2nd Edition, 2015.
2. Ali Bahrami, ”Object Oriented Systems Development”, McGraw Hill International Edition, 1999.

References:

1. Fedor Fedor G. Pikus, ”Hands-On Design Patterns with C++”, Addison-Wesley, 2019.
2. Martin Fowler, ”UML Distilled: A Brief Guide to the Standard Object Modeling Language”, Addison Wesley, 3rd edition, 2003.

ONLINE/NPTEL Courses:

1. Object oriented analysis and design: https://archive.nptel.ac.in/courses/106/105/106105153/

ICBPE006 MATHEMATICS FOR NETWORKS & CRYPTOGRAPHY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge of Basic Mathematics and Computer network.

Course Objectives:

- To learn the theoretical foundations in computer networking and the fundamental concepts in networking, graph theory and coding theory.

Course Outcomes:

- To understand and apply graphs and trees in various applications.
- To apply Euclidean algorithm to different applications.
- To understand and apply Chinese remainder theorem to different applications.
- To understand diverse networking coding approaches.
- To demonstrate shortest path Algorithms.

UNIT I (9 Hrs)

GRAPH: First theorem of Graph Theory, regular graph, subgraph, Paths, Cycles, Matrix representation, Trees, Bridges, Theorems, spanning trees, Directed graphs, Indegree and Outdegree.

UNIT II (9 Hrs)

SHORTEST PATH MODEL: Shortest Path Model, Systematic Method, Dijikstras Algorithm, Floyds Algorithm, Minimum Spanning Tree Problem, Prim Algorithm, Kruskals Algorithm, Maximal Flow Problem.

UNIT III (9 Hrs)

EUCLIDEAN ALGORITHM: Fundamental Theorem of Arithmetic and Applications, Dirichlet Progressions, Irrational Numbers, Fermat Factorization, Linear. Diophantine Equations, Congruence, Linear Congruence.

UNIT IV (9 Hrs)

CHINESE REMAINDER THEOREM: Wilson's and Fermat's Little Theorem, Euler's Theorem, Properties of the Euler Phi Function. The Binary Symmetric Channel, Error Correction, Error Detection, Linear Codes, Representation Through Generator and Parity-Check Matrices, Syndrome Decoding 10 15.

UNIT V (9 Hrs)

HAMMING CODES: Hamming Codes, Introduction to Finite Fields and Double-Error Correcting Codes, Irreducible Polynomials, Primitivity, Singleton Bound, MDS Codes, Hamming Sphere, Packing Bound, Perfect Codes.

Laboratory/ Practicals:

1. Write a program for Dijkstra's single source shortest path algorithm.
2. Write a program to demonstrate hamming code.
3. Write a program for Prim's Algorithm.
4. Write a program to demonstrate Basic Euclidean Algorithm
5. Write a program to demonstrate Spanning tree.

Text Books:

1. R. Balakrishnan, K. Ranganathan, "A Textbook of Graph Theory", Springer New York, 2012.
2. Torleiv Kløve, "Codes for Error Detection", World Scientific, 2007.

References:

1. David M. Burton, "Elementary Number Theory", McGraw-Hill Education (India) Private Limited, 2012.
2. Dudley U., "A guide to elementary number theory", The mathematical association of America, 2004.

ONLINE/NPTEL Courses:

1. Cryptography And Network Security: https://archive.nptel.ac.in/courses/106/105/106105162/

ICBPE007 DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Database Management System.

Course Objectives:

- To learn the concepts of data warehouse and data mining to get acquainted with the tools and techniques used for Knowledge Discovery in Databases.

Course Outcomes:

- To understand data warehouse concepts
- To understand about the utilization of data mining tools in more precise way.
- To understand the different classifiers.
- To understand the association rule mining.
- To understand and employ clustering and trend analysis in data mining.

UNIT I (9 Hrs)

DATA WAREHOUSING: Data warehousing Components –Building a Data warehouse — Mapping the Data Ware- house to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

UNIT II (9 Hrs)

BUSINESS ANALYSIS: Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

UNIT III (9 Hrs)

DATA MINING: Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing.

UNIT IV (9 Hrs)

ASSOCIATION RULE MINING AND CLASSIFICATION: Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT V (9 Hrs)

CLUSTERING AND TRENDS IN DATA MINING: Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

Laboratory/ Practicals:

1. Installation of WEKA Tool.
2. Pre-processing Techniques on Data set.
3. Implementation of K-Means algorithm .
4. Generate Association Rules using the Apriori Algorithm.
5. Clustering high Dimensional Data

Text Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, ”Introduction to Data Mining”, Person Education, 2007.
2. K.P. Soman, Shyam Diwakar and V. Aja, ”Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.

References:

1. G. K. Gupta, ”Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
2. Daniel T.Larose, ”Data Mining Methods and Models”, Wiley-Inter science, 2006.

ONLINE/NPTEL Courses:

1. Data Mining: https://archive.nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs15/

ICBPE008 FOG AND EDGE COMPUTING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Knowledge in any programming language with problems solving skills with good understanding of Networking, cloud and IoT.

Course Objectives:

- To become familiar with the concepts of fog and edge computing and to understand their architecture, components, working of components and their performance.

