

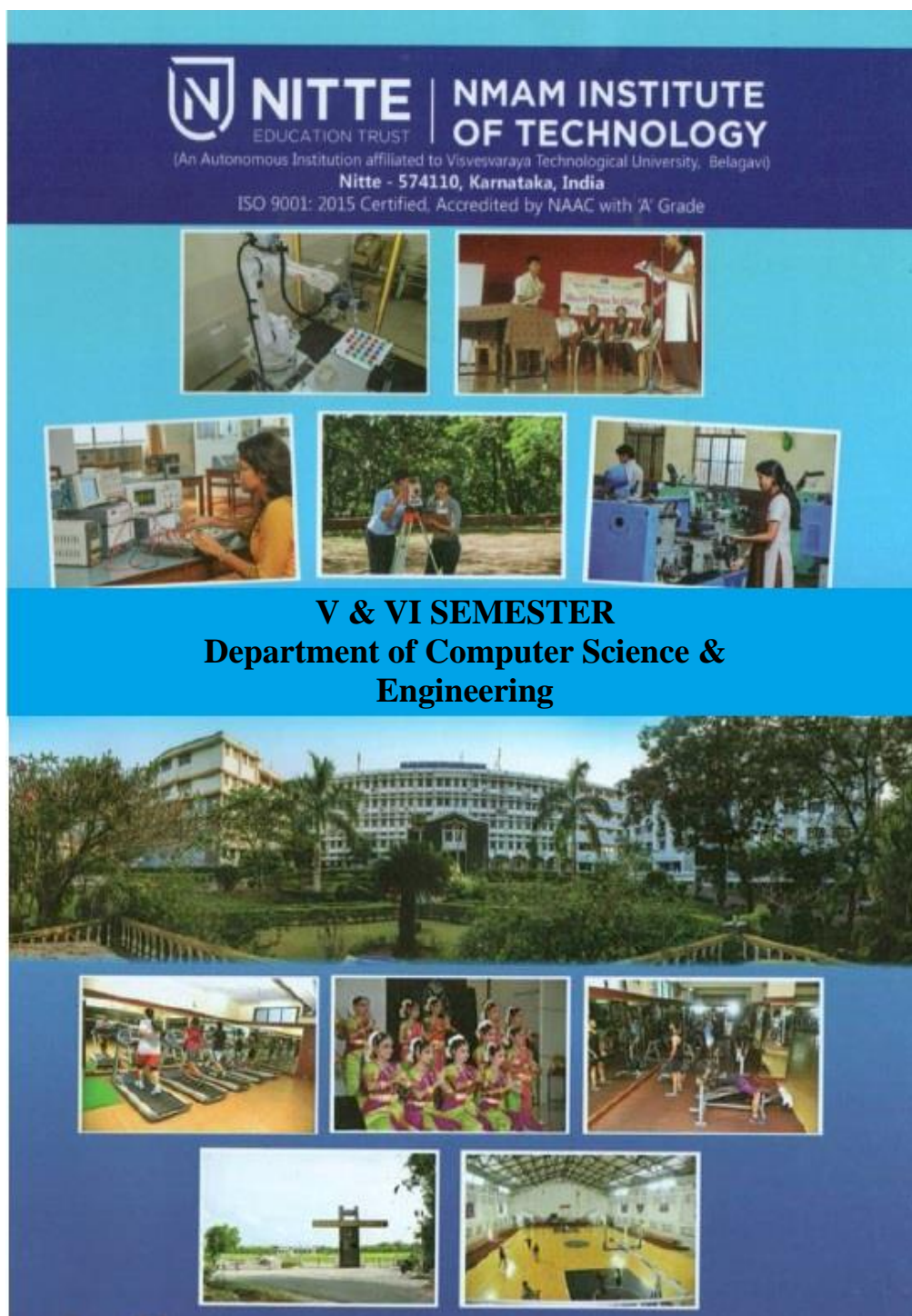


College Calendar 2023-24

Department of Computer Science & Engineering



Syllabus of 3rd Year



**मातेव रक्षति पितेव हिते नियुङ्क्ते
कान्तेव चापि रमयत्यपनीय खेदम् ।
लक्ष्मीं तनोति वितनोति च दिक्षु कीर्तिं
किं किं न साधयति कल्पलतेव विद्या ॥**

ಮಾತೇವ ರಕ್ಷತಿ ಪಿತೇವ ಹಿತೇ ನಿಯುಂಕ್ತೇ
ಕಾಂತೇವ ಚಾಪಿ ರಮಯತ್ಯಪನೀಯ ಖೇದಮ್ ।
ಲಕ್ಷ್ಮೀಂ ತನೋತಿ ವಿತನೋತಿ ಚ ದಿಕ್ಷು ಕೀರ್ತಿಂ
ಕಿಂ ಕಿಂ ನ ಸಾಧಯತಿ ಕಲ್ಪಲತೇವ ವಿದ್ಯಾ ॥

ತಾಯಿಯಂತೆ ರಕ್ಷಣೆಯನ್ನಿತ್ತು, ತಂದೆಯಂತೆ ಸನ್ಮಾರ್ಗದಲ್ಲಿ ತೊಡಗಿಸಿ ಪತ್ನಿಯಂತೆ ದುಃಖವನ್ನು ದೂರಮಾಡಿ ಮನಕ್ಕೆ ಮುದಕೊಡುತ್ತಾ, ಸಂಪತ್ತನ್ನು ವರ್ಧಿಸಿ ದಶದಿಕ್ಕುಗಳಲ್ಲಿ ಕೀರ್ತಿಯನ್ನು ಪಸರಿಸುವ 'ವಿದ್ಯೆ', ಕಲ್ಪಲತೆಯಂತೆ ನಾವು ಬಯಸಿದ್ದನ್ನು ಕೊಡುತ್ತಾಳೆ.

विद्या माता की तरह पालन करती है, बाप के तरह हितकर मार्ग में ही ले लेता है। पत्नी की तरह हमारा दुःख दूर करता है। मन को संतोष देता है, धन देती है, दिशाओं में कीर्ति फैलाती है। कल्पवल्ली की तरह वह सब कामनाये पूरी करती है।

Do you know in how many ways the 'Knowledge' serves his master? Like mother it protects, like father it teaches and guides, like wife, provides all kinds of happiness after destroying all sorrows, it brings wealth from every corner and spreads the fame in all direction. Like 'Kalpalatha' knowledge offers everything to human being whatever he wishes.



(An Autonomous Institution affiliated to VTU, Belgavi)
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India
ISO 9001:2015 Certified, Accredited by NAAC with “A” Grade

COLLEGE CALENDAR

2023-24

(V & VI Semester)





(An Autonomous Institution affiliated to VTU, Belgavi)
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India
ISO 9001:2015 Certified, Accredited by NAAC with “A” Grade

Vision Statement

Pursuing Excellence, Empowering people, Partnering in Community Development

Mission Statement

To develop N.M.A.M. Institute of Technology, Nitte, as Centre of Excellence by imparting
Quality Education to generate competent,
Skilled and Humane Manpower to face emerging Scientific, Technological,
Managerial and Social Challenges
with Credibility, Integrity, Ethics and Social Concern.

In Memorium



Late Nitte Mahalinga Adyanthaya

Our Founder



Late Justice K. S. Hegde
1909-1990



SRI N. VINAYA HEGDE

President, Nitte Education Trust
Chancellor, Nitte (Deemed to be University), Mangaluru


**NMAM INSTITUTE
OF TECHNOLOGY**

Sl.No.	Name of the Faculty	Designation
1.	Dr. N. Niranjan Chiplunkar	Principal
2.	Mr. Yogeesh Hegde	Director(CM&D)
3.	Dr. Shrinivasa Rao B. R.	Vice Principal/Controller of Examinations/Professor
4.	Dr. I. Ramesh Mithanthaya	Vice Principal / Dean (Academic)/Professor
5.	Dr. Sudesh Bekal	Dean (R&D)/Professor
6.	Dr. Rajesh Shetty K.	Dean (Admissions)/Professor
7.	Dr. Rekha Bhandarkar	Deputy Registrar of Nitte Off-campus Centre, Nitte (DU)
8.	Dr. Subrahmanya Bhat K	Deputy COE of Nitte Off-campus Centre, Nitte (DU)
9.	Dr. Nagesh Prabhu	Director(Curriculum Development) Nitte (DU)
10.	Dr. Srinath Shetty K.	Resident Engineer/Professor
11.	Dr. Narasimha Bailkeri	Dean(Student Welfare)/Professor
12.	Dr. Rajalakshmi Samaga BL	PG Coordinator/Professor

HEADS OF DEPARTMENTS

1.	Dr. Arun Kumar Bhat	HoD, Civil Engg.
2.	Dr. Jyothi Shetty	HoD, Comp. Science & Engg
3.	Dr. Ashwini B	HoD, Information Science & Engg
4.	Dr. Ujwal P	HoD, Biotechnology
5.	Dr. KVSSSS Sairam	HoD, E&C Engg.
6.	Dr. Suryanarayana K	HoD, E&E Engg.
7.	Dr. Muralidhara	HoD, Robotics & Artificial Intelligence
8.	Dr. Kumudakshi	HoD, Mathematics
9.	Dr. Shobha R. Prabhu	HoD, Physics
10.	Dr. Shivaprasad Shetty M.	HoD, Chemistry
11.	Dr. Mamatha Balipa	HoD, MCA
12.	Dr. Vishwanatha	HoD, Humanities
13.	Dr. Udaya Kumar K Shenoy	HoD, Computer & Communication Engg
14.	Dr. Sharada Uday Shenoy	HoD, Artificial Intelligence & Machine Learning
15.	Dr. Srinivas Pai P	HoD, Mechanical Engg
16.	Dr. Venugopala PS	HoD, Artificial Intelligence & Data Science
17.	Mr. Bharath G Kumar	Head, Training & Placement Cell

INCHARGE OF INSTITUTION'S RESPONSIBILITIES

1. Dr. Shashikanth Karinka	Co-ordinator MoUs
2. Dr. Gururaj Upadhyaya	Workshop Suptd
3. Dr. Joy Elvine Martis	1 st year Coordinator
4. Dr. Jnaneshwar Pai Maroor	Co-ordinator Alumni
5. Dr. Venkatesh Kamath	Assistant CoE
6. Dr. Janardhan Nayak	Co-ordinator – Red Cross Unit
7. Mr. Srinivas Nekkar	NCC Officer
8. Mr. Krishnaraja Joisa	Public Relation Officer
9. Mr. K. Sathish Nayak	Digital Media Executive
10. Sri. Shekar Poojari	Student Welfare Officer

ENTREPRENEURSHIP DEVELOPMENT CELL

1. Dr. Ramakrishna B	Professor/EDC- Incharge
2. Mrs. Geetha Poojarthi	Co-ordinator

DEPARTMENT OF TRAINING & PLACEMENT

1. Mr. Ankith S Kumar	Counsellor
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DEPARTMENT OF MATHEMATICS

1. Dr. Shashirekha B. Rai	Professor
2. Dr. Kumudakshi	Asso. Professor/ HoD
3. Dr. Sharad M. Hegde	Asst. Professor Gd III
4. Dr. Vasanth K.R	Asst. Professor Gd III
5. Dr. Ashwini Kumari	Asst. Professor Gd III
6. Dr. Chaithra K.	Asst. Professor Gd III
7. Dr. Prashanthi K S	Asst. Professor Gd III
8. Dr. Girija K P	Asst. Professor Gd III
9. Dr. Ganesh Kumar K	Asst. Professor Gd III
10. Mrs. Ambika N.	Asst. Professor Gd I
11. Mrs. Vinaya Acharya	Asst. Professor Gd I
12. Mrs. Anitha D. Bayar	Asst. Professor
13. Mrs. Bhavya K.	Asst. Professor
14. Mrs. Bhavya. D.	Asst. Professor
15. Mrs. Sharmila	Asst. Professor
16. Mrs. Anjana Pai K	Asst. Professor
17. Mrs. Soumya	Asst. Professor
18. Mrs. Smitha G. V.	Asst. Professor

DEPARTMENT OF PHYSICS

1. Dr. Manjunath K. B.	Professor
2. Dr. Shobha R. Prabhu	Asso. Professor / HoD
3. Dr. Sathyajith	Asso. Professor

- | | |
|--------------------------|------------------------|
| 4. Dr. Raghavendra Bairy | Asso. Professor |
| 5. Dr. Nagaraja B.S. | Asst. Professor Gd III |
| 6. Dr. Shyam Prasad . K. | Asst. Professor Gd III |
| 7. Dr. Saritha Suvarna | Asst. Professor Gd III |

DEPARTMENT OF CHEMISTRY

- | | |
|--------------------------------|------------------------|
| 1. Dr. Janardhana Nayak | Professor |
| 2. Dr. Ramesh Bhat | Asso. Professor |
| 3. Dr. Shivaprasad Shetty M. | Asso. Prof/HoD |
| 4. Dr. Aarti S. Bhat | Asst. Professor Gd III |
| 5. Dr. Subrahmanya Ishwar Bhat | Asst. Professor Gd III |
| 6. Dr. Sarvajith MS | Asst. Professor Gd III |
| 7. Dr. Ranjitha | Asst. Professor Gd III |

DEPARTMENT OF HUMANITIES

- | | |
|---------------------------------|------------------------|
| 1. Dr. Ramakrishna B. | Professor |
| 2. Mrs. Rashmi D. Hegde | Asso. Professor |
| 3. Dr. Vishwanatha | Asso. Professor /HoD |
| 4. Dr. Jnaneshwar Pai Maroor | Asst. Professor Gd III |
| 5. Dr. Joy Elvine Martis | Asst. Professor Gd III |
| 6. Mrs. Shyla D Mendonca | Asst. Professor Gd II |
| 7. Ms. Sonia Lobo | Asst. Professor Gd I |
| 8. Ms. Akshatha Kumari J Shetty | Asst. Professor Gd I |
| 9. Mr. Srinivas Nekkar | Asst. Professor |
| 10. Mrs. Sudeeksha S. Pai | Asst. Professor |
| 11. Mrs. Shwetha | Asst. Professor |

OFFICE SECTION HEADS

- | | |
|----------------------------|---|
| 1. Mr. Keshava Mugeraya | Sr. Suptd, Academic Section/
Purchase In -Charge |
| 2. Mrs. Suneetha R. Shetty | Sr. Suptd, Administrative Section |
| 3. Mr. Suresh Achar | Sr. Suptd, Stores |
| 4. Mrs. Jayashree | Sr. Programmer, Office Automation Cell |
| 5. Mrs. Shailaja V. Shetty | Suptd, Accounts Section |
| 6. Dr. Preetham Shetty KV | Librarian |

SECURITY DEPARTMENT

- | | |
|---------------------------|---------------------|
| 1. Mr. Hirianna Suvarna S | Security Supervisor |
|---------------------------|---------------------|

SPORTS DEPARTMENT

- | | |
|--------------------------------|-------------------|
| 1. Sri. Shyam Sundar M. | P.E.D |
| 2. Sri. Ganesh Poojary | P.E.D |
| 3. Ms. Sowjanya M. | P.E.I |
| 4. Mr. Ravi Prakash C. Anpur | Basket Ball Coach |
| 5. Mr. Clive Nolan Mascarenhas | Football Coach |
| 6. Mr. Rajesh Acharya | Cricket Coach |

HOSTEL WARDENS

- | | |
|-----------------------|---|
| 1. Dr. Veena Devi S.V | Chief Warden, NET Ladies Hostels, Nitte |
| 2. Dr. Vishwanatha | Chief Warden, NET Gents Hostels, Nitte |

HOSTEL SUPERINTENDENT / MANAGER

- | | |
|---------------------------|-----------------------------------|
| 1. Mr. John D'Souza | Sr. Manager, Gents Main Hostel |
| 2. Mr. Manjunatha Suvarna | Hostel Manager, Gents Main Hostel |
| 3. Mr. Rajesh Ballal | Manager, Gents PG Hostel |
| 4. Mrs. Gayathri Kamath | Manager, Ladies PG Hostel |
| 5. Mrs. Chethana Sharma | Manager, Ladies Main Hostel |
| 6. Mrs. Hema S. Hegde | Superintendent, Hostel Office |

REGULATIONS

2023-24

(Applicable for admission batch 2021-22 onwards)



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**REGULATIONS COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE PROGRAMMES OF
NMAM INSTITUTE OF TECHNOLOGY, NITTE
Karkala, Udupi Dist., Karnataka**

1. INTRODUCTION

- 1.1 The general regulations are common to all B.E. (Credit System) Degree Programmes conducted at the NMAMIT, Nitte Campus and shall be called "NMAMIT Regulations".
- 1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting Instructions of course, conduct of the examination and evaluation and certification of student's performance and all amendments related to the said Degree programme(s).
- 1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the BE Degree program (of VTU) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. **This set of Regulations, may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time, and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.**
- 1.4 In order to guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.
- 1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of NMAMIT courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.
- 1.6 The course shall be called **Bachelor of Engineering** course abbreviated as B.E. (Subject of specialization) – Credit System.

1.7 DURATION OF THE COURSE

- (a) The course shall extend over a period of total duration of 4 years.
- (b) Each year shall have the following schedule with **5 ½** days a week.
Suggested Break down of Academic Year into Semesters

1. No. of Semesters / Year	Three; Two being Main semesters (odd, even) and one being a supplementary semester; after 2 main semesters. (Note: Supplementary semester is primarily to assist weak and / or failed students through make up courses. However, Autonomous Colleges may use this semester to arrange Add-On courses for other students and / or for deputing them for practical training elsewhere.)
2. Semester Duration	Main semester (odd, even) each 19 Weeks; Supplementary Semester 8 Weeks
3. Academic Activities	Main Semester
(Weeks):	Registration of Courses & Course Work (16.0) Examination Preparation and Examination (3.0) Total (19) Supplementary Semester Registration of Courses & Course Work (5.0) Examination Preparation and Examination (3.0) Total (8) Declaration of results: 2 weeks from the date of last examination Inter- Semester Recess: After each Main Semester (2) Total Vacation: 10 weeks (for those who do not register for supplementary semester) and 4 weeks (for those who register for supplementary semester)

(Note: In each semester, there will be provision for students for Registration of courses at the beginning, dropping of courses in the middle and withdrawal from courses towards the end, under the advice of faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and also ensure their better monitoring by Faculty Advisors).

A candidate shall be allowed a maximum duration of eight years from the first semester of admission to become eligible for the award of Bachelor Degree.

The calendar of events in respect of the course shall be fixed by the Senate from time to time, but preferably in line with the academic calendar of the VTU.

2. DEGREE PROGRAMMES

2.1 Undergraduate B.E. Degree Programmes are offered in the following disciplines by the respective programme hosting departments listed below:

i)	Biotechnology Engineering	(BT)
ii)	Civil Engineering	(CV)
iii)	Computer Science & Engineering	(CS)
iv)	Electronics & Communications Engineering	(EC)
v)	Electrical & Electronics Engineering	(EE)
vi)	Information Science & Engineering	(IS)
vii)	Mechanical Engineering	(ME)
viii)	Artificial Intelligence and Machine Learning Engg.	(AM)
ix)	Computer and communication Engineering	(CC)
x)	Robotics and Artificial Intelligence Engineering	(RA)

Other teaching departments are –

i)	Mathematics	(MA)
ii)	Physics	(PH)
iii)	Chemistry	(CY)
iv)	Humanities, Social Sciences and Management	(HU)

2.2 The provisions of these Regulations shall be applicable to any new discipline* that may be introduced from time to time and appended to the above list.

3. REGISTRATION

3.1 Every student after consulting his Faculty Advisor in parent department shall register approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will have to pay a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the college at the end of each semester, like odd, even, supplementary and it forms the basis for determining the student's performance in that semester.

3.2 Lower and Upper Limits for Course Credits Registered in a Semester Course Credit Assignment

All courses comprise of specific Lecture/Tutorial/Practical (L-T-P) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

- i) One hour Lecture per week is assigned one Credit.
- ii) 2-hour Tutorial session per week is assigned 1.0 Credit.
- iii) 2-hour Lab. session per week is assigned 1.0 credit.

For example, a theory course with L-T-P schedule of 3-2-0 hours will be assigned 4.0 credits.

A laboratory practical course with L-T-P schedule of 0-0-2 hours will be assigned 1.0 credit.

Calculation of Contact Hours / Week – A Typical Example

A student must register, as advised by Faculty Advisor, between a minimum of 15 credits and up to a Maximum of 25 credits.

3.3 **Mandatory Pre-Registration for higher semester**

In order to facilitate proper planning of the academic activities of the Semester, it is necessary for the students to declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks prior to the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions -

- i) satisfied all the academic requirements to continue with the programme of studies without termination
- ii) cleared all Institute, hostel and library dues and fines, if any, of the previous semester
- iii) paid all required advance payments of the Institute and the hostel for the current semester
- iv) has not been debarred from registering on any specific grounds by the Institute.

4. **ADD / DROP / AUDIT options**

4.1 **Registration of courses**

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with subject teacher and under faculty advice. The permissible course load to be either average credits (=20) or to be within the limits of minimum (=15) and maximum (=25) credits.

4.2 **DROP-option**

During a specified period at the middle of a semester student's performance in CIE is reviewed by the faculty advisor. Following poor performance by a student he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses to be re-registered by these students and taken up for study at a later time.

4.3 **Withdrawal from courses**

During a specific period specified towards the end of the semester, student's performance in CIE is reviewed by the Faculty advisors. Following poor performance by a student in identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with mention in the Grade card (Grade 'W'). Such courses to be re-registered by these students and taken up for study at a later time.

4.4 **AUDIT-option**

A student can register for courses for audit only, with a view to supplement his/her knowledge and/or skills. The student's grades in such course(s) will have to be reflected in the grade card. However, CORE courses shall not be made available for audit. But these shall not be taken into account in determining the student's academic performance in the semester. 'U' grade is awarded to such courses on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses.

5. COURSE STRUCTURE:

5.1 Typical Breakdown for the B.E. Degree Curriculum:

No.	Course Category	Credit Range
1.	Basic Science Courses	20-25
2.	Engineering Science Courses	18-22
3.	Humanity, Social Science and Management	8-12
4.	Ability Enhancement Courses	10-14
5.	Professional Core Courses (PCC)	40-45
6.	Professional Elective Courses (PEC)	8-12
7.	Open Elective Courses (OE)	8-12
8.	Skill Courses (Project Work / Internship / Seminar)	28-36
9.	Mandatory courses	2
Note: Student can register between 15 to 25 credits per semester Total Credits to be earned : 160		

5.2 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components, the semester wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies(BOS). The BOS will consider the proposals from the departments and make recommendations to the senate for consideration and approval.

5.3 The earned Credit Requirement for the B.E. Degree is 160.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to student to plan their career.

5.4 Mandatory Learning Courses

These are courses that must be completed by the student at appropriate time or at his convenience. The 'PP' grade is awarded for a Pass in the course and 'NP' grade is awarded for a Fail in the course. In case 'NP' grade is awarded, the student has to re- register for the same course wherein he has no alternative options. However, he/she can opt for other courses if he/she has been provided with multiple options.

The 'PP' and 'NP' grades do not carry grade points and hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However such non-credit mandatory courses are required to be included in the students' performance record (transcript) with Pass or Fail (PP or NP).

Courses that come under this category are the following.

Moral and Ethical Values, Communication skills, Entrepreneurship Development Programme,

Environmental issues, Proficiency in a Language etc.

Such courses will not carry any credits for the award of degree, but a pass in each of such course during the programme shall be a necessary requirement for the student to qualify for degree award.

5.5 PROJECT

- i) Project work at 7th semester shall be completed batch wise. The batch shall consist of a maximum of 4 students.
- ii) Project viva-voce examination shall be conducted individually.

5.6 ELECTIVES

- i) A candidate shall take electives in each semester from groups of electives, commencing from 6th semester.
- ii) The minimum number of students to be registered for any Elective offered shall not be less than ten.
- iii) A candidate shall opt for his/her choice of electives and register for the same if pre-registration is not done, at the beginning of each of 6th & 7th semesters. The candidate is permitted to opt for change of elective within 15 days from the date of commencement of the semester as per the academic calendar of the college.

6. ATTENDANCE REQUIREMENT:

- 6.1 Each semester is considered as a unit and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops and paper presentation.
- 6.2 The basis for the calculation of the attendance shall be the period of term prescribed by the College by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course (as per CET/COMED-K or Management allotment).
- 6.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up the shortage.
- 6.4 A candidate having shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded 'N' grade in these courses.
He/she shall have to repeat those course(s). Such students shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or supplementary semester.
- 6.5 **Attendance in CIE and SEE:** Attendance at all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

7. WITHDRAWAL FROM THE PROGRAMME

7.1 Temporary Withdrawal

- a) A student who has been admitted to a degree programme of the college may be permitted once during the course to withdraw temporarily, for a period of one semester, on the grounds of prolonged illness or grave calamity in the family etc., provided –

- i) The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.
- ii) The College is satisfied about the genuineness of the case and that even by taking into account the expected period of withdrawal, the student has the possibility to complete the programme requirements (160 credits) within the time limits specified by the university.
- iii) The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.
- iv) A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the Student's roll list. The fees/charges once paid shall not be refunded.
- v) A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

7.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

- (a) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues if any.
- (b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts.
- (c) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

8. EVALUATION SYSTEM

- 8.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.
- 8.2 The Letter grades S, A, B, C, D, E, F indicate the level of academic achievement, assessed on a decimal (0-10) scale.
- 8.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid-semester examinations and one semester end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE)	: 50% (50 marks)
Continuous Internal Evaluation (CIE)	: 50% (50 marks)
i) Quizzes, Tutorials, Assignments, Seminars, mini projects, tutorials etc.	: 10 marks
ii) Mid-semester Examination	: 40 marks

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

- 8.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.
- 8.5 The course Instructor shall announce in the class and/or display at the Faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

8.6 Passing standards

Evaluation Method	Passing Standard
Sessional (CIE)	Score: $\geq 40\%$ (≥ 20 marks)
Terminal (SEE)	Score: $\geq 40\%$ (≥ 20 marks)

- i) Project work evaluation: The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated by him/her together with a Department committee constituted for this purpose. Seminar presentation, project report and final oral examination conducted by project evaluation committee at the department level shall form the SEE of the project work.
- ii) In the case of other requirements, such as, seminar, industrial internship, field work, comprehensive viva voce, if any, the assessment shall be made as laid down by the Academic council.
- iii) **There shall be no re-examination for any course in the credit system.**

However, students

- who have abstained from attending CIE or SEE without valid reasons ('N' grade), or
- who have failed ('F' grade) to meet the minimum passing standards prescribed for CIE and/or SEE, or
- who have been detained for want of attendance, or
- who have withdrawn ('W' grade),
- who have dropped any course

shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than E in each case. While such students should re-register for same course(s) if core, they can re-register for alternative course(s) from among the elective courses, as the case may be. The re-registration shall be possible when the particular course is offered again either in a main (Odd/Even) or a supplementary semester.