Course Outcomes:

- To understand the use of IoT architecture with its entities and protocols via edge and fog, up to the cloud.
- To understand the security & privacy issues related to area of fog & edge computing, IoT, and big data.
- To understand the exploit fog and edge computing in implementing real time applications.
- To understand and create a model in fog and edge computing scenario.
- To understand and explore Fog and Edge computing on security, multimedia and smart data.

UNIT I (9 Hrs)

INTRODUCTION TO FOG AND EDGE COMPUTING: Fog and Edge Computing (FEC) -Definition-FEC Com- pleting the Cloud Advantages of FEC-Hierarchy of FEC-Business Models Opportunities and Challenges-Addressing the Challenges in Federating Edge Resources – Introduction – The networking challenge- The management challenge

UNIT II (9 Hrs)

MIDDLEWARE: Introduction-Need for Fog and Edge Computing Middleware- Design Goals- State-of-the-Art Middleware Infrastructures-System Model-roposed Architecture-Case Study Example-Future Research Directions. Lightweight Container Middleware for Edge Cloud Architectures-Introduction-Clusters for Lightweight Edge Clouds- Architecture Management – Storage and Orchestration- IoT Integration- Security Management for Edge Cloud Archi- tectures -Future Research Directions.

UNIT III (9 Hrs)

DATA MANAGEMENT AND PREDICTIVE ANALYSIS IN FOG COMPUTING: Introduction to data management- Fog Data Management-Future Research Directions- Predictive Analysis to Support Fog Application Deployment- Introduction-Motivating Example: Smart Building- Predictive Analysis with FogTorch- Motivating Example (continued)- Future Research Directions - Survey of ML Techniques for Defending IoT Devices - Machine Learning in Fog Com- puting - Future Research Directions.

UNIT IV (9 Hrs)

OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING: The Case for Optimization in Fog Computing- Formal Modeling- Framework for Fog Computing Metrics -Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing -optimization Techniques.

UNIT V (9 Hrs)

CASE STUDIES: Smart Surveillance Video Stream Processing at the Edge for Real-Time -Smart Transportation Applications-Intelligent Traffic Lights Management (ITLM) System -Fog Orchestration Challenges and Future Direc- tions.

Laboratory/ Practicals:

1. Autonomous vehicles.
2. Remote monitoring of assets in the oil and gas industry.
3. In-hospital patient monitoring.
4. Virtualized radio networks and 5G (vRAN).
5. Cloud gaming .

Text Books:

1. Rajkumar Buyya, Satish Narayana Srirama, ”Fog and Edge Computing: Principles and Paradigms”, Wiley series on Parallel and Distributed Computing, 2019.

References:

1. Fog Computing: Flavio Bonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, ”A Platform for Internet of Things and Analytics”, Springer International, 2014.
2. FlavioBonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, ”Fog Computing and Its Role in the Internet of Things”, Helsinki, Finland, 2012.

ONLINE/NPTEL Courses:

1. Introduction to IoT:https://archive.nptel.ac.in/courses/106/105/106105166/

ICBPE009 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
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Course Pre-requisite:

- Software Engineering.

Course Objectives:

- To learn an overall view over software engineering, the various methods of cost estimation, software quality management and software metrics.

Course Outcomes:

- To understand the various methods of Cost Estimation.
- To understand the Software Quality Management.
- To understand the uses of software metrics.
- To understand the software cost estimation.

UNIT I (9 Hrs)

PROJECT CONCEPTS AND ITS MANAGEMENT: Project life cycle models-ISO 9001 model - Capability Matu- rity Model - Project, Planning-Project tracking-Project closure - Evolution of Software Economics –Software. **Man- agement Process Framework:** Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities / Automation / Project Control – Modern Project.

UNIT II (9 Hrs)

COST ESTIMATION: Problems in Software Estimation – Algorithmic Cost Estimation Process, Function, Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card.

UNIT III (9 Hrs)

Software Quality Management: Software Quality Factors – Software Quality Components – Software Quality Plan– Software Quality Metrics – Software Quality Costs – Software Quality Assurance-Standard – Certification – Assess- ment.

UNIT IV (9 Hrs)

SOFTWARE MANAGEMENT AND METRICS: Software Configuration Management – Risk Management: Risk Assessment: Identification / Analysis / Prioritization – Risk Control: Planning / Resolution /Monitoring – Failure Mode and Effects Analysis (FMEA) –Defect Management-Cost Management. Software Metrics – Classification of Software Metrics: Product-Metrics: Size Metrics, Complexity Metrics, Halstead's Product Metrics, Quality, Metrics, and Process metrics.

UNIT V (9 Hrs)

PROJECT EVALUATION AND EMERGING TRENDS: Strategic Assessment–Technical Assessment– Cost Ben- efit Analysis–Cash Flow Forecasting–Cost Benefit Evaluation Technique–Risk Evaluation–Software Effort Estima- tion. Emerging Trends: Import of the internet on project Management –people Focused Process Models.

Laboratory/ Practicals:

1. Software effort estimation.
2. Estimating Web application development
3. Draw the GANTT chart for the software Project.
4. Using Project Planning Activities describe how to manage Tasks.
5. Estimation of Project metrics

Text Books:

1. Walker Rayce, ”Software Project Management”, PEA, 2010.
2. Bob Hughes and Mike Cotterell , ”Software Project Management”, Tata McGraw Hill, 3rd Edition, 2004.