8.7

i) Grade point scale for absolute grading

Level	Out Standing	Excellent	Very Good	Good	Average	Poor	Fail
Grade	S	A	B	C	D	E	F
Grade Points	10	09	08	07	06	04	00
Score (Marks) Range(%)	≥ 90	< 90 - ≥80	< 80- ≥70	< 70- ≥60	< 60 - ≥50	< 50 - ≥40	< 40

- ii) The grade points given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in arriving at the credit index of the student for that semester, as it is the sum total of all the credit points earned by the student for all the courses registered in that semester.

8.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range S-E. Letter grade 'F' in any course implies failure of the student in that course and no credits earned.

8.9 The Transitional Grades 'I', 'W' and 'X' would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (S-F) after the student completes the course requirements.

- ♦ Grade 'I': To a student having satisfactory attendance at classes and meeting the passing standard at CIE, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:
 - i) Illness or accident, which disabled him/her from attending SEE;
 - ii) A calamity in the family at the time of SEE, which required the student to be away from the College;
- ♦ Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that particular examination for which he or she is absent, failing which they will not be given permission. This is admissible only for students who have more than 45 CIE marks.
- ♦ Grade 'W': To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice
- ♦ Grade 'X': To a student having attendance ≥85% and CIE rating (90%), in a course but SEE performance observed to be poor, which could result in a F grade in the course. **(No 'F' grade awarded in this case but student's performance record maintained separately).**

8.10 Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the

letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students performance like SGPA and CGPA and the courses taken for audit will not form part of this computation. The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

8.11 The Make Up Examination

The Make Up Examination facility would be available to students who may have missed to attend the SEE of one or more course(s) in a semester for valid reasons and given the 'I' grade; Also, students having the 'X' grade shall be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be same as the regular SEE for the course(s).

- All the 'I' and 'X' grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding 'I' and 'X' grades after the last scheduled make-up examinations shall be automatically converted to 'F' grade.
- All the 'W' grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/ supplementary semester and fulfill the passing standards for their CIE and (CIE+SEE).

9. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices:

SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

$$\text{SGPA} = \frac{\sum [(\text{course credit}) \times (\text{Grade point})] \text{ (for all courses in that semester)}}{\sum [(\text{course credits})]}$$

CGPA is computed as follows:

$$\text{CGPA} = \frac{\sum [(\text{course credits}) \times (\text{Grade points})] \text{ (for all courses excluding those with F grades until that semester)}}{\sum [(\text{course credits})] \text{ (for all courses excluding those with F grades until that semester)}}$$

10. COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitate the declaration of academic performance of a student at the end of a semester and at the end of successive semesters. Both of them would be normally calculated to the second decimal position.

11. VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

11.1 There shall be no restriction for promotion from an odd semester to the next even semester, provided the student has fulfilled the attendance requirement.

11.2 A Student shall be declared fail if he / she

- (i) Has not satisfied the CIE requirements of any Course/s.
- (ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements.

11.3 (A) Vertical Progression in case of students admitted to First year:

- (a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.
- (a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.
- (a.2) Students who have earned all the prescribed credits of I year, and having not more than four grades in the four semesters of II and III year shall be eligible to move to IV year.

(B) Vertical Progression in case of Diploma students admitted to Second year (lateral entry):

- (a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year.
- (a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.
- (b) The mandatory non-credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E/B.Tech. Programmes shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.
- (b.1) In case, any student fails to satisfy the attendance requirement of the Courses Additional Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.
- (b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.
- (c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree.

(C) Vertical Progression in case of B.Sc students admitted to Second year (Lateral entry):

- (a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III year.
 - (a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.
- (b) The prescribed mandatory non-credit Courses Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B. Sc holders admitted to III semester of B.E/B. Tech Programmes, shall attend the classes during the respective semesters to complete CIE and attendance requirements and to appear for the University examinations.
 - (b.1) In case, any student fails to satisfy the attendance requirement of the above said Courses; he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.
 - (b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.
- (c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.

The Principal of each college shall make suitable arrangements in the timetable to facilitate the B. Sc students to attend the above mentioned courses to satisfy the CIE and attendance requirements and to appear for the University examinations.

11.4 Termination from the programme

A student shall be required to withdraw (discontinue) from the programme and leave the college on the following grounds.

- i) **Failure to secure a CGPA = 5.0 on three consecutive occasions.**
- ii) **Failure to earn a credit of 160 (120 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).**
- iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.
- iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

12. AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen from the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks	Class
≥ 7.75	$\geq 70\%$	Distinction
≥ 6.75	$\geq 60\%$	First Class
< 6.75	$< 60\%$	Second Class

$$\text{Percentage} = (\text{GPA} - 0.75) \times 10$$

13. APPEAL FOR REVIEW OF GRADES

- a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.
- b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

14. AWARD OF DEGREE**14.1 (1) B.E. Degree**

- a) Students shall be declared to have completed the Programme of B.E./B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (160 credits for regular students registered for 4 year degree programmes & 120 for lateral entry students).
- b) For the award of degree, a CGPA ≥ 5.00 at the end of Programme shall be mandatory.
- c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.
- d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc. graduates.
- e) (i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/Autonomous colleges under VTU to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eight semester Grade Card.
(ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.
In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(2) B.E. (Honors) Degree

VTU, Belagavi has framed the guidelines for applying for the award of Bachelor of Engineering (Honors) degree.

These Regulations are applicable for the following students:

1. Admitted to **I semester** / I year from the academic year **2018-19** (i.e. USN XXX18XXXXXX)
2. Admitted to **III semester** / II year from the academic year **2019-20** (i.e. USN XXX19XX4XX)
3. These Regulations are uniformly applicable to Affiliated, Autonomous and Constituent Colleges under VTU.

Eligibility criterion

- (i) Students have to earn 18 or more additional credits through MOOCs.
- (ii) Students shall register for this course from fifth semester onwards.
- (iii) Students shall obtain a grade \geq D in all the courses in first attempt only in all the semesters till 5th.
- (iv) Students shall obtain CGPA of 8.5 and above at the end of fourth semester.
- (v) For Diploma students, they shall complete Additional Mathematics I and II during 3rd and 4th semesters in first attempt only.

Requirements:

- (i) Students shall maintain a grade \geq D in all courses from 5th to 8th semester in 'first attempt' only.
- (ii) Students not having CGPA greater than or equal to 8.5 at the end of the B.E. programme shall not be eligible for the award of Honors degree, even if they have satisfied the requirement of additional credits.
- (iii) Students shall take up additional course work, other than the regular courses prescribed by the University from 5th to 8th semester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (\geq 90 %) before closure of eighth semester as per the academic calendar.
- (iv) Students shall be permitted to drop the registered course work (s) and select alternative course work (s) in case they cannot give proctored examination.
- (v) Students have to take courses from the list of MOOCs approved by the University, which can be from NPTEL / SWAYAM / other platforms.
- (vi) Students shall select courses in consultation with their Class Advisor, such that the content / syllabus of them are not similar to that of the core courses, professional electives or open electives, which the students may choose in the program.
- (vii) Students shall earn the additional credits for these courses through MOOCs, by only appearing in person to the proctored examinations conducted by NPTEL / SWAYAM / other platform. The method of assessment shall be as per NPTEL online platform.
- (viii) The Credit equivalence shall be as follows - 4 weeks of online course duration – 1 credit, 8 weeks of online course duration – 2 credits and 12 weeks of online course duration – 3 credits.

Registration:

- (i) Any student meeting the eligibility criteria and interested to register for Honors degree qualification shall apply to the University through the Principal in the prescribed form along with the prescribed application fees within 15 working days after notification by the University.
- (ii) The Registrar shall notify the registration of the student and it will be notified to the student and the student shall pay a one-time, non-refundable registration fees as prescribed by the University to confirm the registration.

Award of Honors Qualification:

- (i) Students who successfully complete the MOOCs prescribed by the University and submit their E-certificates to the University through the Principal against the notification issued by the Registrar in time before the closure of eighth semester, as per the academic calendar shall be eligible for B.E. (Honors) degree. If a student does not submit the certificates in time on or before the last date, their request shall not be considered, even if they have earned the requisite number of credits.
- (ii) The Honors degree shall be awarded only if the CGPA at the end of the B.E. programme is equal to or greater than 8.5.
- (iii) A student who has earned the requisite number of credits and who has submitted the certificates in time and has been accepted by the University will get B.E. degree with Honors suffixed indicating recognition of higher achievement by the student concerned.
- (iv) Further students fulfilling all the above requirements shall be entitled to receive their transcripts indicating both the achievement of the student concerned.
- (v) The award of the Honors degree shall be recommended by the Academic Senate and approved by the Executive Council of the University.

14.2 (1) Noncompliance of CGPA \geq 5.00 at the end of the Programme

- (a) Students, who have completed all the courses of the Programme but not having a CGPA \geq 5.00 at the end of the Programme, shall not be eligible for the award of the degree.
- (b) In the cases of 14.2 (1) a, students shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Main), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.
- (c) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is \geq 5.00, the students shall become eligible for the award of the degree. If CGPA $<$ 5.00, the students shall follow the procedure laid in 14.2 (1) b
- (d) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is \geq 5.00, the students shall become eligible for the award of the degree. If CGPA $<$ 5.00, the students shall follow the procedure laid in 14.2 (1) b
- (e) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is \geq 5.00, the students shall become eligible for the award of the degree. If CGPA $<$ 5.00, the students shall follow the procedure laid in 14.2 (1) b
- (f) In case, the students fail (i.e., earns F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 14.2 (1) b
- (g) Students shall obtain written permission from the Registrar (Evaluation) to reappear in SEE to make up the CGPA equal to or greater than 5.00.

(2) Noncompliance of Mini-project

- (a) The mini-project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements. Also, mini-project shall be considered for eligibility to VII semester.

(3) Noncompliance of Internship

- (a) All the students of B.E/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation. A University examination shall be conducted during VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfy the internship requirements.

14.3 The maximum duration for a student for complying to the Degree requirements is 16 – semesters from the date of first registration for his first semester (8 years from the date of admission to first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

15 GRADUATION REQUIREMENTS AND CONVOCATION

15.1 A student shall be declared to be eligible for the award of the degree if he/she has

- a) **Fulfilled “Award of Degree” Requirements**
- b) **No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centres**
- c) **No disciplinary action pending against him/her.**

15.2 The award of the degree must be recommended by the Senate

15.3 Convocation

Degree will be awarded for the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer 'Award of Degree') within the specified date in order to arrange for the award of the degree during convocation.

16 AWARD OF PRIZES, MEDALS, CLASS & RANKS

For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the College for such awards.

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class as described in 12.

17 CONDUCT AND DISCIPLINE

17.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.

17.2 **As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.**

17.3 The following acts of omission/ or commission shall constitute gross violation of the Code of Conduct and are liable to invoke disciplinary measures:

- a) Ragging.
- b) Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.
- c) Willful damage or stealthy removal of any property/belongings of the College/Hostel or of fellow students/citizens.
- d) Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
- e) Mutilation or unauthorized possession of Library books.
- f) Noisy and unseemly behaviour, disturbing studies of fellow students.
- g) Hacking in computer systems (such as entering into other Person's area without prior permission, manipulation and/or Damage of computer hardware and software or any other Cyber crime etc.).
- h) Plagiarism of any nature.
- i) Any other act of gross indiscipline as decided by the Senate from time to time.
- j) Use of Mobile in the college Academic area.
- k) Smoking in College Campus and supari chewing.
- l) Unauthorized fund raising and promoting sales.

Commensurate with the gravity of offence the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

17.4 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.

17.5 All cases involving punishment other than reprimand shall be reported to the Principal.

17.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.

18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE

18.1 As per VTU guidelines, every students entering 4 year degree programme should earn 100 activity points & every students entering 4 year degree programme through Lateral Entry should earn 75 activity points for the award of the Engineering Degree.

18.2 The Activity Points earned will be reflected on the student's eighth semester Grade Card.

18.3 The activities can be spread over the years (duration of the programme) any time during the semester


weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.

18.4 Activity Points (non-credit) have no effect on SGPA/CGPA point.

18.5 In case students fail to earn the prescribed Activity Points, Eighth semester Grade Card shall be issued only after earning the required Activity Points.

Note: Students are required to be inside the examination hall 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

LIST OF MAJOR SCHOLARSHIPS

Applicable to	Types of scholarship	Method	Website
For SC/ST Students	Income : Below Rs.2,50,000/-	Online application	 SSP
	Income : Above Rs.2,50,000/- to Rs.10,00,000/-		
For Others	Category I : Income Below Rs.2,50,000/-	Online application	
	Category 2A, 3A, 3B Income Below Rs.1,00,000/-	Online application	
	GSB & Brahmins EWS Certificate upto Rs.8,00,000/-	Online application	
	Minority students Income Below Rs.2,50,000/-	Online application	NSP & SSP
Parents must have Beedi Id. Card	Beedi Scholarship	Online application	scholarships.gov.in or nsp.gov.in

1. Scholarship details will be published in the notice board near College Academic Section. Students must see the notice board and submit the application before due dates.
2. All SC/ST and Category I students who have not paid any fee in CET must apply for Fee concession or Scholarship. Otherwise they must pay the tuition fee and college fee.
3. The students, who are applying for any of the above scholarship through online, must submit the hardcopy with supporting documents (with attestation) to the academic section in time.

B. E. SYLLABUS

COMPUTER SCIENCE & ENGINEERING

V & VI SEMESTER

**With
Scheme of Teaching
& Examination**

V Semester													
SN	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Components	Duration	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21CS501	Theory of Computation	CS	3	-	-	-	3	50	50	100	3
2	IPCC	21CS502	Computer Network and Communication	CS	3	-	2	-	3	50	50	100	4
3	PCC	21CS503	Database Management Systems	CS	3	-	-	-	3	50	50	100	3
4	PCC	21CS504	Operating System	CS	3	-	-	-	3	50	50	100	3
5	PCC	21CS505	Database Management Systems Lab.	CS	-	-	2	-	3	50	50	100	1
6	AEC	21HU511	Research Methodology & Intellectual Property Rights	CV/ME	2	-	-	-	3	50	50	100	2
7	HSMC	21CV512	Environmental Studies	CV	1	-	-	-	1	50	50	100	1
8	AEC	21CSA5X	Ability Enhancement Course - V	CS	1	-	-	-	1	50	50	100	1
TOTAL					16	-	4	-	-	400	400	800	18
Ability Enhancement Course - V 1) 21CSA51 - Angular and React JS 2) 21CSA52 - C# and Dot Net Framework 3) 21CSA53 - Internet of Things													

VI Semester													
SN	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	21CS601	Machine Learning	CS	3	-	2	-	3	50	50	100	4
2	HSMC	21CS602	Financial Management	CS	3	-	-	-	3	50	50	100	3
3	PCC	21CS603	Compiler Design	CS	3	-	-	-	3	50	50	100	3
4	PEC	21CSE1XX	Professional Elective Course - 1 (Group 1)	CS	3	-	-	-	3	50	50	100	3
5	OEC	21CS8XYY	Open Elective Course - 1	CS	3	-	-	-	3	50	50	100	3
6	PCC	21CS604	Compiler Design Lab.	CS	-	-	2	-	3	50	50	100	1
7	PROJ	21CS605	Mini Project	CS	-	-	2	-	-	100	-	100	2
8	INT	21INT61	Innovation/Entrepreneurship/Social based Internship(4 Weeks)	CS	-	-	-	-	-	100	-	100	3
TOTAL					15	-	6	-	-	500	300	800	22

Elective Groups for 6th Semester B.E.**Professional Elective Course - 1
(Group - 1)**

Course Code	Course Title
21CSE101	Agile Technology
21CSE102	Advanced JAVA Programming
21CSE103	Digital Image Processing
21CSE104	Advanced Computer Architecture
21CSE105	Full Stack Development
21CSE106	Natural Language processing
21CSE107	Unix System Programming
21CSE108	Mobile App Development
21CSE109	IoT Device Security

THEORY OF COMPUTATION					
Course Code	:	21CS501		CIE Marks	: 50
Teaching Hours /Week (L:T:P)	:	3-0-0		SEE Marks	: 50
Total Hours	:	39		Credits	: 03

Course Learning Objectives:**This Course will enable students to**

1. Outline the theory behind the basic design of machines, the relation between formal languages and programming languages, and their applications.
2. Make use of regular expressions, find the equivalence between finite automata and regular languages, and identify non-regular languages.
3. Design context-free grammars along with simplification of grammars.
4. Get the idea of designing pushdown automata, and identify non-context-free languages.
5. Tell how Turing machines solve any computational process carried by present day computers, their design.

UNIT – I**AUTOMATA:**

Why study automata theory, Central concepts of automata theory.

FINITE AUTOMATA:

Deterministic Finite automata, Nondeterministic finite automata, An application: Text search, Finite automata with epsilon-transitions.

REGULAR EXPRESSIONS AND LANGUAGES:

Regular expressions, Finite automata and Regular expressions, Applications of regular expressions.

PROPERTIES OF REGULAR LANGUAGE

Proving languages not to be regular. (*Text Book-1: Chapter 1: 1.1, 1.5; Chapter 2: 2.1 to 2.5; Chapter 3: 3.1, 3.2.2, 3.2.3, 3.3; Chapter 4: 4.1*)

15 Hours**UNIT – II****PROPERTIES OF REGULAR LANGUAGES:**

Closure properties of regular languages, Equivalence and minimization of automata. (*Text Book-1: Chapter 4: 4.2, 4.4*)

CONTEXT-FREE GRAMMARS AND LANGUAGES:

Context free grammars, ParseTrees: Constructing parse tree, The yield of a parse tree.

Ambiguity in Grammars and Languages : Ambiguous Grammar, Removing ambiguity from grammars.

(Text Book 1: Chapter 5 : 5.1, 5.2: 5.2.1, 5.2.2, 5.4: 5.4.1 , 5.4.2)

PUSHDOWN AUTOMATA

Definition of the Pushdown Automata, Languages of a PDA. (**Chapter 6: 6.1, 6.2.1, 6.2.2**)

15 Hours

UNIT – III

PROPERTIES OF CONTEXT-FREE LANGUAGES:

Normal forms for CFGs. (*Text Book-1: Chapter 7: 7.1*)

INTRODUCTION TO TURING MACHINES

The Turing Machine, Extensions to the basic Turing Machines

Chapter 8: 8.2, 8.4

RECURSIVELY ENUMERABLE LANGUAGES

Recursively enumerable languages and Recursive, The Chomsky hierarchy.

(Text Book-2: Chapter 10: 10.1, 10.4)

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Outline the fundamental understanding of the core concepts in automata theory and formal languages and its applications. Discover finite automata for different language classes. Apply the procedure to convert deterministic finite automata to non-deterministic finite automata.
2. Find the regular expression for a given language and illustrate equivalence between finite automata and regular languages. Show the properties of regular languages and minimize the given finite automata.
3. Discover context-free grammars for different language classes. Demonstrate the ambiguity and unambiguous grammars.
4. Discover Pushdown automata for different language classes.
5. Translate the context-free grammars from one form to another. Discover Turing machines for different language classes. Explain the class of languages and their relationship.

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.1.1, 1.4.1, 2.3.2, 3.2.1	L4
CO2	1,2	1.1.1, 1.4.1, 2.1.2	L2
CO3	1,2,3	1.1.1, 1.4.1, 2.3.2, 3.2.1	L4
CO4	1,2,3	1.4.1, 2.1.2, 3.2.1	L4
CO5	1,2,3	1.4.1, 2.1.2, 3.2.1	L4

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3						1				3	
CO2	2	3											2	
CO3	2	2	3						1				3	
CO4	2	2	3						1				3	
CO5	2	2	3						1				3	

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

- 1) J.P. Hopcroft, Rajeev Motwani, and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education 2012.
- 2) John C Martin, "Introduction to languages and The Theory of Computation", Third Edition, Tata McGraw Hill, 2008.

REFERENCE BOOKS:

- (iii) Peter Linz, "An Introduction to formal languages and Automata", Fourth Edition, Narosa Publishing House, 2011.
- (iv) Michael Sipser, "Introduction to the Theory of Computation", Third Edition, MIT Press, 2014.

E-Books / Online Resources:

- 1) <https://www.eecs.wsu.edu/~ananth/CptS317/Lectures/index.htm>
- 2) https://www.cs.virginia.edu/~robins/Sipser_2006_Second_Edition_Problem_s.pdf
- 3) <http://infocat.ucpel.tche.br/disc/lfa/docs/IAT.pdf>

MOOCs:

- c) <http://nptel.ac.in/courses/106106049/>
- d) <http://aduni.org/courses/theory/index.php?view=cw>
- e) https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-045j-automata-computability-and-complexity-spring-2011/lecture-note*s/

SEE SCHEME:

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabus & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

Computer Network and Communication					
Course Code	:	21CS502		CIE Marks	: 50
Teaching Hours /Week (L:T:P)	:	3:0:2		SEE Marks	: 50
Total Hours	:	39T+26L		Credits	: 4

Course Learning Objectives:

The primary Course Learning Objective is to introduce the

This course will enable students to:

1. Outline the concepts of basic data communications and networking.
2. Explain the idea of signal transmission.
3. Understand the basic of data link layer functionalities and protocols.
4. Study the importance of network layer and differentiate various routing algorithms
5. Acquire the knowledge of working of transport layer, its protocols and some application layer protocols.

UNIT – I

Introduction to data communications: Components, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, The OSI Model.

Physical Layer: Signals, Signal Impairment, Digital Transmission, Analog Transmission, Multiplexing.

Data-Link Layer: Data-link control: Framing, Error Control.

Media Access Protocols: Carrier Sense Multiple Access, CSMA/CD. Link-Layer Addressing: Three Types of Addresses

Local Area Networks: Ethernet, Standard Ethernet Frame Format.

15 Hours

UNIT – II

Network Layer: Data Transfer: Services, Packet Switching, Performance, IPv4: IPv4 Addressing, Main and Auxiliary Protocols. IPv6: IPv6 Addressing, The IPv6 Protocol.

Network Layer: Routing of Packets: General Idea, Least-Cost Routing, Routing Algorithms: Distance-Vector Routing, Link-State Routing, Path-Vector Routing, OSPF, BGP4, Multicast Routing: Unicasting, Multicasting, Distance Vector Multicast Routing Protocol. IGMP.

15 Hours

UNIT - III

Transport Layer: Transport-Layer Services, Transport-Layer Protocols, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). (Chapter 9 Application Layer: Introduction, Client/Server Paradigm, Standard Applications.

9 Hours

Table 1: Mapping Levels of COs to POs

Cos	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3			3							2	3	3
CO 2	3	3			3							2	3	3
CO 3	3	3			3							2	3	3
CO 4	3	3			3							2	3	3
CO 5	3	3			3							2	3	3

Course Outcomes (COs):

Upon completion of this course, students will be able to:

1. Describe the basics of Data Communication and understand the working of signals in physical layer.
2. Understand the working of data link layer, the protocols and differentiate the types of LAN.
3. Comprehend the basic data transfer in network layer.
4. Distinguish between various routing algorithms.
5. Portray the transport layer protocols and the list some of the services in application layer.

Textbooks:

1. Data Communications and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, 6th Edition, 2022, McGraw Hill, ISBN 978-1-26-436335-3

Reference Books:

1. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education.
2. Data Communication and Networking by Behrouz A. Forouzan (Fifth Edition), Tata McGraw Hill.
3. Computer Networking. A Top-down Approach, James F. Kurose, Keith W. Ross, Pearson, ISBN: 1292153598, 2017.
4. Data and Computer Communications, 10th Edition, William Stallings, Pearson Education, 2013, ISBN: 0133506487, 9780133506488.
5. Data and Computer Communication, 8th Edition, William Stallings, Prentice Hall, 0132433109, 2007.
6. An Introduction to Computer Networks, Peter L Dordal, Open Book, <http://intronetworks.cs.luc.edu/> 2020.
7. William A. Shay, "Understanding Data Communications and Networks", 2nd Edition, Thomson.

E-Books / Online Resources:

1. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
2. <https://www.guru99.com/data-communication-computer-network-tutorial.html>

MOOCs:

1. <https://nptel.ac.in/courses/106105082>
2. https://onlinecourses.nptel.ac.in/noc22_ee61/
3. <https://www.coursera.org/learn/fundamentals-network-communications>

Suggested list of experiments

PART-A (Experiments using NS-2)

1. Simulate a three nodes point-to-point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets by TCP/UDP.
3. Simulate the different types of Internet traffic such as FTP a TELNET over a network and analyze the throughput.
4. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
5. Simulate an Ethernet LAN using N-nodes (6-10), change error rate and data rate and compare the throughput.
6. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collision across different nodes.
7. Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and plot congestion window for different source/destination.

PART-B (Experiments using C/C++/Python)

1. Write a program for error detecting code using CRC-CCITT (16-bits).
2. Write a program for frame sorting technique used in buffers.
3. Write a program for distance vector algorithm to find suitable path for transmission.
4. Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.
5. Using UDP SOCKETS, write a client-server program to make the client sending two numbers and an operator, and server responding with the

result. Display the result and appropriate messages for invalid inputs at the client side.

6. Write a program for Hamming Code generation for error detection and correction.
7. Write a program for simple RSA algorithm to encrypt and decrypt the data.

DATABASE MANAGEMENT SYSTEMS						
Course Code	:	21CS503		CIE Marks	:	50
Teaching Hours /Week (L:T:P)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	3

Course Learning Objectives:

This Course will enable students to:

1. Understand the concept of databases, and apply Entity-Relationship Modeling for creating and designing databases for the real world scenarios.
2. Develop structured query language (SQL) statements.
3. Optimize a database using Normalization Rules.
4. Understand and apply database design concepts and algorithms.
5. Analyze the issues associated with Transaction Processing and understand MongoDB database concepts for managing big data.

UNIT – I

INTRODUCTION TO DATABASE SYSTEMS:

Introduction, Characteristics and Advantages of the Database approach, Actors on the scene, Data models, Schemes and Instances, Three Schema Architecture and Data Independence. (Refer Text 1)

ENTITY-RELATIONSHIP MODEL:

Introduction of Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the, ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues. (Refer Text 1)

RELATIONAL MODEL AND RELATIONAL ALGEBRA:

Relational Model Concepts; Relational Model Constraints and Relational

Database Schemas; Update Operations and Dealing with Constraint Violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping. (Refer Text 1)

15 Hours

UNIT – II

SQL-THE RELATIONAL DATABASE STANDARD:

SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL; Basic Queries in SQL; More Complex SQL Queries; Insert, Delete and Update Statements in SQL; Views (Virtual Tables) in SQL.triggers and stored procedures(Refer Text 1)

DATABASE DESIGN:

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions. (Refer Text 1)

15 Hours

UNIT – III

TRANSACTION MANAGEMENT:

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of Locking.(Refer Text 1)

INTRODUCTION TO MONGODB:

Introduction to MongoDB, Data types in MongoDB, MongoDB query language (CRUD operations).

9Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Apply the concepts of Databases, Data Management Systems and ER Modeling to Design a Database.
2. Apply the concepts of Relational Models and Relational Algebra to build database queries.
3. Develop and Examine data base queries using Structured Query Language.
4. Design, Develop and Examine databases by applying the concepts of Normalization and Design algorithms.
5. Outline the issues associated with Transaction Processing and apply the concept of MongoDB databases for managing big data.