References:

1. Christof Ebert, ”A Guide to Distributed Development, Projects, and Outsourcing”, Paperback, November 2011.
2. Shere K. D, ”Software Engineering and Management”, PHI, 1998.
3. S. A. Kelkar,” Software Project Management: A Concise Study”, PHI.7, 2012.

ONLINE/NPTEL Courses:

1. Software Project Management:/https://archive.nptel.ac.in/courses/106/105/106105218/

ICBPE010 INFORMATION SECURITY AND RISK MANAGEMENT

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Networks.
- Cryptography.
- Ethical Hacking & Information Security.
- Cyber and Digital Forensics.

Course Objectives:

- To learn the fundamentals of risk management and information security.

Course Outcomes:

- To understand Information security risk management framework and methodologies.
- To Identify and model information security risks.
- To understand and integrate security into systems design process of information systems.
- To understand and Use qualitative and quantitative risk assessment methods.

UNIT I (9 Hrs)

RISK I: IDENTIFYING AND CATEGORIZING RISKS: Risk Management – Risk Identification – Risk Assess- ment -Documenting the Results .

UNIT II (9 Hrs)

RISK II: RISK MANAGEMENT: Introduction – Control Strategies – Managing Risk – Feasibility and Cost Benefit Analysis – Risk Control Practices.

UNIT III (9 Hrs)

SECURITY POLICY: Purpose of security policies -Enterprise Information – Issue Specific – System Specific – Guidelines.

UNIT IV (9 Hrs)

SECURITY MANAGEMENT OF DEPLOYED SYSTEMS: Organizing For Security - Within an Organization – Components – Security Roles- Education – Training and Awareness – Security Management Models: Access Control – Architecture Models – Management Models - Benchmarking – Performance Measures.

UNIT V (9 Hrs)

CONTINGENCY PLANNING: Fundamentals - Components: Business Impact - Incident Response - Disaster Re-covery – Business Continuity - Timing and Sequence - Crisis Management - Business Resumption Planning – Testing Contingency Planning.

Laboratory/ Practicals:

1. Threat identification and classification.
2. Vulnerability assessment.
3. Risk assessment and mitigation strategies.
4. Access control and Authentication.
5. security policy.

Text Books:

1. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. ”Introduction to information security and cyber laws”. Dreamtech Press. ISBN: 9789351194736, 2015.
2. Mark Merkow, ”Principles of Information Security”, Pearson India, 1st Edition, 2007.
3. Michael E. Whitman and Herbert J. Mattord, ”Management of Information Security”, Cengage Learning, 6th Edition, 2018.

References:

1. Dr. Allen Harper, Daniel Regalado , Ryan Linn, Stephen Sims, ”Grey Hat Hacking: The Ethical Hackers Handbook ”, McGraw Hill, 2020.

ONLINE/NPTEL Courses:

1. Introduction to Information Security:https:https://archive.nptel.ac.in/courses/106/106/106106129/

ICBPE011 DESIGN AND TESTING OF DIGITAL SYSTEMS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Digital systems and Microprocessor.
- Software Engineering.

Course Objectives:

- To impart knowledge on combination and sequential circuits and to design digital circuits with logic devices and VHDL.

Course Outcomes:

- To understand and simulate the combinational circuits using gates, programming logic devices and VHDL.
- To understand and Design sequential circuits and perform fault modeling and simulation.
- To understand and Design the sequential circuits and perform fault modeling and simulation.
- To understand and Apply test ability algorithms to test combinational and sequential circuits.
- To understand and Simulate the combinational and sequencial circuits.

UNIT I (9 Hrs)

COMBINATIONAL CIRCUIT DESIGN AND SIMULATION USING GATES: Review of Combinational Circuit Design-Design of Circuits with limited gate fan-in Gate delays and timing diagrams-Hazards in Combinational Logic- Simulation and testing of Logic circuits-Multiplexer, three-state buffers and Decoder/Encoders.

UNIT II (9 Hrs)

COMBINATIONAL CIRCUITS DESIGN WITH PROGRAMMABLE LOGIC DEVICES AND VHDL: Designing with ROMs-Programmable Logic devices-Complex Programmable Logic Devices-Field Programmable gate Arrays-VHDL Description of combinational Circuits VHDL models for Multiplexers-VHDL Modules and Operators- Signals, constants and Arrays-IEEE Standard Logic.

UNIT III (9 Hrs)

SEQUENTIAL CIRCUITS DESIGN: Sequential Parity Checker-Analysis by Signal Tracing and Timing charts-State Tables and Graphs-Construction and Interpretation of Timing Charts-General Models-Code converter-design Example-Design of Sequential Circuits using ROMs and PLAs.

UNIT IV (9 Hrs)

FAULT MODELING AND SIMULATION: Keyboard basics - Keyboard scanning algorithm - Character LCD mod- ules - LCD module display Configuration - Time-of-day clock - Timer manager - Interrupts - Interrupt service routines

- Interrupt-driven pulse width modulation. Triangle waves analog vs. digital values - Auto port detect - Capturing ana- log information in the timer interrupt service routine - Automatic, multiple channel analog to digital data acquisition.

UNIT V (9 Hrs)

TESTING FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS: Basic IssuesATG for SSFs in Combinational Circuits- Fault oriented ATG-Common Concepts, Algorithms and Selection Criteria-ATG for SSFs in Sequential Circuits.

Laboratory/ Practicals:

1. Design and implement (i) 4-bitParallelAdder/Subtractor using IC 7483. (ii) BCD to Excess-3 code conversion and vice-versa.
2. Design and Implementation of (i) 1-bit Comparator (ii)5-bit Magnitude Comparator using IC 7485.
3. Realize. (i) Adder & Subtactors using IC 74153. (ii)4-variable function using IC74151(8:1MUX).
4. Realize (i) Adder & Subtractors using IC74139. (ii) Binary to Gray code conversion & vice-versa (74139).
5. Create a circuit with 4 inputs, treated as a 4-bit positive binary integer. The circuit should output a 1 if the input is a prime number and 0 otherwise. Note, the numbers 0 and 1 are not prime numbers.

Text Books:

1. Charles H. Roth, Jr.Larry L.Kinney, ”Fundamentals of Logic design” Cenage Learning, 7th Edition, 2013.
2. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, ”Digital Systems Testing and Testable Design”, Jaico Publishing House, 2001.
3. Morris Mano, M.D.Ciletti, ”Digital Design” , Pearson Edition, 2013.

References:

1. M.L. Bushnell and V.D. Agrawal, ”Essentials of Electronic Testing for Digital, Memory and 201 Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2002.
2. P.K. Lala, ”Digital Circuit Testing and Testability”, Academic Press, 2002.
3. A.L. Crouch, ”Design Test for Digital IC’s and Embedded Core Systems”, Prentice Hall International, 2002.
4. Peatman, ”Design of digital Systems”, McGraw-Hill, 1984.
5. Adamski and Barkalov, ”Design of Digital Systems and Devices”, Springer Science & Business Media, 2011.

ONLINE/NPTEL Courses:

1. Digital Circuit and Systems:https://archive.nptel.ac.in/courses/117/106/117106086/

ICBPE012 PRINCIPLES OF MODERN CRYPTOGRAPHY

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Basics of Mathematics.

Course Objectives:

- To gain knowledge about the mathematics of the cryptographic algorithms and get an insight into the working of different existing cryptographic algorithms.

Course Outcomes:

- To understand and apply the knowledge about the mathematics of the cryptographic algorithms.
- To understand and apply different existing cryptographic algorithms.
- To understand about the working of Authentication Mechanisms and Key Management.
- To understand the working of Authentication Mechanisms and Key Management.
- To understand the Challenge Response Protocols

UNIT I (9 Hrs)

INTRODUCTION: Security Goals, Cryptographic attacks, Services and Mechanism, Techniques for Security Goals Implementation – Mathematics of Cryptography – Modular Arithmetic, Congruence and Matrices.

UNIT II (9 Hrs)

TRADITIONAL SYMMETRIC KEY CIPHERS: Mathematics of Symmetric Key Cryptography – Algebraic Struc- tures - Introduction to Modern Symmetric Key Ciphers- DES, Blowfish, IDEA, AES, RC5, - Modes of operation of Modern Symmetric Key Ciphers.

UNIT III (9 Hrs)

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes, Primality Testing, Factorization, Chi- nese Remainder Theorem, Quadratic Congruence - Asymmetric Key Cryptography – RSA, ElGamal Cryptosystem, Elliptic Curve Cryptosystem, Public Key Infrastructure and Digital Certificates.

UNIT IV (9 Hrs)

MESSAGE INTEGRITY AND MESSAGE AUTHENTICATION: Random Oracle Model, Message Authentication – Cryptographic Hash Functions – MD5, SHA-512 - Digital Signature – Process, Services, Attacks on Digital Signature, Digital Signature Schemes – RSA, El Gamal, Elliptic Curve – Variations and Applications.

UNIT V (9 Hrs)

ENTITY AUTHENTICATION: Password based Authentication, Challenge Response Protocols, Zero Knowledge Protocols, Biometrics – Key Management – Symmetric key Distribution, Kerberos, Symmetric Key Agreement, Public Key Distribution, Hijacking.

Laboratory/ Practicals:

1. DES.
2. IDEA.
3. Symmetric key Distribution.
4. RSA Algorithm.
5. Elliptic Curve.

Text Books:

1. William Stallings, ”Cryptography and Network Security Principles and Practice”, Pearson Education 8th edition, 2023.
2. Michael Stinson. D, ”Cryptography: Theory and Practice”, Chapman & Hall/CRC, 3rd edition, 2010.
3. Wembo Mao, ”Modern cryptography: Theory & practice”, Pearson Education; 1st Edition, 2004.

References:

1. Jonathan Katz Yehuda Lindell, ”Introduction To Modern Cryptography Chapman & Hall/CRC Cryptography and Network Security”, Chapman and Hall/CRC, 2nd Edition, 2007.

ONLINE/NPTEL Courses:

1. Foundations of Cryptography: https://archive.nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs02/

ICBPE013 FOUNDATIONS OF MODERN NETWORKING

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Networking Basics: OSI Model, TCP, UDP, TCP/IP.