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.2.1, 1.3.1, 2.1.3, 3.1.2	L2, L3
CO2	1,2	1.4.1, 2.1.2, 2.3.1	L2, L3, L4
CO3	1,2	1.4.1, 2.1.3, 2.3.2	L2, L3, L4
CO4	1,2,3	1.4.1, 2.1.3, 2.3.2, 3.2.2	L2, L3, L4
CO5	1,2	1.4.1, 2.3.1	L2, L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3											3	
CO2	2	3												3	
CO3	2	3												3	
CO4	1	2	3											3	
CO5	1	2												3	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXTBOOKS:

- Elmasri and Navathe, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2003.
- Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", First Edition, Wiley, 2015.

REFERENCE BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudharshan: "Data base System Concepts", Sixth Edition, Mc-GrawHill, 2010.
3. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Pearson Education, Inc. 2012.

E-Books / Online Resources:

- iv) <http://agce.sets.edu.in/cse/ebook/DBMS%20BY%20RAGHU%20RAMA%20KRISHNAN.pdf>
- v) <http://iips.icci.edu.iq/images/exam/databases-ramaz.pdf>

MOOC:

- (d) <http://nptel.ac.in/courses/106106093/>
- (e) <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/>

There will be **8** questions of **20** marks each in the question paper divided into **3** units as per the syllabus & contact hours and the student will have to answer **5** full questions, selecting **two full** questions from **first two unit** and **one full** question from **third** unit.

OPERATING SYSTEMS						
Course Code	:	21CS504		CIE Marks	:	50
Teaching Hours /Week (L:T:P)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Explain the concepts, principles and services of operating system.
2. Identify fundamental operating system concepts such as processes, inter-process communication, threads, CPU scheduling and demonstrate them.
3. Assess the need of concurrency and synchronization and apply them to write concurrent programs and analyze the cause for the occurrence of deadlocks and determine solutions to overcome the deadlocks.
4. Study the concepts of main memory and virtual memory allocation methods and demonstrate them.
5. Analyze the need for file system concepts, directory implementation and disk scheduling algorithms and demonstrate them.

UNIT – I

Operating System structure: Operating System Services, User and Operating System interface, System calls, System Services, Linkers and Loaders, **Process Management:** Process concept; Process scheduling; Operations on processes; Inter-process communication. **Threads:** Multithreading Models. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling.

15 Hours

UNIT – II

Process Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Monitors, Classical problems of synchronization. **Deadlocks:** System model; Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, avoidance, detection and recovery from deadlock. **Main Memory:** Paging, Structure of page table, Swapping.

14 Hours

UNIT – III

Virtual Memory: Demand paging, Copy-on-write, Page replacement, Allocation of frames. Implementing File System: File system Concepts, File System Structure, Operations and implementation, Directory implementation, Allocation methods, Free space management. disk scheduling algorithms.

10 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

- (b) **Recognise** the structural components of operating system
- (c) **Demonstrate** the creation and termination of the processes, threads and CPU scheduling algorithms.
- (d) **Illustrate** critical section problem and **demonstrate** the Peterson's solution. **Investigate** the Deadlock condition and **determine** the solution to avoid the deadlocks.
- (e) **Summarize** Main memory and Virtual Memory allocation methods and **prepare** a page replacement schedule to the given set of page requirement request.
- (f) **Classify** file systems based on operations and implementations and **illustrate** the disk scheduling algorithms.

Table-1: Mapping of COs to Pls, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2	L2
CO2	1, 2	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 2.3.2, 3.4.3	L4
CO3	1, 2	1.3.1, 1.4.1, 2.1.2, 2.2.3, 2.2.5, 2.3.2, 2.4.3	L3
CO4	1, 2	1.3.1, 1.4.1	L3
CO5	1, 2	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.2.2, 2.2.5, 2.4.3	L3

Table-2: Mapping Levels of COs to POs / PSOs																
Cos	Program Outcomes (POs)											PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2												1	2	
CO2	3	2											1	2	3	
CO3	3	2											1	2	3	
CO4	3	2											1	2	3	
CO5	3	2											1	2	3	

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. Operating System Concepts, Abraham Silberschatz, Greg Gagne, Peter B. Galvin, 10th Edition, John Wiley & Sons, 2018, ISBN: 9781119320913.

REFERENCE BOOKS:

1. D.M Dhamdhare: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.
2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006.
3. Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley, 1990.

E-Books / Online Resources:

1. http://www.uobabylon.edu.iq/download/M.S%2020132014/Operating_System_Concepts,_8th_Edition%5BA4%5D.pdf
2. <http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts--9th2012.12.pdf>

MOOCs: <https://freevideolectures.com/university/iit-bombay/>

1. <https://www.cse.iitb.ac.in/~mythili/os/>

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

DATABASE MANAGEMENT SYSTEMS LAB WITH MINI PROJECT					
Course Code	:	21CS505		CIE Marks	: 50
Teaching Hours /Week (L:T:P)	:	0-0-2		SEE Marks	: 50
Total Hours	:	26		Credits	: 1

- 1) Design and implementation of SQL queries involving various constructs of SQL as discussed in the Unit-III of the syllabus.
- 2) Implementation of a mini project that involves a user interface design, database design and design of SQL queries to suit the need of the designed application.

RESEARCH METHODOLOGY AND IPR						
Course Code	:	21HU511		CIE Marks	:	50
Teaching Hours /Week (L:T:P)	:	2-0-0-0		SEE Marks	:	50
Total Hours	:	25		Credits	:	02

Course Learning Objectives:

1. To explain the significance of carrying out research work,
2. To explain the Research Problem, Review the literature.
3. To understand Research Design, methodological way of execution.
4. To understand Data Collection, and Interpretation and Report Writing.
5. To appreciate the importance of Intellectual property rights protection.

UNIT – I**Research Methodology:**

Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method.

Defining the Research Problem:

Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to

your research problem. Broadening knowledge base in research area, Enabling contextual findings. How to review the literature. searching the existing literature. reviewing the

UNIT – II

Research Design:

Need for Research Design, Features of a Good Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Design of Sample Surveys:

Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Data Collection:

Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Interpretation and Report Writing:

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout.

9 Hours

UNIT – III

Introduction to Intellectual Property

Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; evolution of IPR – Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

Agreements and Treaties

TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017.

Basics of Patents and Concept of Prior Art

Introduction to Patents; Types of patent applications, Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”. Patent databases

Patent filing procedures

National & PCT filing procedure; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Patent licensing and agreement; Patent infringement- meaning, scope, litigation.

7 Hours

Course outcome (Course Skill Set)**At the end of the course, student will be able to:****CO1:** Explain the significance of carrying out research work and identifying a research problem and perform the literature review.**CO2:** Explain the Research Design, methodological way of execution, Data Collection, and Interpretation and Report Writing**CO3:** Explain the importance of Intellectual property rights and patents.**PO-CO mapping**

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	1							3					1
CO 2	3	3	2			1	1								1
CO 3	1	1				3	2	2		3					1

1: Low 2: Medium 3: High**TEXTBOOKS:**

1 Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International

4th Edition, 20182 Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications Ltd . 3rd Edition, 2011

3 Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

REFERENCE BOOKS:

1 Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005.

2 Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

Web links and Video Lectures (e-Resources):

NPTEL course material related to operations management, operations research and entrepreneurship.

ENVIRONMENTAL STUDIES					
Course Code	:	21CV512	CIE Marks	:	50
Teaching Hours /Week (L: T:P:S)	:	1-0-0-0	SEE Marks	:	50
Total Hours	:	13	Credits	:	1

Course Learning Objectives:

1. To raise consciousness about environmental conditions and to imbibe environmentally appropriate behaviour.
2. To equip the engineering undergraduates to identify the significance of environmental practice in their daily life and in the engineering practices.
3. To make them conscious of understanding the environment where we live and act up on.

UNIT - I**Environment**

Definition, significance of environmental studies- current scenario, local, regional, national and global problems Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere. Layers of atmosphere and its role.

Parts of Earth- lithosphere and its role; hydrological cycle

Eco system - Definition, ecology and environment, ecosystem components: biotic and abiotic components; ecological balance; elements of ecosystem: biotic, abiotic; producers, consumers and decomposers. Habitat, range of life, Biome, balanced ecosystem, food chain, food web and ecological pyramids

Human activities - The Anthropogenic System- human activities like growing food, building shelter and other activities for economy and social security. Soil erosion, water logging -definition. Organic farming- definition.

Natural resources

Resources - Natural resources, water, minerals, Fossil fuels and energy

Water resources - Global water resources: distribution, uses of water for irrigation, domestic and industrial purposes in India.

Quality aspects - Water quality parameters, drinking water standards for

turbidity, pH value, total hardness, iron, fluoride, lead, arsenic, nitrate

Mineral resources-Metallic minerals, non-metallic minerals Fossil fuels - Coal and petroleum

Forest Wealth - Components of the forest, key benefits of forests. Deforestation-environmental effects of deforestation and remedies Sustainable development- definition, objectives

Material cycles - Carbon, Nitrogen, and Sulphur cycles.

5 Hours

UNIT – II

Environmental pollution: Definition, harmful effects related to public health

Water pollution:

Definition, types, and sources – agriculture (pesticides and fertilizers), industry, domestic and mining, harmful effects, water borne and water induced diseases- definition, common diseases and their causatives, Fluoride problem in drinking water

Land pollution:

Definition, sources_ agriculture, housing, industry, mining, transportation. Types of municipal Solid waste Disposal (Sanitary landfills, composting, incineration (in brief) and effects

Air Pollution:

Definition, types, and sources: industry, mining, agriculture, transportation, and effects

Noise pollution:

Definition, sources, mining, industries, rail-roads, aviation, effects and control measures

Energy

Different types of energy-

Non-renewable energy; fossil fuels- coal, oil, and natural gas- brief description only.

Nuclear energy- nuclear power plants,

Renewable energy: solar energy- Photovoltaic systems for street and domestic lighting, solar water heating-brief description only

Wind energy- definition, merits and demerits, Hydro power- definition, merits, and demerits.

Biomass energy- definition, sources of bioenergy, biogas, biofuels, India's position in renewable energy

Hydrogen as an alternative future source of energy- brief scope, fuel cells.

5 Hours

UNIT – III

Current environmental issues of importance

Population growth- Definition, growth rate, effects, remedies Urbanization - Definition, environmental impacts and remedies Global warming and climate change-

Concept of greenhouse effect, sources of greenhouse gases, effects, and remedial measures of greenhouse gases

Acid rain: Definition, causes and effects, control measures. Ozone

Depletion: Definition, causes, effects, and control measures.

Environmental Impact Assessment- EIA definition, objectives, and benefits of EIA.

3 Hours

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

1. Identify the significance of environmental practice in their daily life and in the Engineering practices.
2. Create awareness about environmental conditions.
3. Follow environmentally appropriate behaviour.
4. Understand the importance of their surroundings.
5. Understand Current environmental issues of importance

Table: Mapping Levels of COs to POs / PSOs

Cos	Program Outcomes (POs)											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	2	-	-	-	-	-	2	-	-	-		1	
CO2	-	-	-	1	-	-	-	-	-	1	-		1	
CO3	1	-	-		1	-	-	-	-	-	-		1	
CO4	1	-	-	1	-	-	-	-	-	-	-		1	
CO5	-	-	3	-	-	-	-	-	-	-	3		1	

1: Low

2: Medium

3: High

TEXTBOOKS:

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi, 2005.
2. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, London, 2005.

REFERENCE BOOKS:

1. Balasubramanya, N and Chatwal, Gurdeep R., "Environmental Studies", Himalaya Publishing House, Mumbai, 2007.
2. Barucha, E., "Environmental Studies", University Grants Commission, New Delhi, 2004.
3. Bhatia, S. C., "Environmental Chemistry", CBS Publishers, New Delhi, 2005.
4. De, A.K. and De, A. K., "Environmental Studies", 2006. Keller.

VI Semester

MACHINE LEARNING						
Course Code	:	21CS601		CIE Marks	:	50
Teaching Hours/Week (L: T:P:S)	:	3:0:2:0		SEE Marks	:	50
Total Hours	:	39T+26L		Credits	:	4

Course Learning Objectives:

This course will enable students to

- 1) Gain comprehensive knowledge about the role and significance of hypothesis in machine learning, including its design and various applications.
- 2) Create a model that can use to predict the class of the target variable by learning simple decision rules.
- 3) Explore various supervised and unsupervised learning algorithms and their usage in solving problems related to the current scenario.
- 4) Evaluate the performance of the machine learning models using various metrics.
- 5) *Explore the power of adaptive learning systems and design the system* to perform various computational tasks faster than traditional systems.

Prerequisites:

Knowledge of linear algebra, calculus, probability, statistics

UNIT - I

Introduction:

Machine learning: what and why?- Types of machine learning, Supervised learning and Unsupervised learning. Well-Posed Learning Problems, Designing Learning Systems. (Textbook 1: Chapter 1- 1.1-1.3, Textbook 2: Chapter: 1.1,1.2,1.3)

Applications of Machine Learning: Social Media Features, Product Recommendations, Image & Speech Recognition, Sentiment Analysis, Self-driving cars, Email Spam and Malware Filtering, Stock Market Trading, Medical Diagnosis, Online Fraud Detection, and Automatic language translation, Perspectives and Issues in Machine Learning.

(Internet resource)

Supervised Learning-I:

Decision Tree Learning: Decision Tree representation, appropriate problems for the decision tree, basic decision tree algorithm, basics of C4.5 and issues in decision tree learning. (Textbook 2: Chapter: 3.2,3.3,3.4,3.5,3.7)

K-Nearest Neighbour: K-NN rule, Measuring Similarity, Irrelevant attributes, and scaling problems. (Textbook 3: Chapter: 3.1,3.2,3.3).

15 Hours

UNIT – II

Supervised Learning-II:

Regression Versus classification

Regression: Linear Regression, Simple Linear Regression, Multiple Linear Regression, Polynomial Linear Regression.

Naïve Bayes classifier: Introduction, Bayes Theorem, Naive Bayes Classifier. (Textbook 2: Chapter 6.1,6.2,6.9).

Random Forest Algorithm: Working of the Random Forest Algorithm, Advantages, and Disadvantages of Random Forest Algorithm.

Unsupervised Learning: Types of unsupervised learning, Challenges in unsupervised learning, Cluster Analysis, K-means, Hierarchical Aggregation, Normalization, Dimensionality Reduction: Principal Component Analysis.

(Textbook 3: Chapter 14.1,14.2,14.4).

Model Evaluation and Classification metrics: Confusion matrix, Accuracy, Precision, Recall, F1 Score, AUC curve, Regression metrics, Mean Squared Error or MSE, Root Mean Squared Error or RMSE, Mean Absolute Error or MAE, Root Mean Squared Log Error or RMSLE. (Textbook 3: Chapter 11.1,11.2,11.3).

15 Hours

UNIT – III

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron, Basics of Backpropagation algorithm.

(Textbook 2: Chapter 4.1 - 4.5.2).

Reinforcement Learning: Introduction, Learning Task, Q Learning, Nondeterministic Rewards, and Actions.

(Textbook 2: Chapter 13.1 – 13.4).

Ensemble Learning: Bagging, Boosting, AdaBoost-Practical version of Boosting.

(Textbook 3: Chapters: 9.1,9.2, 9.3).

9 Hours

Course Outcome:

On Completion of the course, the students will be able to

1. Develop an extensive understanding of the importance and impact of hypothesis in machine learning, encompassing its design and diverse range of applications.
2. Develop a predictive model capable of utilizing basic decision rules to accurately determine the class of the target variable.
3. Apply various supervised and unsupervised learning algorithms to effectively address and resolve challenges pertinent to the present situation.
4. Assess the effectiveness and efficiency of machine learning models by utilizing different evaluation metrics.
5. Achieve a deeper understanding of the capabilities of adaptive learning systems and develop a system that excels in executing diverse computational tasks.

Table: Mapping of COs to PIs, POs, and BTL			
Course Outcome s (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxono my Level (BTL)
CO1	1,2	1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.4.3	L2
CO2	1,2,4,5,12	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 12.1.2, 12.2.1	L3
CO3	1,2,4,5,12	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 12.1.2, 12.2.1	L3
CO4	1,2,4,5,12	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.2.4, 2.4.1, 2.4.3, 4.1.2, 4.1.3, 4.2.1, 4.3.1, 4.3.3, 4.3.4, 5.1.1, 12.1.2, 12.2.1	L3
CO5	1,2	1.3.1, 1.4.1, 2.1.3, 2.2.3, 2.4.3	L2

Mapping of POs & COs:

Table: Mapping Levels of COs to POs / PSOs														
Cos	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2							1	1		1	1	1
CO2	2	3		3	1				1	1		1	3	2
CO3	2	3		2	1				1	1		1	3	2
CO4	2	3		2	1				1	1		1	3	2
CO5	1	1							1	1		1	1	1

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. Kevin. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
2. T.M.Mitchell, "Machine Learning", Indian Edition, McGrawHill, 1997.
3. Miroslav Kubat, "An Introduction to Machine Learning", Second Edition

WEBSITES:

1. <https://www.udemy.com/course/machinelearning/>
2. <https://www.coursera.org/browse/data-science/machine-learning>

REFERENCE BOOKS:

1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson Education
2. R.O. Duda, P.E.Hart, and D.G.Stock, "Pattern Recognition", Wiley Publications, 2001.
3. T. Hastie, R. Tibshirani, J. Friedman. "The Elements of Statistical Learning", 2nd Edition, 2008.
4. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.
5. K. P. Murphy, "Machine Learning: A probabilistic Perspective", MIT Press, 2012.

SEE Question Paper Pattern:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

Machine Learning Lab List of Programs	
1.	<p>Write a python program for the Chronic disease dataset and perform the following</p> <ol style="list-style-type: none"> 1. Analyze and Preprocess the data to check if there is any null value, if any replace it by NAN. 2. Check if the class label is balanced or not. To Balance the class label perform Oversampling of Minority Class 3. Check the Outlier using Boxplot and Remove Outlier using Z-Score. Draw a correlation heatmap to identify irrelevant data and plot the correlated data. 4. Classify the chronic disease dataset by using logistic regression, Adaboost algorithm, K Nearest Neighbour, Random forest algorithms and find the accuracy of each of the algorithm using Confusion Matrix.
2.	<p>Write a python program for the Heart disease dataset and perform the following</p> <ol style="list-style-type: none"> 1. Analyze and Preprocess the data to check if there is any null value ,if any replace it by NAN. 2. Check if the class label is balanced or not. To Balance the class label perform Oversampling of Minority Class 3. Check the Outlier using Boxplot and Remove Outlier using Z-Score. Draw a correlation heatmap to identify irrelevant data and plot the correlated data 4. Classify the Heart disease dataset by using logistic regression, Adaboost algorithm, K Nearest Neighbour, Random forest algorithms and find the accuracy of each of the algorithm using

	Confusion Matrix.
3.	<p>Write a python program to predict the price of the flight by using flight.csv dataset</p> <ol style="list-style-type: none"> 1. Analyze and Preprocess the data and generate a data correlation heatmap. 2. Check the Outlier using Boxplot and cleanse the Outlier using Z-Score. 3. Build a machine learning model using Decision Tree Regressor, Random Forest Regressor and Adaboost Regressor and find RMSE, MAE, MSE and R2 score.
4.	<p>Write a python program for the Breast cancer dataset and perform the following</p> <ol style="list-style-type: none"> 1. Analyze and Preprocess the data and check if the class label is balanced or not. Do Oversampling of Minority Class to Balance the class label. 2. Check the Outlier using Boxplot and cleanse the Outlier using Z-Score. 3. Classify the dataset by using logistic regression, Decision tree, Support vector machine, Random forest algorithms and find the accuracy of the model using Confusion Matrix.

FINANCIAL MANAGEMENT						
Course Code	:	21CS602		CIE Marks	:	50
Teaching Hours/Week (L: T:P:S)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	3

Course Learning Objectives:**This Course will enable students to**

1. Develop basic financial management knowledge essential to make a managerial career in professional life.
2. Impart some of the crucial and basic skills required to work in the area of budgeting, investment and financial decision making.
3. Enable in making a right decisions on selection of projects for investment.
4. Understand the basics of finance and financial markets, project evaluation and selection.

UNIT - I**TIME VALUE OF MONEY**

Financial Management: Concepts and Meaning – Introduction to Finance; Objectives of Financial Management; Profit Maximization; EVA; Changing Role of Financial Managers. TIME VALUE OF MONEY: TECHNIQUES AND APPLICATIONS OF COMPOUNDING AND DISCOUNTING.

15 HOURS**UNIT – II****CAPITAL BUDGETING AND WORKING CAPITAL**

Capital Budgeting (Investment Evaluation Techniques): Payback Period Method; Present Worth Method; Annual Worth Method; Profitability index method; Estimation of IRR.

Cost of Capital: Sources of various Types of Capital; Cost of Debenture Capital; Cost of Preferential Capital; Cost of Term Loans; Cost of Equity Capital.

WORKING CAPITAL: FACTORS INFLUENCING WORKING CAPITAL REQUIREMENTS.

15 HOURS**UNIT – III****INVENTORY MANAGEMENT AND BREAK EVEN ANALYSIS**

Inventory Management: Techniques of Inventory Management and Control – EOQ, ABC Analysis, Just-in-Time (JIT) System

BREAK EVEN ANALYSIS: ESTIMATION OF BREAK-EVEN POINT AND VALUES.**9 HOURS****Course Outcomes:****AT THE END OF THE COURSE THE STUDENT WILL BE ABLE TO:**

1. DESCRIBE THE BASIC FINANCIAL MANAGEMENT SKILLS REQUIRED FOR A PROFESSIONAL.
2. EXPLAIN TECHNIQUES AND APPLICATIONS OF COMPOUNDING AND DISCOUNTING AND CALCULATE COMPOUNDED/DISCOUNTED AMOUNT FOR THE GIVEN PROPOSAL.
3. EVALUATE THE GIVEN INVESTMENT OPTION BY CAPITAL BUDGETING TECHNIQUES.
4. DESCRIBE THE BASICS OF COST OF CAPITAL AND WORKING CAPITAL. DETERMINE THE COST OF CAPITAL FOR THE GIVEN INVESTMENT OPTION.
5. DESCRIBE THE BASICS OF INVENTORY MANAGEMENT AND CALCULATE THE ECONOMIC ORDER QUANTITY AND REORDER POINT FOR THE GIVEN CONDITIONS. CALCULATE BREAK-EVEN POINT FOR THE GIVEN MANUFACTURING SETUP.

Course Outcomes Mapping with Program Outcomes & PSO																
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO			
													1	2	3	
MG1002-1.1	3	-	-	-	-	-	-	-	1	1	-	1	-	-	-	
MG1002-1.2	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-	
MG1002-1.3	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-	
MG1002-1.4	2	3	-	-	-	-	-	-	1	1	-	1	-	-	-	
MG1002-1.5	1	3	-	-	-	-	-	-	1	1	-	1	-	-	-	
1: Low 2: Medium 3: High																

TEXTBOOKS:	
1.	M Y Khan, P K Jain , "Financial Management – Text, Problems & Cases", 7th Edition, 2015; McGraw Hill Education (India) Pvt. Ltd, New Delhi.
2.	I M Pandey, "Financial Management", 11th Edition, 2015; Vikas Publishing House Pvt. Ltd. (UP) India.
3.	James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", 4th Edition, Tata McGraw Hill Edition.

REFERENCE BOOKS:	
1.	Prasanna Chandra, "Financial Management", 6th Edition, 2004; Tata McGraw Hill Publishing Company Ltd, New Delhi.
2.	S. D. Sharma, "Operation Research" , Kedar Nath Ram Nath Publishers, 2015.

COMPILER DESIGN					
Course Code	:	21CS603		CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0		SEE Marks	: 50
Total Hours	:	39		Credits	: 03

Course Learning Objectives:**This Course will enable students to**

1. Outline lexical analysis, use of regular expressions, transition diagrams, scanner-generator tools and context free grammars.
2. Get the idea of major parsing techniques top-down (recursive-descent, LL(1)) and Bottom up parsers.
3. Discuss LR parsers using items sets and parsing tables.
4. Make use of the principal ideas in syntax-directed definitions, syntax-directed translations and intermediate code representations for assignment statements and boolean expressions.
5. Describe how to construct the basic blocks from intermediate code, code optimization techniques and code generation algorithm.

UNIT – I**INTRODUCTION:**

Language Processor, The Structure of a Compiler.

Chapter 1: 1.1,1.2**LEXICAL ANALYSIS:**

The role of a Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical – Analyzer Generator-LEX.

Chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5

SYNTAX ANALYSIS:

Introduction- The role of a Parser, Context-Free Grammars , Top- Down Parsing, Bottom-Up Parsing .

Chapter 4: 4.1.1, 4.2, 4.4, 4.5

15 Hours

UNIT – II

SYNTAX-ANALYSIS:

Introduction to LR Parsing: Simple LR , Items and LR(0) Automaton, The LR Parsing Algorithm, Constructing SLR Parsing Tables.

Chapter 4: 4.6-4.6.1, 4.6.2, 4.6.3, 4.6.4

More powerful LR Parsers: Canonical LR(1) Items, Constructing LR(1) Sets of Items, Canonical LR(1) Parsing Tables, Constructing LALR Parsing Tables.

Chapter 4: 4.7- 4.7.1, 4.7.2, 4.7.3, 4.7.4,

SYNTAX-DIRECTED DEFINITIONS

Syntax Directed Definitions, Evaluation orders for SDD's, Applications of Syntax Directed Translation- Construction of Syntax Trees, SDT's with Actions Inside Productions.

Chapter 5: 5.1, 5.2, 5.3-5.3.1 , 5.4- 5.4.3

INTERMEDIATE CODE GENERATION:

Variants of Syntax Trees, Three Address Code, Flow of Control Statements, Control Flow Translation of Boolean Expressions.

Chapter 6: 6.1, 6.2, 6.6.3, 6.6.4

15 Hours

UNIT – III

CODE GENERATION:

Issues in the Design of a Code Generator, The target Language, Basic Blocks and Flow graphs, Optimization of Basic Blocks, A Simple code generator.

Chapter 8: 8.1, 8.4, 8.5, 8.6

9 Hours

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

1. Explain the various phases of compiler. Build the regular expressions and transition diagrams by applying the knowledge of finite automata. Develop and Implement tokenizer using high level programming language and LEX Tool.
2. Develop top down parsers by applying the knowledge of context free grammar and parsing algorithms.
3. Construct LR item sets by applying the knowledge of Closure and Go to functions. Make use of SLR, CLR and LALR parsing tables to parse the language constructs. Design and Implement parser using high level programming language and YACC Tool.
4. Illustrate Syntax-Directed translation scheme for engineering problems. Apply three address code representations to generate an intermediate code for assignment statement and Boolean expressions.
5. Build a code generator for the intermediate code by applying the knowledge of Basic blocks, address, register descriptors and next use information. Apply code optimization techniques to optimize the target code.

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (Pis)	Bloom's Taxonomy Level (BTL)
CO1	1, 2,3	1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.1.3, 2.2.2	L2
CO2	1, 2,3	1.1.1, 1.1.2, 1.3.1, 1.4.1, 2.1.1, 2.2.2, 2.2.3, 2.3.2, 3.4.3	L4
CO3	1, 2,3	1.3.1, 1.4.1, 2.1.2, 2.2.3, 2.2.5, 2.3.2, 2.4.3	L3
CO4	1, 2	1.3.1, 1.4.1	L2
CO5	1, 2	1.1.1, 1.1.2, 1.3.1, 2.1.1, 2.1.2, 2.2.2, 2.2.5, 2.4.3	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)											PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	1	2	3		3				1			1	1	3		
CO2	1	2	3		3				1			1	1	3	2	
CO3	1	2	3		3				1			1	1	3	3	
CO4	1	2	3		1				1			1	1	3		
CO5	1	2	3		1				1			1	1	3	1	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOK:

1. Alfred WAho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers-Principles, Techniques and Tools", Addison-Wesley, Second edition, 2007.

REFERENCE BOOKS:

1. Andrew W Apple, "Modern Compiler Implementation in C", Cambridge University Press, 1997.
2. Kenneth C Loudon, "Compiler Construction Principles & Practice", Thomson Education, 1997.
3. John R. Levine, Tony Mason, Doug Brown, "LEX and YACC", O'Reilly Publication, 1999.

E-Books / Online Resources:

1. https://www.tutorialspoint.com/compiler_design/index.htm
2. http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf
3. <http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf>

MOOC: MOOCs:

1. <http://www.nptelvideos.in/2012/11/compiler-design.html>

SEE SCHEME:

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabus & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

21CS61x-Professional Elective Course-I

AGILE TECHNOLOGY					
Course Code	:	21CSE101	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	:	50
Total Hours	:	39	Credits	:	03

Course Learning Objectives:

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

1. Understand the theoretical as well as practical of agile software development practices and how small teams can apply them to create high-quality software.
2. To good understanding of software design and a set of software technologies and APIs
3. To do a detailed examination and demonstration of Agile development and testing techniques.
4. To understand the benefits and pitfalls of working in an Agile team.
5. To understand Agile development and testing.

UNIT – I**Agile Methodology**

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

Agile Process

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

15 Hours**UNIT – II****Unit-2 Agility, Knowledge Management and Requirement Engineering****Agility and Knowledge Management**

Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition,

Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

Agility and Requirement Engineering

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

15 Hours

UNIT – III

Unit-3 Agility and Quality Assurance

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

9 Hours

Course Outcomes:

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

1. Realize the importance of interacting with business stakeholders in determining the requirements for a software system
2. Perform iterative software development processes: how to plan them, how to execute them.
3. Point out the impact of social aspects on software development success.
4. Develop techniques and tools for improving team collaboration and software quality.
5. Perform Software process improvement as an ongoing task for development teams and show how agile approaches can be scaled up to the enterprise level.

Table-1: Mapping of COs to Pls, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.2.1, 1.3.1, 2.1.3, 3.1.2	L2
CO2	1, 2,	1.4.1, 2.1.2, 2.3.1	L2
CO3	1, 2,3	1.4.1, 2.1.3, 2.3.2	L2
CO4	1, 2,3	1.4.1, 2.1.3, 2.3.2, 3.2.2	L3
CO5	1, 2,3	1.4.1, 2.3.1	L3

Table: Mapping Levels of COs to POs / PSOs

COs		Program Outcomes (POs)											PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	1	2	3		3				1			1	1	3		
CO2	1	2	3		3				1			1	1	3	2	
CO3	1	2	3		3				1			1	1	3	3	
CO4	1	2	3		1				1			1	1	3		
CO5	1	2	3		1				1			1	1	3	1	

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

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

REFERENCE BOOKS:

1. Craig Larman, —Agile and Iterative Development: A Manager's Guidell, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Managementll, Butterworth-Heinemann, 2007.

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

ADVANCED JAVA PROGRAMMING						
Course Code	:	21CSE102		CIE Marks	:	50
Teaching Hours /Week (L: T:P:S)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	3

Course Learning Objectives:

This course will enable students to:

1. Apply the database development applications in Java.
2. Design server-side web applications using Java Servlets and JSP.
3. Apply the networking concepts to develop applications in Java
4. Apply the generics and Java FX to the user applications.

UNIT – I

Java Database Connectivity (JDBC) - The Vendor Variation Problem, SQL and Versions of JDBC, creating an ODBC Data Source, Simple Database Access, Modifying the Database Contents, Transactions, Meta Data, Scrollable Result Sets in JDBC 2.0, Modifying Databases via Java Methods. Network Programming with Java - Basic Concepts, Protocols and Terminology, Clients, Servers and Peers, Ports and Sockets, The Internet and IP Addresses, Internet Services, URLs and DNS, TCP, UDP. The InetAddressClass, Using Sockets (TCP and UDP). (Textbook 2 - Chapter 2, 7)

15 Hours

UNIT – II

Java Servlets – Benefits, A simple Java Servlet, Anatomy of a Java Servlet, Reading data from a client, Reading HTTP Request Headers, Sending data to a client and writing the HTTP Response Header, Working with Cookies, Tracking Sessions. Java Server Pages (JSP) – Installation, JSP Tags, Request String, User Sessions, Cookies, Session objects.

(Textbook 1- Chapter 17). (Textbook 2-Chapter 8, 9) (Textbook 3- Chapter - 10,11)

9 Hours

UNIT – III

Generics: What Are Generics? A Simple Generics Example, A Generic Class With Two Type Parameters, Bounded Types, Using Wildcard Arguments. (T1: Ch:17 Ch: 14) Introducing JavaFX GUI Programming: JavaFX Basic Concepts, The Application Class and the Life-cycle methods, launching a JavaFX Application, A JavaFX Application Skeleton, Compiling and Running a JavaFX Program, The Application Thread, A Simple JavaFX Control: Label, Using Buttons and Events, Event Basics, Introducing the Button Control, Demonstrating Event Handling and the Button.

(Textbook 1- Chap 14, 17, 34)

15 Hours

Course Outcomes:

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

2. Apply the basic concepts of Object-Oriented Programming to **develop** programs in Java and **implement** the concepts of database connectivity using JDBC.
3. **Design** programs using network programming concepts of Java.
4. **Develop and implement** the application program with GUI using Java servlet and JSP for interactive web pages.
5. Implement generic concepts using Java.
6. **Implement** JavaFX concepts to develop applications.

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,5	1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 5.1.1, 5.1.2	L3
CO2	1,2,3,5	1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 3.1.1, 3.2.1, 3.2.2, 3.4.2, 5.1.2	L3
CO3	1,2,3,5	1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 3.1.1, 3.2.1, 3.2.2, 3.4.2, 5.1.2	L3
CO4	1,2,3,5	1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 3.1.1, 3.2.1, 3.2.2, 3.4.2, 5.1.2	L3
CO5	1,2,3,5	1.4.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 3.1.1, 3.2.1, 3.2.2, 3.4.2, 5.1.2	L3

Table-2: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3			2				1	1		1	2	3
CO2	1	2	2		1				1	1		1		3
CO3	1	2	3		1				1	1		1		3
CO4	1	2	3		1				1	1		1	2	3
CO5	1	2	3		1				1	1		1		3

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. The Complete Reference Java by Herbert Scheldt, Seventh Edition, 2007, Tata McGraw-Hill.
2. An Introduction to Network Programming with Java by Jan Graba, 2007, Springer Publications.
3. The Complete Reference J2EE by Jim Keogh, Tata McGraw-Hill. 2002

REFERENCE BOOK:

1. Java – How to Program? by H. M. Deitel, 2004, Prentice Hall.

E-Books / Online Resources:

1. Online course material by Oracle:
 - a. <http://docs.oracle.com/javase/tutorial/index.html>
2. <https://www.udemy.com/courses/search/?q=java&price=price-free&view=grid>
3. <http://www.mindview.net/Books/TIJ>
4. <http://docs.oracle.com/javase/specs/jls/se8/html/index.html>
5. <http://greenteapress.com/thinkapjava/html/index.html>

MOOC:

1. Oracle www.oracle.com/events/global/en/java.../java-a-beginners-guide-1720064.pdf
2. NPTEL: www.nptelvideos.com/java/java_video_lectures_tutorials.php
3. [Duke University](http://dukeuniversity.edu), [Andrew D. Hilton](http://andrewd.hilton.com): “Java Programming: Principles of Software Design” (Coursera).
4. <http://nptel.ac.in/courses/106106147/>.

DIGITAL IMAGE PROCESSING					
Course Code		21CSE103	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)		3-0-0-0	SEE Marks	:	50
Total Hours		39	Credits	:	03

Course Objectives:

This Course will enable students to:

1. Outline the theory behind the basics of digital image processing, the relation between the components of image processing system. Make use of Electromagnetic Spectrum, find the equivalence between pixels.
2. Make use of spatial and frequency domain, smoothing and sharpening filters.
3. Make use of Homomorphic Filtering and how to simplify Detection of Discontinuities.
4. Get the idea of Models Elements of Information, find the equivalence between Dilation and Erosion, Opening and Closing, and identify the Hit-or-Miss Transformation. Understand different compression model.
5. Tell how Components of an Image Processing System works, their design, and get the feeling of Histogram Processing.

UNIT – I

Introduction-What Is Digital Image Processing? Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals - Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic

Relationships between Pixels.

Intensity Transformations and Spatial Filtering -Background, Some Basic Intensity Transformation Functions, Histogram Processing-Histogram Equalization, Histogram Matching. Local Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

[Text book chapters 1,2,3]

15 Hours

UNIT – II

Filtering in Frequency Domain – Background, Sampling and the Fourier Transform of Sampled Functions, The Discrete Fourier Transform (DFT) of Functions of one continuous variable, Image smoothing using Frequency-Domain Filters – Ideal Lowpass Filters, Butterworth Lowpass Filters, Gaussian Lowpass Filters, Image Sharpening using Frequency Domain Filters -Ideal Highpass Filters, Butterworth Highpass Filters, Gaussian Highpass Filters, Homomorphic Filtering.

[Text book chapter 4.1,4.3,4.4,4.8,4.9]

Image Compression – Fundamentals- Coding Redundancy, Spatial and Temporal Redundancy, Image Compression Model. Some Basic Compression Model – Huffman Coding, Arithmetic Coding, LZW coding, Bit-Plane Coding, Run -Length Coding. [Text book chapter 8.1,8.2]

Morphological Image Processing – Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation, Some Basic Morphological Algorithms -Boundary Extraction, Thinning, Thickening.[Text book chapter 9.1,9.2,9.3,9.4,9.5]

15 Hours

UNIT – III

Image Segmentation – Point, Line and Edge Detection – Background, Detection of Isolated Points, Line Detection, Edge Model, Basic Edge Detection, Edge Linking and Boundary Detection, Thresholding- Foundation, Basic Global Thresholding, Region Based Segmentation Region growing, splitting and merging.

[Text book chapter 10.1,10.2,10.3,10.4]

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Apply the concept of Digital Image Processing and Steps in Digital Image Processing, Able to apply the Knowledge of Image Sampling and Quantization and Illustrate Some Basic Relationships between Pixels using Knowledge of 4-8 and M adjacency.
2. Design and Formulate Histogram processing. Analyze Smoothing Spatial Filters, Sharpening Spatial Filters by applying mathematical knowledge.
3. Explain Frequency domain and illustrate Smoothing Frequency-Domain Filters. Analyze Sharpening frequency-Domain Filters. Apply and Design Image Compression Standards and models.
4. Analyze the concept of Morphological Image Processing by applying mathematical knowledge.
5. Design and Formulate Image segmentation techniques and prove the properties Region-Based Segmentation.

Table 1: Mapping of COs to Pls, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1, 2.4.2, 3.2.2	L2
CO2	2	2.1.3, 2.4.2	L3
CO3	1,2	1.4.1, 2.4.2	L2
CO4	1,3,4	1.4.1, 3.2.2, 4.2.1	L3
CO5	2,4	2.4.2, 4.2.1	L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	3										3	2
CO2		3											3	
CO3	2	3											3	
CO4	2		3										3	2
CO5		2	3										3	2

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOK:**

12. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition.

REFERENCE BOOKS:

1. Digital Image Processing With Matlab & Labview Vipula Singh Published by Reed Elsevier India Pvt.Ltd | Language - English | Binding - Paper Back.
2. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice-Hall of India Pvt. Ltd., 1997.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Thomson Learning, Brooks/Cole, Second Edition. 2001.
4. B.Chanda, D Dutta Majumder, "Digital Image Processing and Analysis", Prentice- Hall, India, 2002.
5. Steven W. Smith, "The Scientist and Engineers Guide to Digital Signal Processing", California Technical Publishing ,Second Edition , 1999.

E-Books / Online Resources:

1. iitlab.bit.edu.cn/HandbookofImageandVideoProcessing.pdf
2. <http://www.cs.ukzn.ac.za/~sviriri/Books/Image-Processing/book4.pdf>

MOOC:

1. <https://nptel.ac.in/courses/117105079/>
2. https://swayam.gov.in/nd1_noc19_ee55/preview
3. <https://www.coursera.org/learn/image-processing>
4. <https://www.coursera.org/learn/image-processing>

SEE SCHEME

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

ADVANCED COMPUTER ARCHITECTURE					
Course Code	:	21CSE104		CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0		SEE Marks	: 50
Total Hours	:	39		Credits	: 03

Course Learning Objectives:

This Course will enable students to:

1. Outline the preamble of quantitative principles of computer architecture, various parallel computer models and fundamentals of parallel processing
2. Make use of the concept of pipelining and apply in Linear and Non Linear pipelining processors
3. Learn how to enhance a MIPS processor's ability by understanding challenges like hazards and techniques like static and dynamic scheduling
4. Get an idea of Synchronization mechanism in Multiprocessors and Optimizations in Cache and memory.
5. Summarize the fundamental aspects of Instruction Level Pipelining and utilize in case studies of Itanium and Intel IA-64 Architecture along with the Hardware and Software.

UNIT – I**FUNDAMENTALS OF COMPUTER DESIGN:**

Introduction, Classes of Computers, measuring, reporting and summarizing performance, quantitative principles of computer design (Text 1, chapter: 1).

PARALLEL COMPUTER MODELS:

Shared memory multiprocessors, Distributed-Memory multicomputers (Text 3: chap 1.2). Introduction to Parallel processing: Concepts of concurrent and parallel execution, types and levels of parallelism. (Text 2: chapter 3)

PIPELINING:

Introduction, the major hurdle of pipelining- pipeline hazards, How is pipelining implemented. (Text 1, Appendix A). Linear pipeline processors and Non-linear pipeline processors (Text 3, chapter 6).

15 Hours

UNIT – II

EXPLOITING INSTRUCTION LEVEL PARALLELISM:

Concepts and Challenges, Basic compiler techniques for exposing ILP, Reducing branch cost with prediction, overcoming data hazards with dynamic scheduling, hardware based speculation, exploiting ILP using multiple issues and static scheduling, exploiting ILP using Dynamic scheduling, multiple issue and speculation, advanced techniques for instruction delivery and speculation. (Text 1, chapter 2)

MEMORY HIERARCHY DESIGN:

Introduction; review of concepts. Basic six cache optimization. **Eleven Advanced optimizations of Cache performance (self-study)**; Memory technology and optimizations. (Text 1, chapter 5: 5.1,5.2,5.3)

15 Hours

UNIT – III

HARDWARE AND SOFTWARE FOR VLIW AND EPIC:

Introduction: Exploiting Instruction-Level Parallelism Statically; Detecting and Enhancing Loop-Level Parallelism; Scheduling and Structuring Code for Parallelism; Hardware Support for Exposing Parallelism: Predicated Instructions; Hardware Support for Compiler Speculation; The Intel IA-64 Architecture and Itanium Processor; Conclusions. (Text 1, Appendix G)

9 Hours

Course Outcomes:

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

1. **Describe** the principles of computer design using Amdahl's law, principle of locality and parallelism.
2. **Demonstrate** instruction level parallelism in MIPS processor using instruction pipelining.
3. **Elaborate** how processor performance is enhanced using software and hardware techniques.
4. **Compare** cache optimization techniques and **choose** the suitable one to improve processor performance.
5. **Illustrate** the hardware and software support for VLIW and EPIC with the case study of Intel IA-64 architecture

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.4.1, 2.2.5	L3
CO2	1, 2	1.4.1, 2.2.2, 2.2.3, 2.2.4	L3
CO3	1, 2	1.4.1, 2.2.3, 2.2.4	L3
CO4	1, 2	1.4.1, 2.2.3, 2.2.4	L4
CO5	1, 2	1.4.1, 2.2.2, 2.2.3, 2.4.3	L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3							1	1		1	3	
CO2	2	3							1	1		1	3	
CO3	2	3							1	1		1	3	
CO4	2	3							1	1		1	3	
CO5	2	3							1	1		1	3	

3: Substantial (High)**2: Moderate (Medium) 1: Poor (Low)**

TEXTBOOKS:

1. John L. Hennessey and David A. Patterson, "Computer Architecture, A Quantitative Approach", 4th Edition, Elsevier, 2007
2. Dezső Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer architectures - A Design space approach", Pearson Education 1997.
3. Kai Hwang, "Advanced Computer Architecture Parallelism, Scalability", Tata Mc Grawhill, 2003

REFERENCE BOOKS:

1. Computer Architecture and Organization, John P. Hayes, Volume 2, McGraw-Hill, 2012
2. Computer Organization and Architecture: Designing for Performance, William Stallings, PHI 9 edition, 2012

E-Books / Online Resources:

1. Computer Architecture and Organization - Design Principles and Applications, B. Govindarajalu, McGrawhill HED, Edition: 2nd Edition, 2010
2. Fundamentals of computer organization and architecture, M Abd-El-Barr and Hesham El-Rewini, Wiley Interscience, 2005

MOOC:

1. NPTEL course on Computer Architecture, by Prof. Madhu Mutyam, PACE Laboratory, Department of computer Science and Engineering, Indian Institute of Technology Madras. Online:
<https://www.youtube.com/watch?v=Tz7kMR-MAuk>
2. NPTEL course on Advanced Computer Architecture, by Dr. John Jose, Department of computer Science and Engineering, Indian Institute of Technology Guwahati. Online:
<https://www.youtube.com/watch?v=6oiKalH7BKU>
3. NPTEL course on Parallel computer Architecture, by Dr. Mainak Chaudhuri, Department of Computer Science and Engineering, Indian Institute of Technology Kanpur. Online:
<https://nptel.ac.in/courses/106/104/106104024/>

FULL STACK DEVELOPMENT						
Course Code	:	21CSE105		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Design static and modern web pages using HTML5, Cascading Style Sheets (CSS) and Bootstrap.
2. Develop client-side validations using JavaScript.
3. Develop the server-side script using PHP.
4. Develop the interactive web application using NodeJS framework
5. Design the server-side database using MySQL and MongoDB.

UNIT – I

BASICS OF HTML5, CSS AND JAVASCRIPT: Overview of HTML5, HTML5 elements, Introduction to CSS, Levels of style sheets, The Box Model, The basics of Javascript, General syntactic characteristics, Event Handling.(Refer Textbook 1)

BOOTSTRAP:

What is Bootstrap? Why use Bootstrap? Where to get Bootstrap? Bootstrap CDN, First Web Page with Bootstrap, Bootstrap Grid system, Contextual Colors and Backgrounds, Bootstrap Tables, Bootstrap Images, Bootstrap Jumbotron and Page Header, Bootstrap Wells, Bootstrap Alerts, Bootstrap Buttons, Bootstrap Badges and Labels, Bootstrap Progress Bars, Bootstrap List Groups, List Group With Badges, Tabs, Tabs With Dropdown Menu, Pills, Bootstrap Navigation Bar, Bootstrap Forms, Bootstrap Form Inputs, Bootstrap Media Objects, Bootstrap Carousel Plugin. (Refer Textbook 2)

15 Hours**UNIT – II****INTRODUCTION TO PHP:**

Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, Operations and Expressions, Output, Control statements, Arrays, Functions, Pattern Matching, Form handling, Files, Cookies, Session tracking,

Database access with PHP and MySQL. (Refer Textbook 1)

NodeJS: Introduction to Node.js- Installing Node.js - Node.js Modules, Node.js File System, Node.js URL Module, Node.js NPM, Node.js Events, Node.js Upload Files, Node.js Email (Refer Textbook 5)

15 Hours

UNIT – III

NodeJS MySQL - Create Database, Create Table, Insert into, select from, Where, Order by, Delete, Drop Table, Update, Limit, Join. (Refer Textbook 5)

Introduction to Mongo DB- Node.js MongoDB, Create Database, Create Collection, Insert, Find, Query, Sort, Delete, Drop.

9 Hours

Course Outcomes:

1. **Describe** the fundamental features of HTML5, CSS and Bootstrap and **Design** static web pages.
2. **Design** and **Implement** the client-side validations using JavaScript.
3. **Illustrate** the concept of PHP and **Develop** the server-side script using PHP.
4. **Develop** the interactive web application using NodeJS framework.
5. **Design** the server-side database using MySQL and MongoDB.

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1, 2.2.1, 3.2.1	L1, L2, L3
CO2	1,2	1.4.1, 2.2.2, 2.3.2	L1, L2, L3
CO3	1,2	1.4.1, 2.1.2	L1, L2, L3
CO4	1,2,3	1.4.1, 2.2.1, 3.2.1	L1, L2, L3
CO5	1,2	1.4.1, 2.2.2, 2.3.2	L1, L2, L3

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)											PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3											3	
CO2	2	3												3	
CO3	2	3												3	
CO4	1	2	3											3	
CO5	1	2												3	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXTBOOKS:

1. Robert W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson, 2014.
2. Jake Spurlock, "Bootstrap-Responsive Web Development", O'Reilly publications, 2013.
3. Ari Lerner, Ng-book, "The complete book on Angular JS", 2013.
4. Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer Paperback – Import, 20 November 2018.
5. David Herron, Node.js Web Development: Server-side web development made easy with Node 14 using practical examples, 5th Edition Edition, 2020

REFERENCE BOOKS:

1. M. Deitel, P.J. Deitel, A. B. Goldberg, "Internet & World Wide Web: How to Program, 4e Paperback – 1 January 2009.
2. Chris Bates, "Web Programming Building Internet Applications", Third Edition, Wiley India, 2006

E-Books / Online Resources:

- https://www.cs.uct.ac.za/mit_notes/web_programming.html
- <http://www.multitech.ac.ug/uploads/IntroductiontoWebProgramming.pdf>
- <https://www.w3schools.com/php/>
- <https://www.w3schools.com/bootstrap/>
- <https://www.w3schools.com/nodejs/>
- <https://www.tutorialspoint.com/nodejs/index.htm>

MOOCs:

1. <http://nptel.ac.in/courses/106106156/2>
2. <https://www.coursera.org/learn/web-development>
3. <https://www.coursera.org/learn/server-side-nodejs>

SEE SCHEME:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

NATURAL LANGUAGE PROCESSING						
Course Code	:	21CSE106		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This course will enable students to

1. Explain the importance of NLP and breaking of words.
2. Outline the syntax, semantics and pragmatics in speech language.
3. Describe the models for different applications of NLP.
4. Understand state-of-the-art algorithms and techniques for text-based processing of natural language with computational semantics and application.
5. **Demonstrate** understanding of Question answering summerization.

UNIT - I

Knowledge in speech and language processing; Ambiguity; Models and algorithms; Regular expressions - Basic Regular Expression Pattern,

Disjunction, Grouping, and Precedence, A Simple Example, A More Complex Example, Advanced Operators(2.1.1 - 2.1.5), Using an FSA to Recognize Sheep-talk, Formal Languages, Another Example, Non-Deterministic FSAs, Using an NFSA to Accept String(2.2.1 - 2.2.5); Words and Transducers - Inflectional Morphology, Derivational Morphology, Cliticization, Non-concatenative Morphology, Agreement(3.1.1 - 3.1.5); Finite-state morphological parsing(3.2); Detecting and correcting spelling errors, Minimum edit distance(3.10 - 3.11), N-Grams - Counting words in corpora, Simple(un-smoothed) n-grams(4.1 - 4.2); Part – of - Speech Tagging - English word classes, tagsets for English(5.1 - 5.2), Hidden Markov Models - Markov chains, The Hidden Markov Model(6.1 - 6.2).
(Refer Text Book 1)

15 Hours

UNIT – II

Syntactic Parsing: Grammars and syntax structure, A top down parser, Depth first strategy vs Breadth first strategy, Bottom up chart parser, Efficiency considerations, Transition Network Grammars, Top down chart parser. (Refer Text Book 2)

Representing Meaning: Computational desiderata for representations, Meaning structure of language, Model theoretic semantics, First order logic. (17.1 – 17.4)
Computational Semantics: Syntax driven semantic analysis, Semantic augmentations to context-free grammar rules, Quantifier scope ambiguity and under specification, Unification based approaches to semantic analysis. (18.1 – 18.4)

Applications:Information Extraction - Named entity recognition, Relation detection and classification, Temporal and event processing, Template filling (22.1-22.4). (Refer Text Book 1)

15 Hours

UNIT – III

Question Answering and Summarization – Information retrieval, Factoid question answering, Summarization, Multi document summarization (23.1 – 23.4); Dialog and Conversational Agents - Properties of human conversations, Basic dialogue systems, VoiceXML (24.1-24.3) (Refer Text Book 1)

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. **Explain** the understanding of core tasks in NLP.
2. **Demonstrate** the syntax, semantics and pragmatics in speech language.
3. **Implement** and experiment the models and parsing for different applications of NLP.
4. **Demonstrate** understanding of state-of-the-art algorithms and techniques for text-based processing of natural language with computational semantics and application.
5. **Demonstrate** understanding of human languages and be familiar with the most mainstream descriptive and theoretical frameworks for handling their properties.

Table-1: Mapping of COs to Pls, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.3.1, 1.4.1, 2.1.3	L3
CO2	1,2,3	1.3.1, 1.4.1, 2.1.2	L3
CO3	1,2	1.3.1, 1.4.1, 2.1.3	L3
CO4	1,2,3	1.3.1, 1.4.1, 2.1.2	L3
CO5	1,2	1.3.1, 1.4.1, 2.1.2	L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												3
CO2	1	2	3											3
CO3	2	3												3
CO4	1	2	3											3
CO5	2	3												3

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXTBOOKS:

1. Jurafsky, D. and J. H. Martin, "Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Second Edition, Prentice Hall, 2008.
2. Allen, James, "Natural Language Understanding", Second Edition, Benjamin/Cumming, 1995.

REFERENCE BOOKS:

1. Steven Bird, S., Klein, E., Loper, E, "Natural Language Processing with Python-Analyzing Text with the Natural Language Toolkit", O'Reilly Media, 2010.
2. Grant S Ingersoll, Thomas S. Morton, and Andrew L. Farris, "Taming text: how to find, organize, and manipulate it" Manning Publications Co., 2013.
3. Feldman Ronen, and James Sanger, "The text mining handbook: advanced approaches in analyzing unstructured data", Cambridge university press, 2007.
4. Christopher D Manning, and Hinrich Schütze, "Foundations of statistical natural language processing", MIT press, 1999.

E-Books / Online Resources:

1. <http://www.allitebooks.in/mastering-natural-language-processing-python/>
2. <https://github.com/hayderimran7/free-tech-ebooks-from-packtpub/tree/master/Natural%20Language%20Processing%20with%20Java%20and%20LingPipe%20Cookbook>

MOOC:

1. <https://www.experfy.com/training/courses/natural-language-processing-for-retail>
2. <https://www.class-central.com/course/coursera-natural-language-processing-9603>

SEE SCHEME

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit - II** and **1** full question from **Unit - III**.