Course Objectives:

- To learn the principles behind the modern network approaches such as SDN NFV and IoT and to analyse data center topologies and virtualized environment.

Course Outcomes:

- To understand the basic principles behind the Modern Network approaches.
- To understand the concept of virtualization and explore it to the fullest.
- Ability to analyze Data Center topologies and virtualized environment
- Knowledge about IoT security.
- Ability to design algorithms for virtualization over multi-tenant environments

UNIT I (9 Hrs)

MODERN NETWORKING: Networking Ecosystem -Network Architecture – 4G/5G - Cloud Computing - Internet Of Things - Types of Network and Internet Traffic - Demand: Big Data, Cloud Computing, and Mobile Traffic - Requirements: QoS and QoE - Routing Congestion Control - SDN and NFV - Modern Networking Elements.

UNIT II (9 Hrs)

SOFTWARE DEFINED NETWORKS: Network Requirements - The SDN Approach - SDN- and NFV-Related Standards - SDN Data Plane - OpenFlow Logical Network Device - OpenFlow Protocol - SDN Control Plane Architecture - REST API - SDN Application Plane

UNIT III (9 Hrs)

VIRTUALIZATION: Background and Motivation for NFV - Virtual Machines - NFV Concepts - NFV Reference Architecture - NFV Infrastructure - Virtualized Network Functions - NFV Management and Orchestration - NFV Use Cases - SDN and NFV.

UNIT IV (9 Hrs)

THE INTERNET OF THINGS: Components: The IoT Era - Scope of the Internet of Things - Components of IoT-Enabled Things - IoT World Forum Reference Model - ITU-T IoT Reference Model -IoTivity - Cisco IoT System
- ioBridge - SDN and NFV over IoT Deployment DevOps.

UNIT V (9 Hrs)

SECURITY: Security Requirements - SDN Security - NFV Security - ETSI Security 125 Perspective - IoT Security - The Patching Vulnerability - IoT Security and Privacy Requirements Defined by ITU-T – An IoT Security

Framework
- The Impact of the New Networking on IT Careers.

Laboratory/ Practicals:

1. SDN-Routing Within an SDN Network.
2. Interconnection Between Legacy Networks and SDN Networks.
3. Multi-access Edge Computing (MEC) in NFV
4. SDN Security.
5. SDN and NFV over IoT Deployment Devops.

Text Books:

1. William Stallings, ”Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud”, Publisher: Addison- Wesley, 2015.
2. Jim Doherty, ”SDN and NFV Simplified: A Visual Guide to To understanding Software Defined Networks and Network Function Virtualization”, Addison-Wesley Professional, 1st Edition, 2016.

References:

1. Paul Goransson Chuck Black, ”Software Defined Networks A Comprehensive Approach”, Morgan Kaufmann, 1st Edition, 2014.

ONLINE/NPTEL Courses:

1. Computer Networks:https://nptel.ac.in/courses/106105081

ICBPE014 NETWORK PROTOCOLS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer networks.

Course Objectives:

- To learn the different network architectures and protocols, various TCP/IP protocols, various network security technologies and protocols.

Course Outcomes:

- To understand the different network architectures and protocols.
- To understand various network security technologies and protocols.

UNIT I (9 Hrs)

APPLICATION LAYER PROTOCOLS: TCP/IP, HTTP, SHTTP, LDAP, MIME,- POP& POP3 RMONSNTP- SNMP. Presentation Layer Protocols-Light Weight Presentation Protocol Session layer protocols – RPC protocols-transport layer protocols- ITOT,RDP,RUDP,TALI,TCP/UDP, compressed TCP. Network layer Protocols – routing protocols-border gateway protocol-exterior gateway protocol-internet protocol IPv4- IPv6- Internet Message Control Protocol-IRDP.

UNIT II (9 Hrs)

DATA LINK LAYER PROTOCOL: ARP – In ARP – IPCP – IPv6CP – RARP – SLIP .Wide Area Network Protocols- ATM protocols – Broadband access Protocols – Point to Point Protocols – Other WAN Protocols- security issues.

UNIT III (9 Hrs)

LOCAL AREA NETWORK AND LAN PROTOCOLS: ETHERNET Protocols – VLAN protocols –Wireless LAN Protocols – Metropolitan Area Network Protocol – Storage Area Network and SAN Protocols -FDMA, WIFI and WIMAX Protocols- security issues - Mobile IP – Mobile Support Protocol for IPv4 and IPv6 – Resource Reservation Protocol - Multi-casting Protocol – BGMP – IGMP – MSDP.

UNIT IV (9 Hrs)

ISO PROTOCOLS: Application Layer- ISO ACSE: Association Control Service Element –ISO CMIP: Common Management Information Protocol - CMOT: CMIP over TCP/IP - ISO FTAM – ISO ROSE - ISO RTSE - ISO VTP - ISO-PP - ISO-SP - ISO-TP: OSI - TP0, TP1, TP2, TP3, TP4 – Network Layer CLNP: Connectionless Network Protocol (ISO-IP) -ISO CONP - ES-IS: IDRP - IS-IS – Cisco Protocols: CDP: Cisco Discovery Protocol - CGMP – DTP – EIGRP - HSRP IGRP - ISL & DISL –RGMP - TACACS – VTP – XOT - Novell NetWare and Protocols - IPX - NCP - NLSP – SPX -IBM SMB – APPC - SNA NAU - NetBIOS – NetBEUI – APPN – DLSw - QLLC – SDLC -AppleTalk - SS7/C7 Protocols – BISUP – DUP - ISUP - MTP2 and MTP3: - SCCP – TCAP – TUP –CIFS - Microsoft SOAP - Xerox IDP - Toshiba FANP.

UNIT V (9 Hrs)

WIRELESS NETWORK PROTOCOLS: EEE 802.15 and Bluetooth – WPAN Communication Protocols – IEEE 802.16- IEEE 802.16A.WCDMA – Services – WCDMA Products – Networks- device addressing – System Address- ing – Radio Signaling Protocol – Multimedia Signaling Protocol.

Laboratory/ Practicals:

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
2. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
3. Simulation of DNS using UDP sockets.
4. Write a code simulating ARP /RARP protocols.
5. Study of TCP/UDP performance using Simulation tool.

Text Books:

1. Deepanshu Khanna and Yoram Orzach, ”Network Protocols for Security Professionals: Probe and identify network-based vulnerabilities and safeguard against network protocol breaches”, Packt Publishing, 2022.
2. Jelin Dong, ”Network Protocols Handbook” Jawin Technologies Inc., 2005.
3. Lawrence Harte, ”Introduction to WCDMA”, Althos Publishing, 2004.

References:

1. Ralph Oppliger, ”SSL and TSL: Theory and Practice”, Arttech House, 2009.
2. Jessica Fridrich, ”Steganography in Digital Media: Principles, Algorithms, and Applications”, Cambridge university press, 2010.
3. Lawrence Harte, ”Introduction to CDMA- Network services Technologies and Operations”, Althos Publishing, 2004.
4. Lawrence Harte, ”Introduction to WIMAX”, Althos Publishing, 2005.

ONLINE/NPTEL Courses:

1. Computer Networks and Internet Protocol:https://archive.nptel.ac.in/courses/106/105/106105183/

ICBPE015 COMMUNICATION TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer network.

Course Objectives:

- To learn the various technologies, architectures, and protocols used in the telecommunications industry.

Course Outcomes:

- To understand about the latest Telecommunications Technology.
- To understand in-depth knowledge about various Networking.
- To understand various Cellular Services And Standards can be learned.
- To understand various internet and IP Telephony.
- To understand about the IEEE standard.

UNIT I (9 Hrs)

INTRODUCTION TO TELECOMMUNICATIONS AND TRANSMISSION: Human–Machine Interactions - Embedded Devices - Intelligent Wearable - Traffic Patterns - The Electromagnetic Spectrum - Analog and Digital, Multiplexing Media: Twisted-Pair - Coaxial Cable Microwave – Satellites - Fiber Optics - Data Communication Traf- fic - Data Transmission - OSI and TCP/IP Reference Models.

UNIT II (9 Hrs)

INTRODUCTION TO THE INTERNET AND IP TELEPHONY: Internet and Routing Protocols- Internet Archi- tecture, and Infrastructure - Subnetting: IPv4, IPv6; DNS, QoS- Service Providers - IPT Network Architecture, QoS - VoIP Call Signaling Protocols - Digital Voice, ENUMVPNs: Layer 3, 2, Security- Unified communications- IP voice and IPTV- The Broadband Infrastructure - Quality of Service-Virtualization- Cloud Computing.

UNIT III (9 Hrs)

FIBRE OPTIC NETWORKS, WIRED AND WIRELESS BROADBAND: Optical Networking Elements : Switches, Edge, Core - DSL - Cable TV Networks, Packet Cable- Fiber Solutions- Wireless Broadband- HANs PANs, CANs, MANs- Broadband PLT - Antennas- Wireless Bandwidth - Spectrum Utilization- Spread Spectrum.

UNIT IV (9 Hrs)

CELLULAR SERVICES AND STANDARDS: Cellular: 2G, 2,5G, 3G, 4G. 5G - WiMax,LTE - mobile security - Digital Cellular Radio -Enhanced Data Services - Broadband Wireless 3G Standards : : UMTS, TD-SCDMA,CDMA Solutions.

UNIT V (9 Hrs)

WIRELESS PERSONAL AREA NETWORK WIRELESS NETWORK ARCHITECTURE, WIRELESS AND MOBILITY: BFWAWLANs -IEEE 802.11a,b,g,n - IEEE 802.16, WiMax, WiBro and Mobile-Fi - VoWLAN - Integration of WLANs and Cellular Networks, RFIDMesh Networks - Mobile IP, IP Multimedia Subsystem - Applications, Mobile Video, Mobile TV, and Content.

Laboratory/ Practicals:

1. To establish voice link using optical fiber.
2. Code Division Multiple Access (CDMA) - Multipath
3. Modeling and simulation of TD-SCDNA for wireless communication
4. Implementation of A single-polarization smart antenna for TDSCDMA system.
5. Modeling and simulation of UMTS for wireless communication

Text Books:

1. Ian Walden, "Telecommunications Law and Regulation", OUP Oxford, 4th Edition, 2018.
2. Olof Liberg, Marten Sundberg, Eric Wang, Johan Bergman"Cellular Internet of Things: Technologies, Standards, and Performance", Academic Press, 2017.