UNIX SYSTEM PROGRAMMING						
Course Code	:	21CSE107		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This course will enable students to:

1. List the file APIs and design the programs to perform file-handling operations.
2. Illustrate the concept of processes and their environment.
3. Implement programs to handle processes in the Linux platform.
4. Demonstrate the concepts of signals and timers.
5. Apply inter-process communication concept for data exchange between programs.

UNIT – I

The POSIX standards. File types. General File APIs, File handling programs, Makefile - introduction, creation, and execution of make file. The Process: Introduction, Mechanism for creating process. The UNIX Kernel support for the process. The environment of a UNIX process: Introduction, main function, Process Termination, Command line arguments, Environment List, the Memory layout of a C program, Memory allocation, Environment variables, and functions.

15 Hours**UNIT – II**

Setjmp and longjmp functions, getrlimit, setrlimit Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, Wait3, wait4 functions, Race conditions, exec functions, Interpreter files, System Function. Signals: The Unix Kernel Support for signals, Signal, Signal mask, Sigaction, The SIGCHLD Signal, and waitpid functions, The sigsetjmp and siglongjmp Functions, Kill, Alarm, and Interval Timers. Daemon processes: Introduction, Daemon Characteristics, and Coding Rules

15 Hours

UNIT – III

Interprocess communications: Overview of IPC Methods, Pipes, popen, Pclose functions, FIFOs, SOCKETS: Introduction, functions, Client/Server Message Handling Example.

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Define and discuss the POSIX standard and different types of files under the UNIX platform.
2. Apply various file APIs for developing file-handling programs that can work on the UNIX platform.
3. Illustrate the representation of a process and its environment in UNIX and design programs that can use various process APIs for creating and handling the processes in UNIX.
4. Demonstrate the concept of signal and signal handling methods. Use the signal handling APIs for developing programs to handle operating system issues in the UNIX platform.
5. Describe the concepts of demon process and inter-process communication, and design programs to demonstrate the working of inter-process communication using suitable APIs of UNIX for achieving computer communication.

Table-1: Mapping of COs to Pls, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.4.1, 2.1.2, 2.2.3,2.3.1	L2
CO2	1, 2,3	1.4.1, 2.1.1,2,1,2, 2.3.1, 3.2.1,3.4.2	L3
CO3	1, 2,3	1.4.1, 2.1.1,2,1,2, 2.3.1, 3.2.1,3.4.2	L3
CO4	1, 2,3	1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 3.2.2, 3.2.1,3.4.2	L3
CO5	1, 2,3	1.4.1, 2.1.1,2,1,2, 2.3.1, 3.2.1,3.4.2	L3

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)											PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3												3	2
CO2	2	2	3											2	3
CO3	2	2	3											2	3
CO4	2	2	3											2	3
CO5	1	2	3											2	3

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. Terrence Chan, "UNIX System Programming Using C++", Prentice Hall India, 1999. (Chapters 1, 5, 6, 7, 8, 9, 10)
2. W.Richard Stevens," Advanced Programming in the UNIX Environment", Addison – Wesley/PHI, 2013. (Chapters 7, 8, 9, 13, 14, 15)
3. Sumitaba Das, "UNIX-Concepts and Applications", Fourth Edition, Tata McGraw Hill, 2006. (Chapter 9).

REFERENCE BOOKS:

1. Maurice.J.Bach,"The Design of the Unix Operating System", Pearson Education /Prentice Hall of India, First Edition, 1986.
2. UreshVahalia," UNIX Internals, Pearson Education", ASIA, 2001.
3. R. Stones, N. Matthew, "Beginning Linux Programming", Wrox publication, Fourth Edition,2007.

E-Books / Online Resources:

1. <http://www.codeman.net/wp-content/uploads/2014/04/APUE-3rd.pdf>
2. richard.esplins.org/static/downloads/linux_book.pdf

MOOCs:

1. <http://nptel.ac.in/courses/106101163/56>
2. <http://nptel.ac.in/courses/106106156/>

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

MOBILE APPLICATION DEVELOPMENT					
Course Code	:	21CSE108	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	1-1-2-0	SEE Marks	:	50
Total Hours	:	39	Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. **Describe** the fundamentals of the Flutter framework and DART programming.
2. **Develop** a mobile application and incorporate widgets and state into app
3. **Build** an application using Forms and Gestures and Animation.
4. **Demonstrate** Asnyc Dart and Flutter and Infinite Scrolling and state management
5. **Develop** application to file handling, using SQLite database, RESTful API calls and Firebase

UNIT – I

Introduction

What is Flutter, Why Flutter ?, The other options, Native solutions, What is Dart. Basics of Dart

Basics of Dart

Keywords, built-in types, functions, operators, control flow statements, exceptions, classes, generics, libraries and visibility, asynchrony support, generators, callable classes, isolates, typedefs, metadata, comments Setting up Flutter development environment.

The basics of writing Flutter code

Hello World Flutter App Basic Widgets such as App bar, Column, Row, Container, Image, Icon, Buttons, Text.

15 Hours

UNIT – II

Flutter UI: Important widgets, themes, and Layout , The base features of Flutter app. **User Interaction:** Forms and Gestures. **Pushing pixels:** Flutter Animation and using the canvas, Painting to the canvas and details of using flutter animation. Asnyc Dart and Flutter and Infinite Scrolling, Flutter state management.

15 Hours

UNIT – III

Working with files

Including libraries in your Flutter app, Including a file with your app, Reading/Writing to files, Using JSON, Using Shared Preferences.

Working with SQLite Database, Making RESTful API Calls with HTTP, Using Firebase/Firestore with Flutter

9 Hours

Course Outcomes:

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

1. **Understand** the Flutter Platform and basics of art programming.
2. **Design** the user interface using the Flutter basic UI components and widgets.
3. **Apply** the flutter UI concepts such as Layouts, Themes, Forms, Gestures and Animation.
4. **Develop** a flutter application using Asnyc Dart and Flutter and Infinite Scrolling and state management
5. **Apply** the file handling, using SQLite database, RESTful API calls and Firebase in app development.

Table-1: Mapping of COs to Pls, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1,2.1.2,2.2.2,3.1.1,3.4.2,	L2
CO2	1,2,3,5	1.4.1,2.1.2,2.2.2,3.1.1,3.4.2, 5.1.2,5.2.2	L3
CO3	1,2,3,5	1.4.1,2.1.2,2.2.2,3.1.1,3.4.2, 5.1.2, 5.2.2	L3
CO4	1,2,3,5,6,7	1.4.1,2.1.2,2.2.2,3.1.1,3.4.2, 5.1.2, 5.2.2 , 6.1.1, 7.1.1	L3
CO5	1,2,3,5	1.4.1,2.1.2,2.2.2,3.1.1,3.4.2, 5.1.2, 5.2.2	L3

Table-2: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2										2	3
CO2	2	3	3		3								2	3
CO3	3	3	3		3								2	3
CO4	3	3	3		3	2	1						2	3
CO5	3	3	3		3								2	3

TEXTBOOKS:

1. Eric Windmill, "Flutter in Action", Manning Publications, January 2020
2. Rap Payne, "Beginning App Development with Flutter: Create Cross-Platform Mobile Apps", Apress Publisher, December 2019
3. Ed Freitas, "Flutter Succinctly", 2019

REFERENCE BOOKS:

1. Marco L. Napoli, "Beginning Flutter: A Hands-On Guide to App Development", 2019
2. Kevin David Moore, Michael Katz, and Vincent Ngo "Flutter Apprentice (First Edition): Learn to Build Cross-Platform Apps", 2021

E-Books / Online Resources:

1. <https://dart.dev/guides/language/language-tour>
2. <https://flutter.dev/docs>

MOOC:

1. https://onlinecourses.nptel.ac.in/noc20_cs52/preview
2. The Complete Flutter Development Bootcamp with Dart offered by Udemy

SEE SCHEME:

Practical Examination will be conducted in the respective Laboratories for 50 marks

IOT DEVICE SECURITY						
Course code	:	21CSE109		CIE Marks	:	50
Hours / week(L:T:P:S:)	:	3-2-2-0		SEE Marks	:	50
Total teaching hours	:	39		Credits	:	03

Prerequisite

Teaching department(s): CSE & ECE

Course objectives

1. Understand IoT Architecture and potential security vulnerabilities
2. Learn cryptography fundamentals required for IoT Security
3. Understand attacks on IoT devices and commonly used security mechanisms
4. Learn about enhancing security of IoT devices by integrating secure element.

UNIT – I**Introduction to IoT Systems**

IoT Systems: Introduction to IoT, IoT Architecture, IoT threats / Security Vulnerabilities

Corner stone of Security: Authentication, confidentiality, Integrity, Non-repudiation and Availability. Authentication Mechanisms (Password, Bio, Single/multiple layer),

Cryptography: Data encryption techniques, Data encryption standards (AES, DES, ECB, CBC), Public Key Cryptography, RSA, ECC, Key Management - Public key certificate and key exchange, Message Digest (MD5, SHA256, HMAC, RIPEMD160), Digital Signature (ECDSA), Random number.

14 Hours**UNIT - II****Security by Design**

Attacks on IoT devices: TVR (Threat, Vulnerability, Risks), Attack technologies, Logical Attack, Invasive, Semi-Invasive and Non-Invasive Attacks

Threat modelling: Asset identification, Identify threats, threat mitigation/measures, Secure Software Development Life Cycle

IoT Security functions/defenses: Device Authentication, Key Provisioning, Secure Communication (TLS), Stored Data Protection, Secure boot, Secure SW/FW update

Security Concepts: "Software Security concepts - Integrity of program flow, data integrity, function parameter integrity, randomization, data masking, full comparison pattern, redundant decision making, Hardware Security concepts -

Memory and register encryption/masking, random number generator, Isolation, Secured Architecture (ROSI)"

16 Hours

UNIT - III

Device Security

Platform Security: TEE Overview, TrustZone, ARM PSA, Trusted FM

Secured MCUs: Overview, Security features

Secure Elements: Overview (Different form factor), Security features, Introduction to Optiga Trustx, Feature Set.

9 Hours

Course Outcomes

1. Understanding security threats for IoT Devices
2. Understand Cryptographic mechanisms relevant for IoT Device security
3. Threat modelling and Identification of defensive mechanisms
4. Understand the importance of hardware based security
5. Designing Secured edge devices

TEXTBOOKS:

1. Cryptography And Information Security - V K Pachgare
2. Practical Internet of Things Security - Brian Russell, Drew Van Duren

REFERENCE BOOKS:

1. Security in Embedded Devices - Catherine H. Gebotys

E Books / Articles

1. http://ethesis.nitrkl.ac.in/4170/1/Buffer_Overflow_Attacks_%26_Counter_measures.pdf
2. https://trustedconnectivityalliance.org/wp-content/uploads/2020/01/NFC_Secure_Element_Stepping_Stones_v1.0.pdf
3. <https://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-630.pdf>
4. https://www.dsci.in/sites/default/files/documents/resource_centre/IoT%20Security%20Guide.pdf

COMPILER DESIGN LAB						
Course Code	:	21CS604		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	0-0-2		SEE Marks	:	50
Total Hours	:	26		Credits	:	01

1. Design and implementation of Lexical Analyser and Syntax Analyser and as discussed in the Unit-I and UNIT-II of the syllabus.
2. Implementation of a mini project that involves Implementation of Lexical Analyser and Syntax Analyser.

BIG DATA ANALYTICS						
Course Code	:	21CS701		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Study and comprehend in depth the fundamental issues behind Big Data problem.
2. Understand various Big Data technologies, different databases and Hadoop Components.
3. Learn various NoSQL systems and Compare NoSQL systems with other and relational systems.
4. Determine various techniques for analyzing the data such as Pig and Hive.
5. Study and Relate different Analytics associated with Big Data problem.

UNIT – I

Chapter 1: What Is Big Data and Why Is It Important? Challenges of Big Data.

The Evolution of Data Management, Understanding the Waves of Managing Data, creating manageable data structures, Web and content management, Managing big data. Defining Big Data, building a Successful Big Data Management Architecture, beginning with capture, organize, integrate, analyze, and act, Setting the architectural foundation, Performance matters, Traditional and advanced analytics.

Chapter 2: Examining Big Data Types and its Sources.

Defining Structured Data Exploring sources of big structured data, Understanding the role of relational databases in big data Defining Unstructured Data, exploring sources of unstructured data, Understanding the role of a CMS in big data management. Looking at Real-Time and Non-Real-Time Requirements, Putting Big Data Together, managing different data types, integrating data types into a big data environment.

Chapter 3: Technology Foundations of Big Data.

Exploring the Big Data Stack: - Layer 0: Redundant Physical Infrastructure - Physical redundant networks, Managing hardware: Storage and servers, Infrastructure operations - Layer 1: Security Infrastructure, Interfaces and Feeds to and from Applications and the Internet- Layer 2: Operational Databases. Layer 3: Organizing Data Services and Tools. Layer 4: Analytical Data Warehouses, Big Data Analytics, Big Data Applications. (Text book: chapter 1,2,4)

15 Hours

UNIT – II

Chapter 4 : Big Data Management. Introduction to NoSQL, NewSQL

Introduction to NoSQL, Uses, Features and Types, Need, Advantages, Disadvantages and Application of NoSQL, Overview of NewSQL. RDBMSs Are Important in a Big Data Environment. PostgreSQL relational database. Nonrelational Databases. Key-Value Pair Databases - Riak key-value

database. Document Databases MongoDB, CouchDB . Columnar Databases, HBase columnar database. Graph Databases- Neo4J graph database.

Chapter 5 : MapReduce Fundamentals

Tracing the Origins of MapReduce. Understanding the map Function, Adding the reduce Function Putting map and reduce together.

(Text book:chapter 7,8)

15 Hours

UNIT – III

Chapter 6 : Hadoop Eco System and Analytics of Big data.

Explaining Hadoop, Understanding the Hadoop Distributed File System (HDFS) NameNodes. Data nodes, Under the covers of HDFS. Hadoop MapReduce. Getting the data ready, Let the mapping begin. Reduce and combine. Building a Big Data Foundation with the Hadoop Ecosystem, Managing Resources and Applications with Hadoop YARN, Storing Big Data with HBase, Interacting with Pig and Pig latin, Sqoop, Zookeeper.

Chapter 7: Defining Big Data Analytics. Basic analytics, Advanced analytics, Operationalized analytics, Monetizing analytics. Modifying Business Intelligence Products to Handle Big Data, Studying Big Data Analytics Examples.

(Text book: Chapter 9,10,12)

9 Hours

Course Outcomes:

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

1. **Outline** the theory of big data, and explain applications of big data.
2. **Analyse** the technological foundations for Big data with hadoop and **design** of hadoop distributed file system.
3. **Get** the idea of NoSQL databases, different types of NoSQL/NewSQL datastores.
4. **Understand** the concept of MapReduce workflow.
5. **Understand** the need of Big Data Analytics and **Analyze** Hadoop Ecosystem.

**Table-1: Mapping of COs to Pls,
POs and BTL**

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	2.1.3, 2.2.3, 2.2.4	L 3
CO2	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L 3
CO3	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1	L 3
CO4	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L 4
CO5	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.2	L 4

**Table-2: Mapping Levels of COs to
POs / PSOs**

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3												3
CO2	3	3	3											3
CO3	3	3												3
CO4	2	2	3											3
CO5	3	3												3

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXTBOOK:

1. Judith Hurtiwz, Alan Nugent, Dr. Fern Halper, Marica Kaufman “Big Data for Dummies” A wiley Brand.

REFERENCE BOOKS:

1. Minelli, Chambers, Dhiray, “Big Data Big Analytics”, Wiley, 2013.
1. Bart Baesens, “Analytics in a Big Data World”, Wiley, 2014.
2. Boris Lublinsky, Kevin T. Smith, “Hadoop Solutions”, Wrox, First Edition, 2013
3. Chuck Lam, “Hadoop in Action”, Dreamtech, 2011.
4. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley, 2017.
5. Alex Holmes, “Big Data Black Book”, Dreamtech, 2015.

E-Books / Online Resources:

1. ftp://public.dhe.ibm.com/software/pdf/at/SWP10/Big_aa_Analytics.pdf
1. <https://www.wileyindia.com/big-data-analytics-2ed.html>

MOOCs:

1. <https://www.coursera.org/specializations/big-data>
1. nptel.ac.in/courses/106104135/48

CRYPTOGRAPHY AND NETWORK SECURITY						
Course Code	:	21CS702		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:**This Course will enable students to**

1. Outline the basic principles of Network security and its applications.
1. Design various block ciphers and design various cryptographic algorithms.
2. Use the theorems needed for cryptographic operations and compare & contrast different types of cryptography.
3. State the concepts & uses of Digital signature and web security.
4. Demonstrate the need and summarize the concept of Secure Electronic Transactions & Intrusion detection system.

UNIT – I

Overview: Services, Mechanisms and Attacks. A Model of Network Security.

Conventional Encryption Techniques : Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.

Block Cipher and the Data Encryption Standard: Simplified DES. Block Cipher Principles. The Data Encryption Standard, the Strength of DES, Block Cipher Design Principles, Block Cipher Modes of Operations. Triple DES, Blowfish, Random Number Generation .

15 Hours**UNIT – II**

Number Theory: Group, cyclic groups, Modular arithmetic operation, GCD operation. Prime Numbers, Fermat's and Euler's Theorems, Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm, attacks on RSA, Key Management: Diffie- Hellman Key Exchange. Digital signature, DSS, Elliptic Curve Cryptography.

Network Security: Electronic Security, pretty good privacy, IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining Security Associations.

15 Hours

UNIT – III

Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction. Intruders, Viruses, and Worms: Viruses and Related Threats, Firewalls: Firewall Design Principles, Trusted Systems.

9 Hours

Course Outcomes:

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

1. **Identify** Explain basic network security model and its applications.
2. **Design and Classify** various block ciphers and its usages.
3. **Apply** and Illustrate the concept public key cryptography & apply digital signatures in email processing.
4. **Describe** different techniques used in key exchange protocols.
5. **Apply the knowledge of** usages of email-security, IP security and web security.

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1, 2,	1.1.1, 1.3.1, 2.1.3,	L1, L2,
CO2	2,3	2.1.1, 2.1.2, 2.3.1, 3.1.1,3.1.2,3.1.3, 3.2.1,3.2.2	L2, L3
CO3	1, 2,	1.4.1, 2.1.3, 2.3.2	L2, L3
CO4	1, 2, 3	1.4.1, 2.1.3, 2.3.2, 3.2.2	L2, L3
CO5	1, 2,	1.4.1, 2.3.1	L2, L3

Table-2: Mapping Levels of COs to POs / PSOs													
COs	Program Outcomes (POs)												PSOs
	1	2	3	4	5	6	7	8	9	10	11	12	1 2

CO1	3	3											2	3
CO2		2	3										2	2
CO3	2	3											3	3
CO4	2	2	3										2	3
CO5	2	3											2	3

TEXTBOOKS:

1. William Stallings, "Cryptography and Network Security", Third Edition, Pearson Education, 2003.
1. W. Stallings, Prentice Hall, 2005. Applied cryptography, 2nd edition, B. Schneier, John Wiley & Sons, 1996.

REFERENCE BOOKS:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private communication in a Public World", Second Edition, Pearsdon Education Asia, 2002.
1. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.

E-Books / Online Resources:

1. https://wanguolin.github.io/assets/cryptography_and_network_security.pdf
1. <https://www.wileyindia.com/cryptography-and-security.html>

MOOC:

1. <http://nptel.ac.in/courses/106105031/>
1. <https://www.mooc-list.com/tags/cybersecurity>

SEE Scheme:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

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Professional Elective Courses-II

OBJECT ORIENTED MODELLING AND DESIGN

Course Code	:	21CSE201	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	:	50
Total Hours	:	39	Credits	:	03

Course Learning Objectives:

This course will enable students to:

1. Recall the object-oriented concepts, three pillars of object-orientation and their benefits.
1. Illustrate the various models that can be used to demonstrate the object-oriented design of any real world software systems.
2. Make use of use-cases for interpreting the requirements and develop class diagrams that model both the domain state model and design model of a software system.
3. Examine the dynamic aspects of a software system, model the interaction diagrams to justify those aspects.
4. Relate how the UML constructs are used to represent various models.

UNIT – I

Introduction:

What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history.

Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary associations;

(Text Book-1: Chapter 1 to 4.3)

Advanced Class Modeling: Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

Advanced State Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model;

Relation of class and state models; Practical tips.

Interaction Modeling: Use case models; Sequence models; Activity models; Use case relationships; Procedural sequence models; Special constructs for activity models

(Text Book-1: Chapter 4.4,5,6 ,7)

15 Hours

UNIT – II

Process Overview, System Conception: Development stages; Development life cycle, Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Application Analysis: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.

(Text Book-1: Chapter 10,11,12, 13)

System Design: Overview; Estimating performance; Making a reuse plan; Breaking a system in to sub- systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

(Text Book-1: Chapter 14)

15 Hours

UNIT – III

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Re-cursing downwards, Re-factoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example

Implementation Modeling: Overview of implementation; Fine- tuning classes; Fine-tuning generalizations; Realizing associations; Testing

Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

(Text Book-1: Chapter 15,16,17,23)

9 Hours

Course Outcomes:

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

1. **Acquire** Knowledge about different software systems modelling techniques, class design and associations by **making use of** concept diagrams
1. **Illustrate** Advanced Class, State and Interaction models of software systems **utilizing** class, state and interaction diagrams
2. **Outline** the system concepts, Development Life Cycle, **Analyse** and **Define** Problem Statement, **Analyse** the system domain, application, class, state and interaction models
3. **Overview** of system design, **estimate** performance, **divide** it into subsystems, managing resources, selecting appropriate architectural styles
4. **Describe** class design, Implementation modelling, Legacy systems and Reverse engineering concepts, **realizing** use cases, associations, **Fine Tuning** Classes, **Constructing** Interaction and State models.

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.2.1, 1.3.1, 1.4.1, 1.4.2, 2.1.1, 2.2.3	L3
CO2	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L3
CO3	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1	L4
CO4	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 3.2.2	L4
CO5	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.2, 2.2.1, 2.2.2	L3

TEXTBOOK:

1. Object-Oriented Modeling and Design with UML, Michael Blaha, James Rumbaugh, 2nd Edition, Pearson Education, 2005

REFERENCE BOOKS:

1. Object-Oriented Analysis and Design with Applications, Grady Booch et al, 3rd Edition, Pearson Education, 2007.
1. Practical Object-Oriented Design with UML, Mark Priestley, 2nd Edition, Tata McGraw-Hill, 2003.
2. Object-Oriented Design with UML and JAVA, K. Barclay, J. Savage, Elsevier, 2008.
3. The Unified Modeling Language User Guide, Booch, G., Rumbaugh, J., and Jacobson I, 2nd Edition, Pearson, 2005.
4. Object-Oriented Systems Analysis and Design Using UML, Simon Bennett, Steve McRobb and Ray Farmer, 2nd Edition, Tata McGraw-Hill, 2002.

E-Books / Online Resources:

1. Object-Oriented Analysis and Design with Applications, Grady Booch, Robert A. Maksimchuk, Michael W. Engel, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Third Edition The Addison-Wesley Object Technology Series, 2007
1. Object-Oriented Modeling and Design with UML, James R Rumbaugh, Michael R. Blaha Pearson Education, 21-Nov-2011
2. Object-Oriented Analysis and Design, Ramnath, Sarnath, Dathan, Brahma, ISBN 978-1-84996-522-4, Springer Publications, 2011.

MOOC:

1. Object-Oriented Design, <https://www.coursera.org/learn/object-oriented-design>

Object-Oriented Analysis and Design

<https://nptel.ac.in/courses/106/105/106105153/#>

SEE Scheme:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

CYBER SECURITY					
Course Code	:	21CSE202	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	:	50
Total Hours	:	39	Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Understand the fundamental concepts of cyber security and the attacker techniques and impact.
1. Understand the behavior, types and the impact of malicious code on to the cyber system and the techniques used by the hackers.
2. Understand the various defensive tools and policies need to be followed.

UNIT – I

INTRODUCTION TO COMPUTER SECURITY:

Introduction, How Seriously Should You Take Threats to Network Security, Identifying Types of Threats - Malware, Compromising System Security, Denial of Service Attacks, Web Attacks, Session Hijacking, DNS Poisoning; Assessing the Likelihood of an Attack on Your Network, Basic Security Terminology - Hacker Slang, Professional Terms; Concepts and Approaches, How Do Legal Issues Impact Network Security? Online Security Resources – CERT, Microsoft Security Advisor, F-Secure, SANS Institute.

CYBER STALKING, FRAUD, AND ABUSE:

Introduction, How Internet Fraud Works - Investment Offers, Auction Frauds; Identity Theft – Phishing; Cyber Stalking - Laws about Internet Fraud; Protecting Yourself against Cyber Crime - Protecting against Investment Fraud, Protecting against Identity Theft, Secure Browser Settings.

DENIAL OF SERVICE ATTACKS:

Introduction, Denial of Service, illustrating an Attack - Common Tools Used for DoS, DoS Weaknesses, Specific DoS attacks, Land Attack, Distributed Denial of Service (DDoS).

15 Hours

UNIT – II

MALWARE:

Introduction, Viruses - How a Virus Spreads, Recent Virus Examples, W32/Netsky-P, Troj/Invo-Zip, MacDefender, The Sobig Virus, The Mimail Virus, The Bagle Virus, A Nonvirus Virus, Rules for Avoiding Viruses; Trojan Horses, The Buffer-Overflow Attack, The Sasser Virus/Buffer Overflow, Spyware - Legal Uses of Spyware, How Is Spyware Delivered to a Target System? Obtaining Spyware Software;

Other Forms of Malware – Rootkit, Malicious Web-Based Code, Logic Bombs, Spam; Detecting and Eliminating Viruses and Spyware - Antivirus Software, Antispyware Software.

TECHNIQUES USED BY HACKERS:

Introduction, Basic Terminology, The Reconnaissance Phase - Passive Scanning Techniques, Active Scanning Techniques; Actual Attacks - SQL Script Injection, Cross-Site Scripting, Password Cracking.

INDUSTRIAL ESPIONAGE IN CYBERSPACE:

Introduction, What Is Industrial Espionage? Information as an Asset, Real-World Examples of Industrial Espionage - Example 1: VIA Technology, Example 2: General Motors, Example 3: Interactive Television Technologies, Inc, Example 4: Bloomberg, Inc, Example 5: Avant Software, Industrial Espionage and You; How Does Espionage Occur? - Low-Tech Industrial Espionage, Spyware Used in Industrial Espionage, Steganography Used in Industrial Espionage; Phone Taps and Bugs, Protecting against Industrial Espionage, Industrial Espionage Act, Spear Phishing.

15 Hours

UNIT – III

COMPUTER SECURITY SOFTWARE:

Introduction, Virus Scanners - How Does a Virus Scanner Work? Virus-Scanning Techniques, Commercial Antivirus Software; Firewalls - Benefits and Limitation of Firewalls, Firewall Types and Components, How Firewalls Examine Packets, Firewall Configurations, Commercial and Free Firewall Products, Firewall Logs; Antispyware, Intrusion-Detection Software - IDS Categorization, IDS Approaches, Snort, Honey Pots, Other Pre-emptive Techniques.

SECURITY POLICIES:

Introduction, What Is a Policy, Defining User Policies – Passwords, Internet Use, Email Usage, Installing/Uninstalling Software, Instant Messaging, Desktop Configuration, Final Thoughts on User Policies; Defining System Administration Policies - New Employees, Departing Employees, Change Requests, Security

Breaches, Virus Infection, Denial of Service Attacks, Intrusion by a Hacker; Defining Access Control, Developmental Policies, Standards, Guidelines, and Procedures.

9 Hours

Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

Table-2: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3											3	
CO2	3	3											3	
CO3	2	3											3	
CO4	3	2											3	
CO5	3	2						1				3	3	

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.3.1, 2.1.2, 2.2.2, 2.4.3	L2
CO2	1, 2	1.3.1, 2.1.2, 2.2.2, 2.4.3	L3
CO3	1, 2	1.3.1, 2.1.2, 2.2.1, 2.4.3	L2
CO4	1, 2	1.3.1, 2.4.4	L3
CO5	1, 2, 8, 12	1.3.1, 2.4.4, 8.1.1, 12.2.2	L3

Course Outcomes:

Upon completion of this course, students will be able to:

1. **Discuss** the various threats approaches on the cyber system.
1. **Interpret** the threat impact on the cyber system.
2. **Identify** the nature and varying structures of the malicious code and the techniques used by the hackers that is harm to the security.
3. **Recognize** the defense tools available to protect the cyber systems.
4. **Interpret** the associated security policies need to be followed.

TEXTBOOK:

1. Chuck Easttom, "Computer Security Fundamentals", Pearson publication, second edition.

REFERENCE BOOKS:

1. William Stalling, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson Education.
1. Karen Scarfone, Peter Mell "Guide to Intrusion Detection and Prevention Systems (IDPS)", NIST special publication 800-94.
2. Cyber Security –Nina godbole, SunitBelapure, Publication: John Wiley, 2012.
3. Allan Friedman and P. W. Singer, "Cybersecurity and Cyberwar: What Everyone Needs to Know", Oxford University Press, published in 2013.
4. [Yuri Diogenes](#), [ErdalOzkaya](#), "[Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics \(Kindle Edition\)](#)", published by Packt publishing ltd. 2018.
5. Don Franke, "Cyber Security Basics: Protect Your Organization by Applying the Fundamentals", CreateSpace Independent Publishing Platform, 2016.
6. Joseph Steinberg, "Cybersecurity for Dummies", John Wiley & Sons, 2019.
7. [RaefMeeuwisse](#), "Cybersecurity for Beginners", Cyber Simplicity, 2017.
8. Amelia Phillips, Bill Nelson, and Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, 2009, fourth edition.
9. [Scott Augenbaum](#), "The Secret to Cybersecurity: A Simple Plan to Protect Your Family and Business from Cybercrime", publisher-Simon and Schuster, 2019.

E-BOOKS / ONLINE RESOURCES:

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
1. <http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf>
2. <http://docshare04.docshare.tips/files/21900/219006870.pdf>
3. <http://www.uou.ac.in/sites/default/files/slm/FCS.pdf>
4. https://cyber-cops.com/book_detail
5. <https://www.sans.org/security-resources/>
6. <https://www.springboard.com/blog/free-cybersecurity-resources/>
7. <https://www.eccouncil.org/free-cybersecurity-resources/>
8. <http://nptel.ac.in/courses/106105031/40>
9. <http://nptel.ac.in/courses/106105031/39>
10. <http://nptel.ac.in/courses/106105031/38>

MOOC:

1. www.coursera.org/course/inforisk
1. <https://www.cyberdegrees.org/resources/free-online-courses/>
2. https://swayam.gov.in/nd2_cec20_cs15/preview
3. <https://www.classcentral.com/course/swayam-cyber-security-13978>
4. <https://www.futurelearn.com/courses/introduction-to-cyber-security>
5. <https://www.my-mooc.com/en/categorie/cybersecurity>

SEE Scheme:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

BLOCKCHAIN TECHNOLOGY					
Course Code	:	21CSE203		CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	: 50
Total Hours	:	39		Credits	: 03

Course Learning Objectives:

This Course will enable students to:

1. Understand conceptual working of block chain technology.
1. Devise the block chain technology to innovate and improve business processes.
2. Get the idea of working with Ethereum and Smart Contracts in Block Chain Environment.
3. Solving real-world problems using Remix IDE and Truffle.
4. Describe and illustrate the idea of Hyperledger Fabric.

UNIT – I

Introduction: What Is the Blockchain? What is Bitcoin? The Connected World and Blockchain: The Fifth Disruptive Computing Paradigm. How blockchain works? How blockchain accumulates blocks? Tiers of blockchain technology, Features of a blockchain, Types of blockchain.

Blockchain Currency: Technology Stack: Blockchain, Protocol, Currency, The Double-Spend and Byzantine Generals' Computing Problems, How a Cryptocurrency Works.

Benefits and limitations of blockchain : Technical Challenges, Business Model Challenges, Scandals and Public Perception, Government Regulation, Privacy Challenges for Personal Records, Overall: Decentralization Trends Likely to Persist.

Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in blockchain, CAP theorem and blockchain

(Test Book 1 : Chapter 1,6 TextBook 2 : Chapter 1)

15 Hours

UNIT – II

Decentralization: Decentralization using blockchain, Methods of decentralization, How to decentralize, Computing power and decentralization, DO, DAO,DAC,DAS,Dapps,

Ethereum and Smart Contracts: Definition, Ricardian contracts, Deploying

smart contracts on a blockchain, Ethereum Blockchain, Ethereum Network, Components of the Ethereum, ecosystem, Ether cryptocurrency, Introducing Solidity, Global Variables and Functions, Expressions and Control Structures, Writing Smart Contracts, Truffle Basics and Unit Testing, Debugging Contracts Remix IDE: Programs execution.

(TextBook 2: Chapter 1,2,9,10 Text Book 3: Chapter 3,4,5,6,9,10)

15 Hours

UNIT – III

Hyperlegder: Fabric, The reference architecture, Requirements and design goals of Hyperledger Fabric, Membership services, Blockchain services, Components of the fabric, Chain code implementation, The application model, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric

(TextBook 2: Chapter 15)

9 Hours

Course Outcomes:

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

1. Explain the block chain technology.
1. Understand the significance of Consensus and working of cryptocurrency.
2. Develop block chain-based solutions and write smart contract using Remix IDE and Ethereum frameworks.
3. Build and deploy block chain application using Truffle Suite.
4. Create and deploy a block chain network using Hyperledger Fabric SDK

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.3.1, 1.4.1, 2.2.1	L2
CO2	1,2	1.3.1, 2.2.4, 2.4.3, 6.2.1	L2
CO3	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.1, 3.4.2,3.4.3	L3
CO4	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.1, 3.4.2,3.4.3	L3
CO5	1,2,3	1.4.1, 2.1.3, 3.4.2,3.4.3	L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2												2
CO2	2	2							1			1		2
CO3	2	3	2	2	3				2			1		2
CO4	2	3	2	2	3				1			1		2
CO5	2	3	2	2	3				1			1		2

3: Substantial (High)**2: Moderate (Medium)****1: Poor****(Low)****TEXTBOOKS:**

1. Melanic Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015.
1. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing.
2. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing

REFERENCE BOOKS:

1. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
1. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners-Guide to Block chain Technology and Leveraging Block Chain Programming".
3. Daniel Drescher, "Block Chain Basics", Apress; 1st edition, 2017.

MOOC Courses:

1. <https://www.coursera.org/specializations/blockchain>
2. <https://www.edx.org/learn/blockchain>
3. <https://nptel.ac.in/courses/106/105/106105184/>

SEE Scheme:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit - II** and **1** full question from **Unit - III**.

SOFTWARE TESTING					
Course Code	:	21CSE204		CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	: 50
Total Hours	:	39		Credits	: 03

Course Learning Objectives:**This Course will enable students to:**

1. Explain the concept of testing and the testing life cycle.
1. Use the testing frameworks, process and test management to generate the test plans.
2. Generate the test plans for a business.
3. Illustrate the use of automation in testing.
4. Perform defect management and data management.

UNIT – I**INTRODUCTION TO TESTING – WHY AND WHAT:**

Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of STLC

SOFTWARE TESTING LIFE CYCLE – V MODEL:

SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing: Functional Testing, API Testing, Usability Testing, Exploratory Testing, Ad-hoc Testing. Static Testing:

Static techniques, reviews, walkthroughs

BASICS OF TEST DESIGN TECHNIQUES:

Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

14 Hours**UNIT – II****TEST MANAGEMENT:**

Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management.

DEFECT MANAGEMENT:

Test Execution, logging defects, defect lifecycle, fixing / closing defects. Use of Bugzilla for logging and tracing defects.

TEST DATA MANAGEMENT:

Test Data Management –Overview, Why Test Data Management, Test Data Types, Need for Test Data Setup, Test Data Setup Stages, Test data management Challenges. Creating sample test data using MS-Excel.

16 Hours

UNIT – III

BASICS OF AUTOMATION TESTING:

Introduction to automation testing, why automation, what to automate, tools available for automation testing.

BASICS OF AUTOMATION TESTING USING SELENIUM:

Introduction to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing, understanding TestNG framework with Selenium Web driver for automation testing, Introduction to Maven automation tool.

09 Hours

Course Outcomes:

Upon Completion of this course students will be able to:

1. Apply the knowledge of engineering to understand the various terms and techniques used in testing domain.
1. Identify the different phases of software testing life cycle and types of testing.
2. Analyze test management and test data management processes.
3. Analyze defect management life cycle and use open source tool for defect management.
4. Design test case and formulate automation testing with demonstration of open source testing tool.

Graduate Attributes (GA)

This course will map the following GA as per NBA:

1. Engineering Knowledge
1. Design / development of solutions
2. Conduct investigation of complex problems
3. Modern tool usage
4. The engineer and society
5. Ethics
6. Life-long Learning

TEXTBOOKS:

1. Rex Black , “Managing the Testing Process”,2nd edition, John Wiley & Sons, 2001
1. Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black,” Foundations of software testing”, Cengage Learning EMEA, 2008.
2. Elfriede Dustin, “Implementing Automated Software Testing: How to Save Time and Lower Costs While Raising Quality”, Addison-Wesley Professional,2009

REFERENCE BOOKS:

1. Paul C. Jorgensen,” Software Testing, A Craftsman’s Approach”, Third Edition, Auerbach Publications, 2008
1. Mauro Pezze, Michal Young,” Software Testing and Analysis –Process”, Principles and Techniques, Wiley India, 2009.

E-Books / Online Resources:

1. <https://www.softwaretestinghelp.com/selenium-tutorial-1/>
1. <http://softwaretestingfundamentals.com/software-testing-methods/>
2. [https://www.tutorialspoint.com/software_testing/software_testing_tutorial.p
df](https://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf)
3. <http://docs.seleniumhq.org/docs/>
4. <http://www.seleniumhq.org/download/>

MOOC:

1. <http://nptel.ac.in/courses/106105150/>
1. <https://freevidelectures.com/course/3625/testing-with-selenium>

CLOUD COMPUTING

Course Code	: 21CSE205	CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	: 3-0-0-0	SEE Marks	: 50
Total Hours	: 39	Credits	: 03

Course Learning Objectives:

This course will enable students to:

1. Outline the fundamental ideas behind Cloud computing, and the evolution of the paradigm, its applicability; benefits as well as current and future challenges.
1. Get the basic idea and principles in Datacenter design and Management and find the importance of Virtualization in Cloud.
2. Get the idea of different Cloud deployment models and Cloud Delivery Models and their security issues.
3. Tell how Cloud Computing solves different problems in the present by considering different Cloud Vendors and their Cloud Design architecture.

UNIT – I

Eras of computing, Parallel vs. Distributed Computing, Elements of Parallel Computing- (What is parallel computing, hardware architecture for Parallel processing, approaches to parallel programming, levels of parallelism, Laws of caution). Elements of Distributed Computing- (General concepts and definitions, components of a distributed system, Architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing- Remote procedure call, Service oriented computing). Classic data center, its elements, challenges and benefits. Data center management Steps in transitioning to cloud- consolidation, automation, IT as a service.

Cloud computing Architecture: - Introduction, Cloud reference models- (Architecture, Infrastructure/Hardware as a service, Platform as a service, Software as a service), Types of cloud – (Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds), Economics of cloud, Open challenges.

15 Hours

UNIT – II

Virtualization: – Introduction, Characteristics Of Virtualized Environments, Taxonomy Of Virtualization Technique- (Execution Of Virtualization, Other Types Of Virtualization-Compute, Storage, Network, Desktop, Application). Virtualization And Cloud Computing, Pros And Cons Of Virtualization, Technology Examples- Xen, Vmware, Microsoft Hyper-V.

Security Concerns, Risk Issues: - Cloud Computing- Security Concerns. A Closer Examination: Virtualization, A Closer Examination: Provisioning. Securing the Cloud: Key Strategies and Best Practices: - Overall Strategy: Effectively Managing Risk-**Risk Management:** Stages and Activities. Overview of Security Controls, Cloud Security Controls Must Meet Your Needs, NIST Definitions for Security Controls, the Cloud Security Alliance Approach. The Limits of Security Controls – Security Exposure Will Vary over Time, Exploits Don't Play Fair. **Best Practices:** Best Practices for Cloud Computing- First Principals, Best Practices across the Cloud Community. Other Best Practices for Cloud Computing- Cloud Service Consumers, Cloud Service Providers. Security Monitoring.

15 Hours

UNIT – III

The Purpose of Security Monitoring, Transforming an Event Stream, The Need for C.I.A. in Security

Monitoring, the Opportunity for MaaS.

Case studies: Public cloud- AWS, Windows Azure, Google App Engine. Private Cloud- Open stack, Eucalyptus.

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. **Discuss** the concept of cloud computing and explain the history of computing by comparing the various forms of computing.
2. **Describe** the cloud reference model and explain the cloud services offered depending on the types of the available cloud.
3. **Describe** the Virtualization at all levels used by XEN, Vmware, Hyper-v.
4. **Explain** the security risk and monitoring concepts in cloud computing.
5. **Summarize** the case studies of public cloud such as AWS, Google App Engine and private cloud such as Open Stack.

Table-1: Mapping of COs to Pls, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.3.1, 2.2.2	L3
CO2	1, 2	1.4.1, 2.2.1	L3
CO3	1, 2	1.3.1, 2.2.3	L3
CO4	1, 2	1.4.1, 2.2.3	L3
CO5	1, 2	1.3.1, 1.4.1, 2.2.2	L3

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)											PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3										2		3	
CO2	3	3										2		3	
CO3	3	3										1		3	
CO4	3	3										2		3	
CO5	3	3										1		3	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXTBOOKS:

1. Buyya, Rajkumar, Christian Vecchiola and ThamaraiSelvi, "Mastering Cloud Computing Fundamentals and Applications Programming", McGraw Hill, 2013.
1. Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures", 3rd Edition, PHI 2001. Winkler, Vic (J.R), "Securing the Cloud - Cloud Computer Security Techniques and Tactics.", Elsevier Inc, 2012.

REFERENCE BOOKS:

1. Hurwitz, Judith, "Cloud computing for dummies.", Wiley India Pvt Ltd, 2011.
1. Rittinghouse, John, "Cloud computing – implementation, management and security", CRC Press, First edition, 2009.
2. Velte, Toby, Anthony Velte and Robert Elsenpete. "Cloud Computing, A Practical Approach.", Tata McGraw-Hill Authors, 2010. J K Sharma, "Discrete Mathematics", 3rd edition, 2013, Macmillan India Ltd.

E-Books / Online Resources:

1. www.motc.gov.qa/sites/default/files/cloud_computing_ebook.pdf.
1. http://eddiejackson.net/web_documents/The_Definitive_Guide_to_Cloud_Computing.pdf.

MOOCs:

1. <http://nptel.ac.in/courses/106106129/28>
1. <https://www.coursera.org/learn/cloud-computing>

There will be 8 questions of 20 marks each in the question paper divided into 3 Units as per the syllabi & contact hours and the student will have to answer 5 full questions, selecting 2 full questions from Unit - I & Unit – II and 1 full question from Unit – III.

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EMBEDDED SECURE ELEMENT						
Course Code	:	21CSE206		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

1. Understand the architecture of secure elements
1. Learn Java Card applet programming
2. Learn about industry standards and domain specifications in the context of secure elements
3. Understand Global Platform and card content management

UNIT - I

Hardware architecture: I/O System, CPU, Memory (RAM, EEPROM, FLASH), Co-Processors.

Packaging: Surface Mount Devices (VQFN, XQFN, USON8)

Software architecture (OS Layers): I/O interface, Hardware Abstraction Layer, Application Layer, Crypto Library

Industry standards and certification schemes: Connectivity standard alliance, Cybersecurity, Labelling Scheme, ARM PSA, Payment Wearables, Digital Identity Tokens, FIPS Certification.

Java Card architecture: Comparison of Java Card Architecture - Java , why JCRE and JCVM; JCVM, JCRE, JC API, JC Applets, JC Library packages; Approach to Applet development (tools, build flow, cap..); Data Objects, File Structure and command APDUs

17 Hours**UNIT – II****Java Card applet programming**

Applet architecture: Java Card Objects, Atomicity and Transactions, Exception Handling, Handling Command APDUs Design & Develop your Applet

17 Hours

UNIT - III

Global Platform for Secure Element content management

Architecture, Security Domains, Secure Element and Application Management, Secure Communications, Command References.

5 Hours

Course Outcomes

1. Usage of Secure element (SE) as per Industry specific standards for applications such as payments, IoT security solutions .
1. Learning Java Card architecture - typically used Operating system for secure elements
2. Design and development of Java card applets
3. Understand purpose of Global platform specifications, SE content management.

TEXTBOOKS:

1. Java Card Technology for Smart Cards - Zhiqun Chen
2. Smart Card Handbook, Wolfgang Rankl, Wolfgang Effing

REFERENCE BOOKS:

Smart Cards, Tokens, Security and Applications- Keith Mayes, Konstantinos Markantonakis

EBooks / Article

1. <https://www.oracle.com/java/java-card/>
2. <https://globalplatform.org/specs-library/card-specification-v2-3-1/>

Professional Elective Courses-III

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS						
Course Code	:	21CSE301		CIE Marks	:	5
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	:	5
Total Hours	:	39		Credits	:	0

Course Objectives:

This Course will enable students to:

1. Outline the various architectural influences and its qualities on the organizational requirements.
1. Make use of different case studies to critically evaluate the suitability of a software architecture.
2. Develop the architecture using different architecture styles.
3. Choose the different architectural pattern and design patterns to design the architecture that enhances the architectural capabilities.
5. Document the software architecture to communicate the system evolution strategy to the stakeholder.

UNIT - I**INTRODUCTION:**

The Architecture Business Cycle: Where do architectures come from? Software processes and the architecture business cycle; What makes a “good” architecture? What software architecture is and what it is not; Other points of view; Architectural patterns, reference models and reference architectures; Importance of software architecture; Architectural structures and views (**Text Book-1: Chapter 1: 1.1, 1.2, 1.3, Chapter 2: 2.1, 2.2, 2.3, 2.4, 2.5**)

QUALITY: Functionality and architecture; Architecture and quality attributes; System quality attributes; Quality attribute scenarios in practice; Other system quality attributes; Business qualities; Architecture qualities. Achieving Quality: Introducing tactics; Availability tactics; Modifiability tactics; Performance tactics; Security tactics; Testability tactics; Usability tactics. (**Text Book-1: Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, Chapter 5: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7**).

15 Hours

UNIT - II

ARCHITECTURAL STYLES AND CASE STUDIES: Architectural styles; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Repositories; Interpreters; Process control; Other familiar architectures; Heterogeneous architectures. Case Study: Mobile robotics.

(Text Book-2: Chapter 2: 2.1, 2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10, Chapter 3:3.3)

ARCHITECTURAL PATTERNS: Introduction, Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control. Adaptable Systems: Microkernel. **(Text Book-2: Chapter 2: 2.1, 2.3,2.4,2.5)**

15 Hours

UNIT – III

DESIGNING AND DOCUMENTING SOFTWARE ARCHITECTURE: Architecture in the life cycle; designing the architecture; Forming the team structure; Creating a skeletal system. Uses of architectural documentation; Views; choosing the relevant views; Documenting a view; Documentation across views. **(Text Book-1: Chapter 7: 7.1, 7.2,7.3,7.4, Chapter 9: 9.1,9.2,9.3,9.4,9.5)**

9 Hours

Course Outcomes:

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

1. **Identify** the requirements which influence the architecture and development strategy.
2. **Analyze** the architecture using different case studies and quality attributes.
3. **Recognize** architecture styles to design the architecture.
4. **Apply** different architecture patterns and design patterns to develop architecture that yields the system that has new organizational capabilities and requirements.
5. **Describe** the different views to document the architecture.

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.3.1, 2.1.1	L2
CO2	1,2,3	1.4.1,2.2.3,3.2.2	L3
CO3	1,2,3	1.3.1,2.1.2	L2
CO4	1,2,3	1.4.1, 2.1.2,3.2.1	L3
CO5	1,2	1.4.1, 2.1.3	L2

Table-2: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3											2	3
CO2	1	2	3										2	3
CO3	1	2												3
CO4	1	2	3											3
CO5	2	3												3

3: Substantial (High)
(Low)

2: Moderate (Medium)

1: Poor

TEXTBOOKS:

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice", Second Edition, Pearson Education, 2003.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern-Oriented Software Architecture", A System of Patterns -Volume 1, John Wiley and Sons, 2006.
3. Mary Shaw and David Garlan, "Software Architecture-Perspectives on an Emerging Discipline", Prentice-Hall of India, 2007.

REFERENCE BOOKS:

1. E. Gamma, R. Helm, R. Johnson, J. Vlissides, "Design Patterns- Elements of Reusable Object-Oriented Software ", Addison- Wesley, 1995.

E-Books / Online Resources:

1. <http://www.hillside.net/patterns/>
1. https://www.cs.cmu.edu/afs/cs/project/vit/ftp/pdf/intro_softarch.pdf
2. <https://www.ics.uci.edu/~yuzok/software-architecture.html>

MOOC:

1. <http://www.nptel.ac.in/syllabus/106104027/>
2. <https://www.coursera.org/learn/software-architecture>

SEE Scheme:

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

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DEEP LEARNING						
Course Code	:	21CSE302		CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0		SEE Marks	:	50
Total Hours	:	39		Credits	:	03

Course Learning Objectives:

This course will enable students to:

1. Explain the importance and basics of deep learning
1. Outline the structure of neural network and the process of training in neural networks
2. Describe the structure and working of convolution neural networks.

UNIT – I

Introduction: What is Deep Learning? What are Neural Networks? Neural networks basics: cost functions, hypotheses and tasks; training data; maximum likelihood-based cost, cross entropy, MSE cost; feed-forward networks; MLP, sigmoid units; neuroscience inspiration;

15 Hours

UNIT – II

Neural Networks Training: Learning in neural network: output vs hidden layers; linear vs nonlinear networks; Back propagation: learning via gradient descent; recursive chain rule (backpropagation); if time: bias-variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU; Deep learning strategies: GPU training, regularization, RLUs, dropout.

Convolution Neural Networks: Invariance, stability, Variability models (deformation model, stochastic model), Scattering networks, Group Formalism, Properties of CNN representations: invertibility, stability, invariance,

15 Hours

UNIT – III

Covariance/invariance: capsules and related models, Connections with other models: dictionary learning, LISTA, localization, regression, Embeddings (DrLim), inverse problems, Extensions to non-Euclidean domains.

Deep Neural Networks for Sequences: Recurrent Neural Networks: RNN for language modelling and other tasks

9 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate the importance and basic of deep learning.
2. Illustrate the various training methods of neural network.
3. Explain the concept of convolution and apply this for neural network design.
4. Explore and develop neural network models
5. Apply Convolution neural networks and recurrent neural networks for real world Problems

Table-1: Mapping of COs to Pls, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.1.1, 2.1.3, 2.2.3	L2, L3
CO2	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1,	L2, L3
CO3	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1	L2, L3
CO4	1,2	1.4.1, 2.1.2, 2.2.5, 2.3.1, 3.2.2	L2, L3, L4
CO5	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.2	L2, L3, L4

Table-2: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3											3	
CO2	3	3											3	
CO3	3	3	2										3	
CO4	3	3											2	3
CO5	3	3	2										3	2

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

TEXTBOOK:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville , “Deep Learning”,Cambridge: MIT press, 2016.

REFERENCE BOOKS:

1. Duda, R.O., Hart, P.E., and Stork, D.G.,”Pattern Classification”, Wiley-Interscience. Second Edition. 2001.
2. Theodoridis, S. and Koutroumbas, K.,”PatternRecognition”,Fourth Edition, Academic Press, 2008.
3. Russell, S. and Norvig, N, Artificial Intelligence: “A Modern Approach”, Prentice Hall Series in ArtificialIntelligence. 2003.

4. Bishop, C. M., "Neural Networks for Pattern Recognition", Oxford University Press. 1995.
5. Hastie, T., Tibshirani, R. and Friedman, J, "The Elements of Statistical Learning", Springer. 2001.

E-Books / Online Resources:

1. <http://cs224d.stanford.edu/syllabus.html>
2. <https://www.cs.colorado.edu/~mozer/Teaching/syllabi/DeepLearningFall2017/>

MOOC:

1. <https://www.class-central.com/course/kadenze-creative-applications-of-deep-learning-with-tensorflow-6679>
2. <https://www.class-central.com/course/practical-deep-learning-for-coders-part-1-7887>

SEE SCHEME

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

NoSQL DATA BASE				
Course Code	:	21CSE303	CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	: 50
Total Hours	:	39	Credits	: 03

Course Learning Objectives:

The primary Course Learning Objective is to Prepare the background in abstraction, notation and critical thinking of mathematics related to computer science. The course will enable students to:

1. **Understand** the importance of NoSQL data management and **compare** with traditional relational database management system.
2. **Understand** the CAP theorem and **compare** with ACID properties of traditional relational database management system.
3. **Understand** the basics of MongoDB and Cassandra NoSQL database management systems.
4. **Develop** queries to store and retrieve the data using MongoDB NoSQL database management systems.
5. **Develop** queries to store and retrieve the data using Cassandra NoSQL database management systems.

UNIT – I

Introduction to NoSQL: Why NoSQL? Types of NoSQL databases, Distribution models: single server, sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication, Consistency: Update Consistency, Read Consistency, The CAP Theorem, MapReduce: Partitioning and Combining, Composing MapReduce calculations.

15 Hours**UNIT – II**

Introduction to MongoDB: What is MongoDB? Why MongoDB?, JSON, Creating Unique Key, Storing Binary data, Terms used in RDMS and MongoDB, Data types in MongoDB, MongoDB Query Language: Insert method, Save method, Update method, Remove method, Find method, Dealing with Null values, Count, Limit, Sort, Skip, Arrays, Aggregate Functions.

15 Hours

UNIT – III

Introduction to Cassandra: Features of Cassandra, CQL data types, CRUD (Create, Update, Read and Delete) operations, Collections: Set collection, List collection, Map collection, Set and List, Map, Alter commands, Import and Export.