References:

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystem", River Publishers Series in Communications, June 2013.

ONLINE/NPTEL Courses:

1. Wireless Ad Hoc and Sensor Networks:https://nptel.ac.in/courses/106105160

APPENDIX –IV

LIST OF OPEN ELECTIVE COURSES [ICBOE]

S.No	Code No.	Name of the Subjects	L	T	P	C
1	ICBOE001	Iot and Its Applications	3	0	0	3
2	ICBOE002	Drone Technologies.	3	0	0	3
3	ICBOE003	5G Networks	3	0	0	3
4	ICBOE004	Cyber Laws	3	0	0	3
5	ICBOE005	Cyber Physical System	3	0	0	3

ICBOE001 IOT AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Computer Programming.

Course Objectives:

- To learn the concepts of Internet of Things and the application of IoT, determine the Market perspective of IoT and Understand the vision of IoT from a global context

Course Outcomes:

- To understand the use of devices, gateways and Data Management in IoT.
- To understand the IoT applications in different domain and be able to analyze their performance
- To understand and implement basic IoT applications on embedded platform.

UNIT I (9 Hrs)

IOT & WEB TECHNOLOGY: The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Tech- nologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

UNIT II (9 Hrs)

M2M TO IOT: A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT III (9 Hrs)

IOT ARCHITECTURE -STATE OF THE ART: Introduction, State of the art, Architecture. Reference Model Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT IV (9 Hrs)

IOT APPLICATIONS FOR VALUE CREATIONS: Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

UNIT V (9 Hrs)

INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE: Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

Text Books:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things: (A Hands-on Approach)”, Universities Press (INDIA) Private Limited , 1st Edition, 2014.

References:

1. Michael Miller, “The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World”, Pearson Education 2015.
2. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, Apress Publications, 1st Edition, 2013.
3. Waltenegus Dargie, Christian Poellabauer, ”Fundamentals of Wireless Sensor Networks: Theory and Practice”, Wiley, 2014.
4. CunoPfister, “Getting Started with the Internet of Things”, O’Reilly Media 2011.

ONLINE/NPTEL Courses:

1. Advanced IOT Applications:https://archive.nptel.ac.in/courses/106/105/106105166/

ICBOE002 DRONE TECHNOLOGIES

L	T	P	C
3	0	0	3

Course Objectives:

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

Course Outcomes:

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

UNIT I (9 Hrs)

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

UNIT II (9 Hrs)

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

UNIT III (9 Hrs)

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

UNIT IV (9 Hrs)

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

UNIT V (9 Hrs)

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

Text Books:

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

References:

1. John Baichtal, “Building Your Own Drones: A Beginners” Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016. 2. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

ONLINE/NPTEL Courses:

1. Design of fixed wing Unmanned Aerial Vehicles: https://nptel.ac.in/courses/101104073

ICBOE003 5G NETWORKS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Digital Communications.
- Mobile Communication Systems.
- Wireless Networks

Course Objectives:

- To learn the 5G interference and mobility management in 5G networks.

Course Outcomes:

- To understand and explain the channel models of 5G and the use cases for 5G.
- To understand and explain 5G architecture, its components and functional criteria and develop 3D animations.
- To understand the multi-carrier techniques and new waveform options for 5G communication.
- To understand the concept of network slicing and V2V communication.
- To understand the interference and mobility management in 5G networks.

UNIT I (9 Hrs)

5G RADIO SPECTRUM: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.-5G channel model: The 5G wireless Propagation Channels: Channel modeling require- ments, propagation scenarios and challenges in the 5G modeling. 5G use cases and system concept: Use cases and requirements, 5G system concept.

UNIT II (9 Hrs)

RADIO INTERFACE ARCHITECTURE: 5G architecture options, core network architecture, RAN architecture. 5G Physical Layer: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming).

UNIT III (9 Hrs)

5G RADIO-ACCESS TECHNOLOGIES: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple access.

UNIT IV (9 Hrs)

TINTRODUCTION TO 5G NETWORK SLICING: Network Slicing, E2E Slicing, SDN and NFV Slicing VE-HICULAR COMMUNICATIONS: From V2V to AV2X, key standards, VC architectures, V2X Use cases.

UNIT V (9 Hrs)

MOBILITY AND HANDOFF MANAGEMENT IN 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

Text Books:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
2. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies", CRC Press, Taylor & Francis Group, 1st Edition, 2018.
3. Harri Holma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP NEW RADIO", John Wiley & Sons 1st Edition,2020.

References:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 1st Edition, 2010. Gordon L. Stuber, "Principles of Mobile Communication", Kluwer academic Publishers, 2nd Edition, 2002.
2. Joseph C. Liberti, Theodore S. Rappaport, "Smart Antennas for Wireless Communications", Prentice Hall PTR, 1999.
3. Ying Zhang, "Network Function Virtualization Concepts and Applicability in 5G Networks", John Wiley & Sons, 2018.

ONLINE/NPTEL Courses:

1. Advanced 3G and 4G Wireless Mobile Communication:https://archive.nptel.ac.in/courses/117/104/117104099/

ICBOE004 CYBER LAWS

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Familiarity with Cyber Security.

Course Objectives:

- To learn the various cyber security laws.

Course Outcomes:

- Exposure to basic information on cyber security.
- To understand and able to find solution for private ordering.
- Understand the issues those are specific to amendment rights.
- Knowledge on copy right issues of software.
- Should be able to understand ethical laws of computer for different countries.

UNIT I (9 Hrs)

INTRODUCTION: Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy. .

UNIT II (9 Hrs)

PRIVATE ORDERING SOLUTIONS: Regulation and Jurisdiction for global Cyber security - Copy Right source of risks – Pirates- Internet Infringement - Fair Use – postings - criminal liability - First Amendments - Data Losing.

UNIT III (9 Hrs)

COPY RIGHT: Source of risks – Trademarks – Defamation - Privacy-Common Law Privacy Constitutional law - Federal Statutes – Anonymity - Technology expanding privacy rights

UNIT IV (9 Hrs)

DUTY OF CARE AND ETHICS: Criminal Liability - Procedural issues- Electronic Contracts & Digital Signatures- Misappropriation of information - Civil Rights, Tax, Evidence.- Legal Developments, Late 1990 to early 1966, Cyber security in Society, Security in cyber laws case studies, General Law and Cyber Law-a Swift Analysis

UNIT V (9 Hrs)

SECURITY POLICY CASE STUDIES: Indian National Cyber Security Policy-2013 – UK National Cyber Security Strategy 2016 to 2021 – US Cyber Security Policy

Text Books:

1. Jonathan Rosenoer,“Cyber Law: The law of the Internet”, Springer-Verlag, 1997.
2. Mark F Grady, FransescoParisi, “The Law and Economics of Cyber Security”, Cambridge University Press, 2005.

References:

1. Richard E. Smith, ”Elementary Information Security”, Jones and Bartlett Publishers, Inc, 2nd Edition, 2015.
2. David Kim and Michael G. Solomon, ”Fundamentals of Information Systems Security”, Jones and Bartlett Publishers, Inc, 4th Edition, 2021.
3. Jason Andress, ”Foundations of Information Security: A Straightforward Introduction”, Jones and Bartlett Pub- lishers, Inc, 4th Edition, 2021.

ONLINE/NPTEL Courses:

1. :Information Security - 5 - Secure Systems Engineering: https://nptel.ac.in/courses/106106199

ICBOE005 CYBER PHYSICAL SYSTEM

L	T	P	C
3	0	0	3

Course Pre-requisite:

- Familiarity with network security.

Course Objectives:

- To introduce the basic concepts of cyber physical system, study about the various automated control design, impart knowledge on modeling and analysis of advanced automata and provide knowledge on hybrid automata modeling.

Course Outcomes:

- Understand the basic concepts of cyber physical system
- Acquire knowledge on automated control design
- Acquire knowledge on modelling and analysis on advanced automata
- Understand on hybrid automata modelling.
- Interpret the various case studies on cyber physical system.

UNIT I (9 Hrs)

INTRODUCTION: Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, CPS HW platforms: Processors, Sensors, Actuators, CPS Network, CPS SW stack RTOS, Scheduling Real Time control tasks.

UNIT II (9 Hrs)

STABILITY ANALYSIS: Principles of Automated Control Design: Dynamical Systems and Stability, Controller Design Techniques CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise. CPS : From features to software components, Mapping software components to ECUs

UNIT III (9 Hrs)

ADVANCED AUTOMATA BASED MODELLING AND ANALYSIS: Basic introduction and examples ,Timed and Hybrid Automata, Definition of trajectories, zenoness, Formal Analysis: Flow pipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Bounded Model checking

UNIT IV (9 Hrs)

HYBRID AUTOMATA MODELLING: flowpipe construction using Flowstar, SpaceX and Phaver tools, CPS SW Verification: Frama-C, CBMC, Secure Deployment of CPS : Attack models, Secure Task mapping and Partitioning, State estimation for attack detection.

UNIT V (9 Hrs)

AUTOMOTIVE CASE STUDY, CPS PERFORMANCE ANALYSIS: Vehicle ABS hacking, Power Distribution Case study: Attacks on Smart grid. effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion, Formal Methods for Safety Assurance of Cyber-Physical Systems.

Text Books:

1. E. A. Lee and S. A. Seshia, “Introduction to Embedded Systems: A Cyber-Physical Systems Approach”, MIT Press, 2011.
2. R. Alur, “Principles of Cyber-Physical Systems,” MIT Press, 2015.
3. T. D. Lewis “Network Science: Theory and Applications”, Wiley, 2009.
4. P. Tabuada, “Verification and control of hybrid systems: a symbolic approach”, SpringerVerlag 2009.

References:

51 . Constance Heitmeyer and Dino Mandrioli, “Formal methods for real-time computing”, Wiley publisher, 1996.
2. C. Cassandras, S. Lafortune, “Introduction to Discrete Event Systems”, Springer 2007.

ONLINE/NPTEL Courses:

1. Foundations of Cyber Physical Systems: https://archive.nptel.ac.in/courses/106/105/106105241/