9 Hours

Course Outcomes:

1. **Understand** the importance of NoSQL data management and **compare** with traditional relational database management system.
2. **Understand** the CAP theorem and **compare** with ACID properties of traditional relational database management system.
3. **Understand** the basics of MongoDB and Cassandra NoSQL database management systems.
4. **Develop** queries to store and retrieve the data using MongoDB NoSQL database management systems.
5. **Develop** queries to store and retrieve the data using Cassandra NoSQL database management systems.

Table-1: Mapping of COs to Pls, POs and BTL			
Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.1.1, 1.3.1	L2
CO2	1, 2	1.1.1, 1.3.1	L2
CO3	1, 2	1.1.1, 1.3.1	L2
CO4	1, 2	1.1.1, 1.3.1	L3
CO5	1, 2	1.1.1, 1.3.1, 2.2.3	L4

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3									1		1	3	
CO2	3									1		1	3	
CO3	3									1		1	3	
CO4	3									1		1	3	
CO5	3	2								1		1	3	

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. Pramod J. Sadalage, Martin Fowler. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence". 1st Edition, Addison-Wesley, 2012.
2. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", 1st Edition, Wiley, 2015.

REFERENCE BOOKS:

Deepak Vohra, Nosql Web Development with Apache Cassandra, Cengage Learning, Inc; New edition, 2015.

Doug Bierer, MongoDB 4 Quick Start Guide: Learn the skills you need to work with the world's most popular NoSQL database, Packt, 2018.

E-Books / Online Resources:

1. <https://www.mongodb.com/nosql-explained>
1. https://cassandra.apache.org/_/index.html

There will be **8** questions of **20** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

BUSINESS INTELLIGENCE					
Course Code	:	21CSE304	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	:	50
Total Hours	:	39	Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Identify various sources of data and identify the methods to process them.
2. Explain the ETL process and carryout the ETL process for a given data set.
3. Design a suitable schema for a given problem.
4. Illustrate the concepts of data mining.
5. Demonstrate the Classification and clustering methods.

UNIT – I**INTRODUCTION TO BUSINESS INTELLIGENCE:**

Types of digital data – Structured, semi structured and unstructured – sources, characterises, challenges; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; BI Framework, Who is BI for, BI Users, BI Applications; BI Roles & Responsibilities,

Need for data warehouse – definition, data mart, Approaches for data warehouse, ETL, Basics of Data Integration – approaches, advantages.

Text Book 1 Chapter [2.3-2.5] [(3.1-3.5), (3.8)] [5.1-5.5] [(6.1-6.3), (6.5-6.10)]

15 Hours

UNIT – II

Introduction to data quality, data profiling, Multidimensional data modelling – Basics, types of data model, Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema; Dimension model life cycle.

Measure, metrics, KPIs and performance management, salient attributes of a good metric, SMART test.

Introduction to enterprise reporting – perspectives, standardization and presentation, balanced scorecards. Concepts of dashboards- types, steps.

Text Book 1 Chapter [6.10-6.12] [7.2-7.8] [(8.2-8.3)] [(9.1-9.2) (9.4-9.7)]

15 Hours

UNIT – III

Data Mining—On What Kind of Data? Data Mining Functionalities—What Kinds of Patterns Can Be Mined? Mining Association rules: Basic concepts, frequent item set mining methods - Apriori Algorithm, Generating Association Rules from Frequent Item sets.

Text Book 2: Chapter [1.1-1.4][6.1-6.2(6.2.1-6.2.4)]

9 Hours

Course Outcomes:

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

1. **Identify** the sources of data based on its type for a business application and **apply** OLTP, OLAP operations. (L3)
2. **Apply** the knowledge of BI operation to **determine** various roles in a BI application and **design** the ETL process for handling the data from a given application. (L3)
3. **Relate** the data warehousing concepts for a real time business application to **model** a star, snowflake schema for a multi-dimensional data of a given problem. (L3)
4. **Explain** data quality and profiling methods, **identify** the quality of the data using data profiling techniques. **Apply** the measures and metrics to the data to design an enterprise report. (L3)
5. Apply the concepts of mathematics and computer algorithm to **illustrate** the data mining concepts using association rules. (L2)

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes	Program Outcomes (POs)	Performance Indicators (PI)	Bloom's Taxonomy Level
CO1	1,2	1.4.1, 2.2.2	L 2
CO2	1,2,3	1.4.1, 2.2.3, 3.2.2	L 3
CO3	1,2,3	1.4.1, 2.1.1, 2.1.2, 3.2.2,3.2.3	L 3
CO4	1,2,3	1.4.1, 2.1.2, 2.2.2, 3.2.2	L 3
CO5	1,2	1.4.1,2.1.3,2.4.1	L 2

Table-2: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3							1	1		1	1	3
CO2	1	2	3						1	1		1		3
CO3	1	2	3						1	1		1		3
CO4	1	2	2						1	1		1		3
CO5	2	3							1	1		1		3

3: Substantial (High)**2: Moderate (Medium)****1: Poor(Low)**

TEXTBOOKS:

1. R N Prasad and Seema Acharya, "Fundamentals of Business Analytics", Wiley-India, 2011
2. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, (ISBN: 1-55860-489-8), 2000.
3. David Loshin, "Business Intelligence -The Savvy Manager's Guide", Morgan Kaufmann Publishers, 2003.

REFERENCE BOOKS:

1. Carlo Vercellis "Business Intelligence-Datamining and Optimization for Decision Making", Wiley, 2009
2. Uddagiri Chandrasekhar S.K. Shinde, "Data Mining and Business Intelligence", Dreamtech Press, 2015.

E-Books / Online Resources:

1. https://cdn.ttgtmedia.com/searchDataManagement/downloads/Data_Warehouse_Design.pdf
2. <http://download.101com.com/tdwi/ww24/WhatWorks24DigitalEdition.pdf>

MOOC:

1. <http://nptel.ac.in/courses/110104086/13>
2. <https://freevideolectures.com/course/3635/microsoft-business-intelligence>

INTERNET OF THINGS

Course Code	: 21CSE305	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	: 3-0-0-0	SEE Marks	:	50
Total Hours	: 39	Credits	:	03

Course Learning Objectives:

This Course will enable students to:

1. Learn the IoT Definitions, Design aspects
2. Identify the IoT hardware and software requirements
3. Describe IoT logical and physical design concepts
4. Implement Arduino based IoT Projects
5. Implement Raspberry Pi based IoT Projects

UNIT – I

Introduction

Introduction to IoT: Definition and characteristics, Physical design, Logical design, enabling technologies, Levels and deployment templates, Examples: Domain specific IoTs, IoT Design and System Engineering, Discuss IoT Requirements, Hardware & Software; Study of IoT sensors, IoT Design methodology, IoT Connectivity and Management, IoT Security & IoT Communication. IoT and M2M
(Text Book-1, Chapter 1 to 5)

15 Hours

UNIT – II

Design Concepts:

IoT Logical Design:

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief Description of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary.

Arduino Programming concepts, Connecting the sensors and actuators, Arduino Based IoT Project Implementation, Cloud Services

(Text Book-1: Chapter 4,5,6 ,7)

15 Hours

UNIT – III

Raspberry Pi based IoT Project Implementation:

Programming on Raspberry Pi with Python, Raspberry Pi for Project Development: Raspberry Pi platform, GPIO, Establishment and setting of Raspberry Pi software, Connecting to the cloud. LAMP project, Home temperature, monitoring system, Webcam and Raspberry Pi camera project (Text Book-1: Chapter 10,11,12, 13)

09 Hours

Course Outcome:

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

1. **Explain** IoT Definitions, Requirements, Systems Design, Sensors, Tags, security communications and **apply** IoT knowledge in understanding IoT systems and applications.
1. **Outline** IoT systems Logical and Physical Design Aspects, Develop Arduino simple programmes for LED, Buzzer, Push button, Digital sensors.
2. **Explain** the networking and security concepts in application to IoT.
3. **Develop and Implement simple** IoT projects **using** Arduino boards.
4. **Develop and Implement simple** IoT projects **using** Raspberry Pi boards.

Table-1: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.3.1, 1.4.1	L3
CO2	1,2,3	1.3.1, 1.4.1, 2.1.1, 2.1.2	L3
CO3	1,2,3	1.3.1, 2.2.4, 3.2.1, 3.2.2	L3
CO4	1,3,5	1.3.1, 1.4.1, 3.4.2, 3.4.3, 5.1.1, 5.2.1, 5.2.2	L4
CO5	1,3,5	1.3.1, 1.4.1, 3.4.2, 3.4.3, 5.1.1, 5.2.1, 5.2.2	L4

Table-2: Mapping Levels or COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1						1	1			1		3
CO2	2	3						1	1			1		3
CO3	3	1						1	1			1		3
CO4	3	2			3			1	1			1	1	3
CO5	3	2			3			1	1			1	1	3

3: Substantial (High)**2: Moderate (Medium)****1: Poor (Low)****TEXTBOOKS:**

1. ArshdeepBahga, Vijay Madiseti, "Internet of Things: A Hands-On Approach,VijayMadiseti", 2014.
2. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino,Raspberry Pi and BeagleBone Black", 1st Edition, McGraw Hill, 2015.

REFERENCE BOOKS:

1. Dr. SRN Reddy, RachitThukral and Manasi Mishra," Introduction to Internet of Things: A practical Approach", ETI Labs
2. Pethuru Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. Jeeva Jose,"Internet of Things", Khanna Publishing House,Delhi
4. Adrian McEwen,"Designing the Internet of Things", Wiley
5. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
6. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

MOOC:MOOC:

1. <https://www.coursera.org/specializations/internet-of-things>
2. <https://www.udemy.com/course/iot-internet-of-things-automation-using-raspberry-pi/>
3. <https://www.udemy.com/course/arduino-iot-cloud/>

PARALLEL COMPUTER ARCHITECTURE & PROGRAMMING				
Course Code	:	21CSE306	CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	3-0-0-0	SEE Marks	: 50
Total Hours	:	39	Credits	: 03

Course Learning Objectives:**This Course will enable students to**

1. Outline the principles of multi-core design.
2. Illustrate the concept of parallelization and develop threaded parallel programs.
3. Develop parallel programs on shared memory and distributed memory parallel computers.
4. Debug and optimize the parallel programs.
5. Develop parallel programs on Graphics Processing Units.

UNIT – I**Introduction to multi-core architecture:**

Introduction, Moore's law, Amdahl's law, Gustafson's law, Motivation for Multi-core processors, Types and levels of parallelism, Flynn's classification of multi-processors, Introduction to parallelization and vectorization: Data dependencies, SIMD technology, Hardware Multithreading vs. Software multi

threading, Hyper threading, SMT, Case Study of multi-core processors: Intel, AMD multicore processors. (Chapter-1 and chapter-2 of Textbook-1)

Thread programming: Definition of thread and process, Parallel programming models, Parallel Programming constructs: Synchronization, Deadlock, Critical sections, Threading APIs-POSIX threads. (Chapter-4 Textbook-1)

15 Hours

UNIT – II

Shared and distributed memory parallel programming:

MPI Model: Collective communication, Data decomposition, Communicators and topologies, point-to-point communication, MPI Library, OpenMP: Directives and clauses, environment variables, Programs using OpenMP and MPI. Introduction to intel TBB, Thread-Safeness.

(Chapter-4 Textbook-1)

Multithreaded program debugging:

Benchmarks and other performance analysis tools, vTune Performance Analyzer, Thread Checker, Thread Profiler, hotspots, performance issues in algorithms, branch misprediction, cache organization, cache loads, efficiency, hardware and software prefetch.

(Chapter-2,3, and 4 of Textbook-2)

15 Hours

UNIT – III

Introduction to GPUs and CUDA programming:

Introduction to GPU Computing, Evolution of Graphics Processing Units, CUDA Device Architecture - Architecture of Modern GPUs, Generalized structure of CUDA Enabled GPU Device, CUDA Enabled NVIDIA GeForce 8800 GPUs. CUDA Thread Model, CUDA Thread Scheduling, Compute Capability, SIMD and SIMT, CUDA Memory Model, Introduction to CUDA C Programming - Structure of a Typical CUDA C Program -Data Transfer Between the Host and

Device, CUDA programs with 1D Grid of 1D Blocks, 2D Grid of 2D Blocks, Tile-based Algorithms using Shared Memory- Matrix multiplication.

(Chapter-7 Textbook-1)

9 Hours

Course Outcomes:

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

1. Identify the concept of multi-core architecture and motivation behind it.
2. Design parallel program using the multithreading concept.
3. Develop parallel programs using parallel programming frameworks.
4. Describe the concept of multithreaded program debugging.
5. Develop GPU programs using CUDA.

Mapping of POs & COs:

POs COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H		H	H				L			H	
2	H	H			H	H		L		M	H	H
3	H	H	H		H	H		L		M	H	H
4	H	H			H			L		M	H	H
5	H	H	H		H	H		L		M	H	H

H : High M: Medium L : Low

TEXTBOOKS

1. Introduction to Parallel Computing, by Niranjana N. Chiplunkar, Raju K., Wiley, 2020.
2. The software optimization cookbook- High performance Recipes for IA-32 Platforms – Richard Gerber, Aart J. C. Bik, Kevin B. Smith, Xinmin Tian, Intel press

REFERENCE BOOKS

1. Multicore programming- Increasing performance through software multithreading,-- Shameem Akhter and Jason Roberts, Intel press
2. Advanced Compiler Design Implementation- Steven S. Muchnick, Morgan Kaufman Publishing 2000.

Value Added Courses

FOUNDATIONS OF MODERN SOFTWARE SYSTEMS					
Course Code	:	21CSV101		CIE Marks	: 50
Teaching Hours /Week (L:T:P:S)	:	2-0-0-0		SEE Marks	: 50
Total Hours	:	26		Credits	: 00

Instructor - Piyush Goel

Course Introduction - In present times, our day-day lives are governed by software. All of our daily activities such as ordering groceries, searching doctors, communication with our loved ones are enabled by handheld devices like cell phones, tablets, or laptops, and desktops. The apps that we use daily are powered by some core principles of Computer Science, and Software engineering.

The objective of this course is to give the students a peek into what goes behind the scenes of modern day applications. The course will use a case-study of a food delivery application like Swiggy/Zomato, and dissect the layers on which such apps are built. This will be a 3-credit course (3-hours per week), including practical assignments. The suggested course break-up is given below.

1. Module-1: Introduction (3 hours)

a. Overview

- i. Overview of a food delivery business such as Swiggy, Zomato.
- ii. Different Components of the software powering such a business

b. Foundations of Software Systems

- i. Storage, Compute, Networking
- ii. Turtles All the way down!

2. Module-2: Storage (12 hours)

- a. Data Types
- b. Fundamentals of data storage (File systems, Serialisation, Compression, etc)
- c. Structuring and Querying Data.
- d. Databases
 - i. Relational
 - ii. Non-Relational
 - 1. Key-Value
 - 2. Document
 - 3. Time-Series
- e. Object Storage (Files, and Blobs)
- f. Brief about advanced concepts such as CAP Theorem (Optional)
- g. Practicals - Experiment, and play around with the various databases.

3. Module-3: Compute (8 hours)

- a. Process, Threads, Memory.
- b. Servers, Virtual Machines, and Containers.
- c. Application Servers (Web Servers, FTP, Email)
- d. Cloud Computing Basics.
- e. Practicals - Playing with Cloud providers such as AWS.

4. Module-4: Networking (12 hours)

- a. Building Blocks (OSI Layer Models, Network Topologies, Subnets, VPNs, etc)
- b. Naming Systems (DNS)
- c. Important Protocols i. TCP/UDP ii. HTTP iii. Web Sockets
- d. Network Security (SSL/TLS)
- e. Practicals - Intercepting Network Traffic and analysing it in detail. Basic commands for tinkering with computer networks.

5. Module-5: Assignment (6 hours)

a. Building a minified version of a real-life application. The students will be expected to work on the assignment in their free time, and show the progress to the instructor on a weekly basis. The assignment shall be done in groups.

6. Examination a. There will be a written examination of 75 mins. It will carry 50% weightage. b. The assignment presentation will carry another 50% weightage.

Mode of Instruction: Online, and Offline classes shall be conducted. The instructor might create a Telegram or an email group to engage the students into group discussions, and knowledge sharing sessions.

Study Material: The relevant books, papers, and blogs will be recommended by the instructor when commencing each module.

Pre-Requisites for the students:

1. Access to Unix based laptops, or desktops.
2. Basic command over a scripting language such as Python, Ruby, PHP.
3. Most of all - Curious minds, and a deep hunger to learn.

Instructor: Piyush Goel (aka, Goel) is the SVP of Engineering at Capillary Technologies, an industry leader in Consumer Engagement software. Goel has more than 15 years of industry experience with stints at companies such as Capillary, InMobi Technologies, Travel Triangle Pvt Ltd, and Yahoo Inc. He holds a BTech, and MTech in Computer Science, and Engineering from the Indian Institute of Technology, Kharagpur, and has over 8 publications in International conferences, and Journals. He is passionate about building software systems that impact human lives, and loves to teach, and mentor young engineers in his spare time. He likes to travel, and is on a spiritual pursuit via the Buddhist meditation practise of Vipassana.

LinkedIn - <https://www.linkedin.com/in/piyushgoel1/>

Twitter - <https://twitter.com/pigol1>

PROGRAMMING WITH C++					
Course Code	:	21CSV102	CIE Marks	:	50
Teaching Hours /Week (L:T:P:S)	:	2-0-0-0	SEE Marks	:	50
Total Hours	:	26	Credits	:	00

List of Programs

1. Write C++ program to design a class called BankAccount. Include following data members like name of the depositor, account number and balance. Use following member functions a) to initialize values b) deposit an amount c) to withdraw an amount d) to display name and balance.
2. Write a C++ program to create a class called COMPLEX and implement the following
overloading function ADD that return a COMPLEX number.
i. ADD(a,c2);- where a is an integer(real part) & c2 is a complex no.
ii. ADD(c1,c2);- where c1 & c2 are complex nos. use Function overloading(ADD) and Friend function concept for the implementation
3. Write a C++ program with class Time with data members that represents hours and minutes. Include appropriate member functions to compute time in hours and minutes . (Use of objects as arguments).
4. Given that an EMPLOYEE class contains following members. Data members:Eno, Ename and salary Member functions: to read the data , to print data members. Write a C++ program to read the data of N employees and display details of each employee.(use Array of objects concept).
5. Write a C++ program with two classes A and B with one integer data member in each class. Write member functions to read and display, place a friend function in these classes which takes the data members of these classes and computes maximum of two data members. Demonstrate using main function.

6. Write a C++ program to demonstrate to uses of constructors in derived class concept. (Any inheritance you can use but constructors in base class should have at least one parameter.)
7. Write a C++ program to create a class sample with integer ,character and float data members. Demonstrate Constructor Overloading on this class with all types of constructors including default argument constructor.
8. Write a C++ program to demonstrate the working of dynamic constructors using a class STRNG with string as datamember inside the class, include appropriate member functions to display the object data and a member function to concatenate two strings.
9. Write a C++ program for the diagram using Hierarchical inheritance. Use your own data members and member functions to display student details.
10. Write a C++ program for the diagram using Hybrid inheritance. Use yourown data members and member functions to display student details.
11. Write a C++ program for the diagram using Virtual Base class concept. Use your own data members and member functions to display student details.Create an array of n objects of result class and demonstrate.
12. Create a base class shape to store two double type values. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data() to initalize base class data members and another function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the derived classes to suit the requirements.(Area of rectangle= $x*y$, Area of triangle= $1/2*x*y$).
13. Write a C++ program to overload binary + and – operator to add and subtract two complex numbers. Define relevant data members and member functions for reading and displaying the complex objects
14. Write a C++ program to apply bubble sort on an array of integer and float use the concept of function template
15. Write a C++ program to implement queue operations for integer and float data types. Use concept of class template

OPEN ELECTIVE (VI Semester) - 2023-2024

Sl. No.	Code	Name
1.	21MA8X02	Linear Algebra (for all except CS, IS, EC, CCE & AIML)
2.	21HU8X03	Intellectual property rights (for all)
3.	21CV8X07	Environment Impact Assessment (for all except Civil)
4.	21ME8X08	Industrial Pollution Control (for all except Mechanical)
5.	21HU8X24	Professional and Cognitive Communicative (for all)
6.	21ME8X28	Operations Management and Entrepreneurship (for all except Mechanical)
7.	21IS8X38	Introduction to Python Programming (for all except CS & IS)
8.	21BT8X40	Bio Fuel Engineering (for all except BT)
9.	21BT8X42	Solid Waste Management (for all except BT & Civil)
10.	21EC8X59	PCB Design (For all except E&C)
11.	21ME8X63	Innovation & Entrepreneurship (for all)
12.	21HU8X68	Introduction to Yoga (The classes will be conducted from 7.00 a.m. to 8.00 a.m. Those who are willing to come at 7.00 a.m. should only register)
13.	21HU8X70	Overview of Indian Culture and Arts (for all)
14.	21HU8X71	Principles to Physical Education (The classes will be conducted from 5.30 p.m. to 6.30 p.m. Those who are willing to come at 5.30 p.m. should only register)
15.	21HU8X72	Introduction to Japanese language (Students with no backlogs, CGPA should be above 7.0 & who opt to get placed in Japanese companies in Japan/India are eligible to register)
16.	21HU8X74	Introduction to German Language (for all)
17.	21ME8X75	Sustainable Development Goals (for all)
18.	21IS8X76	Web Technologies (for all except CS & IS)
19.	21CS8X77	Programming in Java (for all except EC,CS & IS)
20.	21CS8X78	Data Structures & Algorithms (for all except EC,CS & IS)
21.	21EE8X79	Electric Vehicle Technology (for all except EE)
22.	21HU8X81	National Cadet Corps: Organization, Functions & Capabilities (for only NCC Cadet Students)
23.	21EC8X82	Fundamentals of Image Processing – a practical approach (Only for CV, ME & BT)
24.	21HU8X86	Introduction to Yakshagana (for all - who are familiar with kannada Language)
25.	21ME8X88	Marketing Management (for all except Mechanical)

LINEAR ALGEBRA			
Course Code	21MA8X02	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable the students to

1. Understand the concepts of vectors, bases.
2. Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3. Find the canonical forms and appraise its importance in various fields.
4. Make use of Gram-Schmidt process to produce an orthonormal basis.
5. Learn the concepts of singular value decomposition and PCA.

UNIT - I

Vector spaces

Vector spaces, subspaces, bases and dimensions, coordinate vectors, null spaces and column spaces of the matrices.

Linear Transformations

15 Hours

UNIT - II

Canonical Forms

Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.

Inner Product Spaces

Inner products; inner product spaces, orthogonal sets and projections, Gram-Schmidt process, QR-factorization, Least-squares problems.

15 Hours

UNIT - III

Symmetric Matrices and Quadratic Forms:

Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.

09 Hours

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

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
CO1	3	2										
CO2	2	2										
CO3	3	1										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Mode of Teaching and Learning:
Class room teaching.
Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:	
1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:	
	There will be 8 questions of 21 marks each in the question paper categorized into 3 Units as per the syllabi & contact hours. The student will have to answer 5 full questions, selecting 2 full questions each from Unit - I & Unit – II and 1 full question from Unit – III .

TEXTBOOKS:	
1.	Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2104.
2.	David C.Lay, "Linear Algebra and its Applications", 3 rd edition, Pearson Education (Asia) Pte. Ltd, 2105.

REFERENCE BOOKS:	
1.	M. Artin , Algebra Prentice Hall of India.2104.
2.	Gilbert Strang, "Linear Algebra and its Applications", 4th edition, Thomson Learning Asia, 2103.
3.	Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications", Pearson Education (Asia) Pte.Ltd 7 th edition ,2103.
4.	Sheldon Axler, "Linear Algebra Done Right", Springer International Publication, Third Edition,2115.

INTELLECTUAL PROPERTY RIGHTS			
Course Code	21HU8X03	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities			
Course Learning Objectives:			
1.	Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.		
2.	Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.		
3.	Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.		

UNIT - I															
Introduction to Intellectual Property Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.														8	
Agreements and Treaties History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2117														8	
UNIT - II															
Basics of Patents and Concept of Prior Art Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)														8	
Patent filing procedures National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies														8	
UNIT - III															
Case Studies: Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa)														7	
Course Outcomes: At the end of the course student will be able to															
1.	Have a General understanding of the Intellectual Property Rights.														
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.														
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.														
4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights														
5.	Be aware and have a general understanding of patenting procedures and licensing.														
Course Outcomes Mapping with Program Outcomes & PSO															
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes													1	2
	CO1		3	3	2		3			2	2		3		
	CO2	2	2	3			3		3	1	1	2	2		
	CO3	2			2		3			2	2	2	3		
	CO4			1	1		3			1	2		3		
	CO5	3	2	1			3			3	1		2		
1: Low 2: Medium 3: High															
REFERENCE MATERIALS:															
1.	BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2107														
2.	Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2107														
3.	Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.														
4.	Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.														
5.	Intellectual Property Today: Volume 8, No. 5, May 2101,														
6.	WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.														
7.	Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and														

	policy options, Zed Books, New York 2100
8.	Wadehra, B. L. Law relating to patents, trademarks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2100
9.	Sinha, Prabhas Chandra Encyclopedia of Intellectual Property Rights, 3 Vols. Eastern Book Corporation, 2106.
10.	“Practical Approach to Intellectual Property Rights”; Rachna Singh Puri and Arvind Vishwanathan, I. K. International Publishing House Pvt. Ltd.
E-RESOURCES:	
1.	http://www.w3.org/IPR/
2.	http://www.wipo.int/portal/index.html.en
3.	http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4.	www.patentoffice.nic.in
5.	www.iprlawindia.org/

ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	21CV8X07	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Identify the need to assess and evaluate the impact of projects on environment.
2. Explain major principles of environmental impact assessment.
3. Understand the different steps within environmental impact assessment.
4. Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT – I

Evolution of EIA: Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

16 Hours

UNIT - II

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

10 Hours

UNIT – III

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

13 Hours

Course Outcomes:

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

1. Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2. Liaise with and list the importance of stakeholders in the EIA process.
3. Know the role of public in EIA studies.
4. Overview and assess risks posing threats to the environment.
5. Assess different case studies/examples of EIA in practice.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1				2	3	2					2	3	
CO2	1	1				2	3	2					2	3	
CO3	1	1				2	3	2					2	3	
CO4	1	1				2	3	2		3			2	3	
CO5	1	1		3		2	3	2				3	2	3	

Note:- 1:Low 2:Medium 3: High

TEXTBOOKS:

1. Noble, L. 2110. Introduction to environmental impact assessment. A Guide to Principles and Practice. 2nd edition. Oxford University Press, Don Mills, Ontario.
2. Larry W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996

ADDITIONAL REFERENCE MATERIALS

1. Morris and Therivel, 2109. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2. Hanna, K.S. 2109. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.

NPTEL SOURCES

<http://nptel.ac.in/courses/121108004/>

<http://nptel.ac.in/courses/121108004/module3/lecture3.pdf>

INDUSTRIAL POLLUTION CONTROL			
Course Code	21ME8X08	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives: This Course will enable students to,	
1	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.
UNIT - I	
Introduction to Pollution	
Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.	
Meteorology	
Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems	
15 Hours	

UNIT - II	
Separation techniques	Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber
Smoke and gaseous pollutants	Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope & Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So ₂ , Co, UBHC, Nox their ill effects and & control methods..
15 Hours	
UNIT - III	
Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards.	
9 Hours	

Course Outcomes:

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

CO 1	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
CO 2	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams.
CO 3	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency.
CO 4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
CO 5	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

TEXTBOOKS:

1. "Environmental Pollution Control Engineering, Wiley Eastern Ltd.,
2. "Introduction to Environmental Engineering & Science", Gilbert M Masters, PHI,1995
3. "Environmental Pollution Control Engineering, C. S RAO New Age Int.

REFERENCE BOOKS:

1. "Air Pollution", Henry C. Perkins, Mc-Graw Hill, 1974.
2. "Air Pollution control", W. L. Faith, John Wiley

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/105106119/36>

Course Articulation Matrix

Course Code / Name : 21ME8X08/ Industrial Pollution Control														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X08.1	2								1	1		1		
C-21ME8X08.2	2								1	1		1		
C-21ME8X08.3	2								1	1		1		
C-21ME8X08.4	2								1	1		1		
C-21ME8X08.5	2								1	1		1		

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

PROFESSIONAL & COGNITIVE COMMUNIQUÉ			
Course Code	21HU8X24	Course Type	OE
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities			
Course Learning Objectives:			
1.	To Problematize Commonsense & Apply Critical thinking skills		
2.	Comprehend etiquettes and manners in different situations		
3.	Be gender sensitive in both offline and online behavior		
4.	Exhibit better comprehension of the social implications of human body		
5.	Understand the importance of reading and writing skills		
UNIT - I			
Common sense and Emotional Intelligence Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking; Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence			15
Etiquettes & Workplace Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace			
UNIT - II			
Social Networking Sites and its Impacts Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour			15
Gender and Body Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA			
UNIT - III			
Writing Types of Writing, Note Taking Methods, Plagiarism Reading Styles of Reading, Types of Reading, Scanning, Skimming			9

Course Outcomes: At the end of the course student will be able to															
1.	Problematize Commonsense & Apply Critical thinking skills														
2.	Comprehend etiquettes and manners in different situations														
3.	Be gender sensitive in both offline and online behavior														
4.	Exhibit better comprehension of the social implications of human body														
5.	Understand the importance of reading and writing skills														
Course Outcomes Mapping with Program Outcomes & PSO															
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes													1	2
	CO1		3							3	3		3		
	CO2		2						3	2	3		2		
	CO3		3							2	2		3		
	CO4		3							2	2		3		
	CO5		2							3	3		2		
1: Low 2: Medium 3: High															
REFERENCE MATERIALS:															
1.	Geetha.V. Gender. Kolkatta: Web Impressions, 2109.														
2.	Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2113): 91-112.														
3.	Barry, Peter. Beginning Theory. New Delhi: Viva Books, 2110.														
4.	Berger, John. Ways of Seeing. London: Penguin Books, 1977.														
5.	Cranny-Francis, Anny, et al. Gender Studies: Terms and Debates. New York: Palgrave Macmillan, 2103.														
6.	Gauntlett, David. Media, Gender and Identity: An Introduction. London: Routledge, 2108														
7.	Pilcher, Jane, and Imelda Whelehan. 50 Key Concepts in Gender Studies. London: Sage, 2104. Print.														
8.	Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.														
9.	Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2104): 199-215.Web.														
E-RESOURCES:															
1.	http://www.cyberpsychology.eu/view.php?cisloclanku=2109061501/ >.														
2.	http://www.surveillance-and-society.org/articles2(2)/webcams.pdf														
3.	http://eprints.rclis.org/19790/ >.														

OPERATIONS MANAGEMENT & ENTREPRENEURSHIP				
Course code		21ME8X28	CIE Marks	50
Teaching Hours/Week (L:T:P)		(3:0:0)	SEE Marks	50
Total Hours		39	Credits	03
Course Learning Objectives: This Course will enable students to,				
1	Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP			
2	Appreciate the importance of Quality tools and methods in operations management			
3	Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability			
4	Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.			
5	Identify and differentiate the different national and state level funding agencies.			
UNIT – I				
Introduction to Production/ Operations Management: Concept of production, Classification of production systems, Production Management, Concept of operations, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management (Customer Service and Resource utilization/ Competitive advantage through Quality-Delivery-Cost), Scope of Operations Management. Introduction to				

Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).	
7 Hours	
Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.	
TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.	
Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools,	
Philosophy of statistical process control and modeling process quality: Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits)	
9 Hours	
UNIT – II	
Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,	
Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk} , p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.	
Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.	
8 Hours	
Entrepreneurship: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.	
Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.	
Application of Operations Management concepts in Facility/ Business Location: General procedure for making locations decisions, Numerical Problems on application of Breakeven analysis and Transportation method to make location decisions.	
8 Hours	
UNIT – III	
Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)	
Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.	
7 Hours	

Course Outcomes (CO)

CO 1	Differentiate production and service systems. Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
CO 2	Discuss Total Quality Management tools and methods. Solve problems on fundamentals of statistics and normal distribution.
CO 3	Draw and Analyze variable process control charts and determine process capability. Calculate reliability of series and parallel systems using the information on failure rate and time.
CO 4	Discuss entrepreneurship, characteristics of an entrepreneur and barriers to entrepreneurship. Discuss the elements of a project report and feasibility studies conducted in the project appraisal.
CO 5	Identify and differentiate the national and state level funding agencies. Discuss the effect of GATT and WTO on Indian economy.

TEXTBOOKS:

- Production / Operations Management**, Joseph G Monks, McGraw Hill Books
- Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
- Statistical Quality Control**: RC Gupta, Khanna Publishers, New Delhi, 2105.
- Total Quality Management**: Dale H. Besterfield, Pearson Education, 2103.
- Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
- Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2106 (2 & 4).

REFERENCE BOOKS:

1. **Statistical Quality Control:** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
2. **Statistical Process Control and Quality Improvement:** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
3. **Statistical Quality Control for Manufacturing Managers:** W S Messina, Wiley & Sons, Inc. New York, 1987
4. **Statistical Quality Control:** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2105, Hoboken, NJ (ISBN 0-471-65631-3).
5. **Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.
6. **Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/110105067/>
2. <https://www.edx.org/course/operations-management-iimbx-om101-1x>

Course Articulation Matrix

Course Code / Name: 18ME8X28/ Operations Management & Entrepreneurship															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C-21ME8X28.1	3	1	0					1	1	1	1				
C-21ME8X28.2	1	2	0						1	1	3				
C-21ME8X28.3	2	2	0				1	0	1	1	3				
C-21ME8X28.4	3	1	0			1	0	1	1		2				
C-21ME8X28.5	1	1	0			1	1	1	1		3				

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

INTRODUCTION TO PYTHON PROGRAMMING			
Course Code	21IS8X38	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites:

Student must have fundamental knowledge of procedure-oriented programming.

Course Learning Objectives (CLOs):

At the end of the course student should be able to:

- Construct Python programs using data types and looping.
- Design object-oriented Python programs using classes and objects.
- Design useful stand-alone and CGI applications in Python.

UNIT - I

INTRODUCTION: Introduction to python, Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages. Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation.

STRING MANIPULATIONS: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers

LISTS, TUPLES, AND DICTIONARIES: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

15 Hours

UNIT – II

FUNCTIONS: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions

CLASSES AND OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (`_eq_`, `_str_`, etc); abstract classes; exception handling, try block

15 Hours

UNIT – III

FILE HANDLING: Manipulating files and directories, Reading from Text Files, Writing to Text Files, Reading from Binary Files, Writing to Binary Files, Seeking Within Files, Creating and Reading a formatted file (csv or tab-separated).

GRAPHICAL USER INTERFACES: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X38.1	Demonstrate the basics of Python programming like data types and looping	L2
C8X38.2	Apply the basic data structures in solving the problems	L3
C8X38.3	Experiment with usage of functions in a given problem	L3
C8X38.4	Develop Objects by creating classes and apply object-oriented features	L3
C8X38.5	Develop applications in Python using File Programming & User Interface	L3

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1	L2
CO2	1,2,3	1.4.1,1.3.1,2.3.1,3.1.1,3.2.2	L3
CO3	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X38.1	1	2	1											
C8X38.2	1	2	1										2	2
C8X38.3	1	2	2										2	3
C8X38.4	1	2	2										2	3
C8X38.5	1	2	2										2	3

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

- 1) Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2111, Cengage Learning, ISBN: 978-1111822705

ADDITIONAL RESOURCES:

1. Think Python. PDF is free.

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

BIOFUEL ENGINEERING			
Course Code	21BT8X40	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites: Nil

Co-requisites: Nil

Course Learning Objectives:

The objective of this course is

- To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.
- To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT – I**LIQUID BIOFUELS**

Description and classification of Biofuels; Primary biomass: Plant materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products-wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).

Production of biodiesel: Sources of Oils – edible and non edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase mediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607). Algal Biodiesel production.

Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

15 Hours

UNIT – II**BIOHYDROGEN AND MICROBIAL FUEL CELLS**

Enzymes involved in H₂ Production; Photobiological H₂ Production: Biophotolysis and Photofermentation; H₂ Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H₂ production, Carbon sources, Detection and Quantification of H₂. Reactors for biohydrogen production.

Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness; Advances in MFC.

15 Hours

UNIT – III**RECOVERY OF BIOLOGICAL CONVERSION PRODUCTS**

Biogasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

9 Hours

Course Outcomes:

At the end of this course, student should be able to:

1. Mark the significance of biofuels and raw materials and Identify suitable feedstock for production of biofuels.
2. Illustrate the production of liquid biofuels from various feed stocks.
3. Demonstrate production of biohydrogen using microbial sources.
4. Extend the concepts of microbial fuel cells towards development of specific application.
5. Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1		M							L			
CO2		M							L			
CO3		M							L			
CO4		M							L			
CO5		M							L			

REFERENCE BOOKS:

1. Drapcho, C. M., Nhuan, N. P. and Walker, T. H. *Biofuels Engineering Process Technology*, Mc Graw Hill Publishers, New York, 2108.
2. Jonathan R.M, *Biofuels – Methods and Protocols (Methods in Molecular Biology Series)*, Humana Press, New York, 2109.
3. Olsson L. (Ed.), *Biofuels (Advances in Biochemical Engineering/Biotechnology Series)*, Springer-Verlag Publishers, Berlin, 2107.
4. Glazer, A. and Nikaido, H. *Microbial Biotechnology – Fundamentals of Applied Microbiology*, 2 Ed., Cambridge University Press, 2107.
5. Godfrey Boyle (Ed). *Renewable Energy- Power for sustainable future*, 3rd Ed. Oxford. 2112.
6. Ramachandran, T. V. *Management of municipal solid waste*. Environmental Engineering Series. Teri Press, 2116.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

SOLID WASTE MANAGEMENT			
Course Code	21BT8X42	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites: Nil

Co-requisites: Nil

Course Learning Objectives:

The objective of this course is

1. To learn types of solid wastes, collection, treatment and disposal methods.
2. To understand various processing techniques and regulations of treatment and disposal.

UNIT – I

INTRODUCTION TO SOLID WASTES AND ITS SEGREGATION & TRANSPORTATION

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.

Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.

Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

15 Hours

UNIT – II

PROCESSING TECHNIQUES, RECOVERY OF RESOURCES AND WASTE DISPOSAL

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.

Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.

Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

16 Hours

UNIT – III

SOLID WASTE MANAGEMENT RULES AND PLANNING ISSUES

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2011.

Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

8 Hours

Course Outcomes:

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

1. Identify the sources, classification and characteristics of solid wastes
2. Develop insight into the collection, transfer, and transport of solid waste.
3. Apply waste processing techniques and recovery of resources from the waste.
4. Select the alternatives of solid waste disposals and its impacts.
5. Acquire knowledge about solid and hazardous waste management legislative rules.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L								L			
CO2	L	L				L	L		L			
CO3		M							L			
CO4		M				L	L		L			
CO5	L								L			L

REFERENCE BOOKS:

1. Tchobanoglous, G., Theisen, H. and Vigil, S. A. *Integrated Solid Waste Management*, McGraw – Hill, 1993.
2. Tchobanoglous, G., Thiesen, H., Ellasen, *Solid Waste Engineering Principles and Management*, McGraw – Hill, 1997.
3. Landrefh, R. E. And Rebers, P. A. Lewis, *Municipal Solid Wastes-Problems & Solutions*, 1997.
4. Bhide, A. D. and Sundaresan, B. B. *Solid Waste Management in Developing Countries*, Indian National Scientific Documentation Centre. New Delhi, 2100.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

PCB DESIGN			
Course Code	21EC8X59	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Pre-requisites:

Basic electrical and electronics engineering.

Course Learning Objectives:

1. To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2. To expose students to complete PCB Design & manufacturing process

List of Experiments

- Introduction to PCB design tool: building a schematic circuit and layout
- Exploring the PCB design tool by creating new components, using existing components and footprint, simulation features, Active & Passive Components
- Drawing a PCB layout in a single layer with constraints such as board area, track width, packages, via etc
- Creating a double layer PCB for a given schematic circuit
- Creating and using different component package types
- Fabrication of single and double layer PCB on a copper clad board using hatching/engraving technique.
- Handling PCB prototype machine using Mach3 CNC tool for the PCB prototype.

Detailed Course Plan**Lab 1**

Introduction to PCB design tool : building a schematic circuit.

Lab 2

Creating Library & Components, using existing components and footprint, simulation features, Active & Passive Components.

Lab 3

Designing a single layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 4

Designing a double layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 5

Simulating digital and analog circuits for given test cases.

Lab 6

Handling programmable microcontroller circuit in the simulation environment of schematic editor .

Lab 7

Defining a footprint for a component in the PCB layout.

Lab 8

Fabrication of single layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 9

Fabrication of single layer PCB using PCB prototype machine – Setting up Mach3 CNC tool.

Lab 10

Fabrication of double layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 11

Fabrication of double layer PCB using PCB prototype machine -Setting up Mach3 CNC tool.

Lab 12

Component placement and soldering.

Lab 13

Desoldering and testing.

Scheme of SEE Examination

It is a 3-Hour exam at the end of the semester where the student is to demonstrate the PCB designing process.

Sl.No	Activity	Max. Marks
1	Creating schematic for a given circuit diagram	15
2	PCB Layout design	21
3	Setting up fabrication	15
Total		50

Course Outcomes:

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

1. Draw schematic circuit and create PCB layout for single or multilayer PCB
2. Fabricate single and double-layer PCB using Mach3Mill operated CNC machine.

INNOVATION AND ENTREPRENEURSHIP			
Course Code	21ME8X63	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites:

The student must have learnt basics of Engineering concepts, applications and business as a whole.

Course Learning Objectives: This Course will enable students to,

1	Understand Technological Innovation
2	Understand Innovation management and the difference between Invention and Innovation.
3	Appreciate the importance of Innovation as management process and Innovation management techniques.
4	Define Innovation system and Understand the importance of Technology management and Transfer.
5	Identify Technological Entrepreneurship and its types and Understand the Institutional support provided for Entrepreneurs

UNIT – I**INTRODUCTION TO TECHNOLOGICAL INNOVATION****14 Hours**

Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.

INTRODUCTION TO INNOVATION MANAGEMENT

Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation.

INNOVATION AND COMPETITIVENESS

Case Study – Barriers for Innovation and Competitiveness.

UNIT – II	
INNOVATION AS A MANAGEMENT PROCESS	14 Hours
Activities to enhance companies capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	
INNOVATION SYSTEMS	
The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National.	
TECHNOLOGY MANAGEMENT AND TRANSFER	
Technology Transfer - Impacts of MNCs in technology transfer -	
UNIT – III	
INTRODUCTION TO TECHNOLOGICAL ENTREPRENEURSHIP	11 Hours
Types of Entrepreneurship: Mixed Entrepreneurship, Pure Entrepreneurship, Social Entrepreneurship, Collaborative Entrepreneurship, Internal Entrepreneurship, External Entrepreneurship - Sustainable Entrepreneurship -	
INSTITUTIONAL SUPPORT	
Business Incubator (Bi) - Determination of the Five Incubator Services - Incubation Centres in India – Atal Incubation Centre – Startup India - NSIC, KIADB, KSFC.	

Course Outcomes (CO):	
At the end of the course the student will be able to,	
CO 1	Describe technological innovation and its key features for business.
CO 2	Describe innovation management and difference between invention and innovation.
CO 3	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
CO 4	Explain innovation system, technology management and transfer.
CO 5	Explain technological entrepreneurship and institutional support.
TEXTBOOK:	
1	Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., “Innovation and Entrepreneurship Theory, Policy and Practice”, Springer, 2115.
REFERENCE BOOKS:	
1	Dick Whittington, “Digital Innovation and Entrepreneurship”, Cambridge University Press, 2118.

Course Articulation Matrix:

Course Code / Name : 21ME8X63/ INNOVATION AND ENTREPRENEURSHIP														
Course Outcomes (CO)	Program Outcomes (PO)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X63.1	3	2				1	1		1			1	3	1
C-21ME8X63.2	3	2				1	1		1			1	3	1
C-21ME8X63.3	2	2				1	1		1			1	3	1
C-21ME8X63.4	2	2				1	1		1			1	3	1
C-21ME8X63.5	3	2				1	1		1			1	3	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

INTRODUCTION TO YOGA				
Course Code:	21HU8X68	Course Type	OEC	
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03	
Total Teaching Hours	39	CIE + SEE Marks	50+50	

Course Learning Objectives:

1.	To give a brief history of the development of Yoga
2.	Identify names of different classical texts on Yoga
3.	To illustrate how Yoga is important for healthy living
4.	To explain the Asanas and other Yogic practices
5.	To explain, how Yoga practices can be applied for overall improvement

<p>Yoga: Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga. Yogic practices for healthy living.</p> <p>General guidelines for Yoga practices for the beginners: Asanas, Pranayama.</p>	<p>09 Hours</p>
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07 Hours

Yoga and Health: Concept of health and Diseases-Yogic concept of body – pancakosaviveka, Concept of disease according to Yoga Vasistha.	06 Hours
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04 Hours

04 Hours

Yoga and physical development: Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.	05 Hours
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04 Hours

1.	Understand a brief history of the development of Yoga
2.	Know important practices and principles of Yoga
3.	Explain how Yoga is important for healthy living
4.	Practice meditation to improvement of concentration etc.
5.	Have knowledge about specific guidelines of yoga practices

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CO1						1			1			1		
CO2						1			1			3		
CO3						2			1			3		
CO4						3			2			3		
CO5						2			2			3		

1: Low 2: Medium 3: High

[illegible]

TEXTBOOKS:	
1.	B.K.S. Iyengar, “Light on Yoga: The Classic Guide to Yoga by the World’s Foremost Authority”, Thorsons publisher 2116.
2.	MakarandMadhukar Gore, “Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices”, MotilalBanarsidass Publishers; 6 edition (2116).
3.	Swami SatyanandaSaraswati, “Asana, Pranayama, Mudra and Bandha: 1”, Yoga Publications Trust.
REFERENCE BOOKS:	
1.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice by Ann Swanson
2.	Yoga for Everyone : 50 Poses For Every Type of Body by Dianne Bondy
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2.	https://youtu.be/FMf3bPS5wDs

OVERVIEW OF INDIAN CULTURE AND ART				
Course Code		21HU8X70	Course Type	OE
Teaching Hours/Week (L:T:P: S)		3:0:0:0	Credits	03
Total Teaching Hours		39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities				
Course Learning Objectives:				
1.	To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.			
2.	To understand the local culture and its vibrancies.			
3.	To develop awareness about Indian Society, Culture and Arts under Western rule.			
4.	To comprehend different dimension and aspects of the Indian culture and arts.			
5.	To appreciate cultural performances in India.			
UNIT - I				
Knowing Culture What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture				7
Influence of Culture Relationship of Culture with: Language, Religion and History, Gender				7
UNIT - II				
Media and Culture Role of News Papers, Indian Cinema, Music, Advertisements				7
Languages, Literature and Culture Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature				7

UNIT - III																																																																																																																							
Arts and Culture Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.													7																																																																																																										
(Self-study Component) Contribution of Indian History to Culture Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning. Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages. Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.													4																																																																																																										
Course Outcomes: At the end of the course student will be able to																																																																																																																							
1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.																																																																																																																						
2.	Appreciate their own local culture from an academic perspective.																																																																																																																						
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.																																																																																																																						
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.																																																																																																																						
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.																																																																																																																						
Course Outcomes Mapping with Program Outcomes & PSO																																																																																																																							
<table><tr><th>Program Outcomes→</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th colspan="2">PSO↓</th></tr><tr><th>↓ Course Outcomes</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>1</th><th>2</th></tr><tr><td>CO1</td><td></td><td>1</td><td></td><td></td><td></td><td>3</td><td></td><td>3</td><td>3</td><td>1</td><td></td><td>3</td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td>2</td><td></td><td>3</td><td></td><td>2</td><td>3</td><td>3</td><td></td><td>3</td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td>1</td><td></td><td></td><td></td><td>1</td><td></td><td></td></tr><tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td>2</td><td>1</td><td>2</td><td></td><td>3</td><td></td><td></td></tr><tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td>3</td><td>3</td><td>3</td><td></td><td>2</td><td></td><td></td></tr></table>															Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		↓ Course Outcomes													1	2	CO1		1				3		3	3	1		3			CO2				2		3		2	3	3		3			CO3						3		1				1			CO4						3		2	1	2		3			CO5						3		3	3	3		2		
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓																																																																																																										
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CO2				2		3		2	3	3		3																																																																																																											
CO3						3		1				1																																																																																																											
CO4						3		2	1	2		3																																																																																																											
CO5						3		3	3	3		2																																																																																																											
1: Low 2: Medium 3: High																																																																																																																							

PRINCIPLES TO PHYSICAL EDUCATION			
Course Code	21HU8X71	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Appreciate and understand the value of physical education and its relationship to a healthy active lifestyle.
2. Work to their optimal level of physical fitness.
3. Show knowledge and understanding in a variety of physical activities and evaluate their own and others' performances.

UNIT - I

History of Physical Education - Olympic games, Modern Olympic games, Olympic Ideals & Objectives, Olympic Symbols, Olympic Flag, Olympic Emblem, Olympic Motto, Olympic Flame, Asian games

International Olympic Committee (IOC), Indian Olympic Association (IOA)

Sports awards - Eligibility, Objectives & Criteria

Yoga - Meaning and Importance

World Health organization (WHO)

10 Hours

UNIT – II

Concept of Health - Meaning of Health, Health Definition, Factors Affecting Health, Qualities of Healthy Person. Health Hazards of College Students, Physical Fitness and Exercises.

Food and Nutrition - Food & Nutrition Defined, Nutrients and their Functions - i) Proteins ii) Carbohydrates iii) Fats iv) Vitamins

Balanced Diet & Malnutrition

Health Education - Meaning of Health Education, Health Education Defined, Scope of Health Education, Importance of Health Education.

Posture - Concept of Posture, Correct Postures, Common Postural Defects

First Aid - First Aid Defined, Need and importance of First Aid, The Requisites of First Aid, Scope of First Aid, Qualities of a First Aider, Fundamental Principles to be followed and the Duties to be performed by the First Aider, First Aid in Different Cases.

Physical Education - Concept of Physical Education, Physical Education Defined, Importance of Physical Education, Scope of Physical Education, Aims and Objectives of Physical Education.

Teaching Aid in Physical Education

Competition - Introduction, Types of competition, Knock out, League or Round Robin Tournament.

12 Hours

UNIT – III

Training in Sports – Meaning, Principles, Warming Up & Limbering Down

Importance of Anatomy and Physiology in Physical Education, Oxygen Debt and Second wind

Leadership and Supervision – Leadership, Qualities of a good leader in Physical Education, Types of Leadership in Physical Education - 1. Teacher Leadership 2. Student Leadership.

Measurement & specification of various playing fields – Cricket, Volley Ball, Basket Ball, Badminton, Ball Badminton, Foot Ball, Hand Ball & their basic playing skills.

16 Hours

Course Outcomes:

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

1. Demonstrate an understanding of the principles and concepts related to a variety of physical activities.
2. Apply health and fitness principles effectively through a variety of physical activities.
3. Support and encourage others (towards a positive working environment).
4. Show self-motivation, organization and responsible behavior.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
													1	2
CO1						3			2	1		1		
CO2						3			2	1		1		
CO3						3			2	1		1		
CO4						3			2	1		1		
CO5						3			2	1		1		

1: Low 2: Medium 3: High

TEXT AND REFERENCE BOOKS:

1. A. K. Uppal, “Physical Education and Health”
2. M. L. Kamlesh, “Fundamental Elements of physical Education”,
3. Swami Ramdev, “Yog its philosophy and practice”, Divya Prakashan
4. V. K. Sharma, “Health and Physical Education”

INTRODUCTION TO JAPANESE LANGUAGE																
Course Code					21HU8X72			Course Type					OEC			
Teaching Hours/Week (L:T:P: S)					3:0:0:0			Credits					03			
Total Teaching Hours					39+0+0			CIE + SEE Marks					50+50			
Teaching Department:																
Course Objectives:																
1.		Have basic spoken communication skills														
2.		Write Simple Sentences														
3.		Listen and comprehend basic Japanese spoken Japanese														
4.		Read and understand basic Japanese characters including Kanji														
UNIT - I																
(Lessons 1-6)															13	
Grammar – Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense																
Vocabulary – Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips																
UNIT - II																
(Lessons 7-13)															13	
Communication skills – Time, Adjective, Seasons, Conversation, Q&A																
Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc.																
UNIT - III																
(Lessons 14-21)															13	
Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji																
Characters, and sentence making, Video Clips																
Course Outcomes: At the end of the course student will be able to																
1.		Understand Simple words, expressions and sentences, spoken slowly and distinctly														
2.		Speak slowly and distinctly to comprehend														
3.		Read and Understand common words and sentences														
4.		Ask Basic questions and speak in simple sentences														
5.		Write Hiragana/Katakana and Kanji (121) characters.														
Course Outcomes Mapping with Program Outcomes & PSO																
	Program Outcomes→		1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes														1	2
	CO1							3			2	1		1		
	CO2							3			2	1		1		
	CO3							3			2	1		1		
	CO4							3			2	1		1		
	CO5							3			2	1		1		
1: Low 2: Medium 3: High																

INTRODUCTION TO GERMAN LANGUAGE				
Course Code		21HU8X74	Course Type	OEK
Teaching Hours/Week (L:T:P: S)		3:0:0:0	Credits	03
Total Teaching Hours		39+0+0	CIE + SEE Marks	50+50
Teaching Department: Mechanical				
Course Objectives:				
1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.			
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er			
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.			
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases			
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.			
UNIT - I				
Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischenKarte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vierJahreszeiten, die Jahre Mir gehes gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings), Wieschreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles: the □ der/die/das; a/an □ ein/eine Die vierFälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv(Not in level A-1) Deklination des bestimmtenArtikels der/die/das Deklination des unbestimmtenArtikelsein/eine (Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified) Deklination von Substantiven (Declension of nouns) (Singular and Plural) (German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects). Nominativ und Akkusativ(nominative and accusative cases) The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive. (Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs) Negation „kein/e/er “(negation with „kein/e/er “) (Singular und Plural) The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k“ at the beginning of the declined form of ein/eine/ein. Peter siehteinHaus. □ Negation □ Peter siehtkeinHaus. (Peter sees a house. □ negation □ Peter does not see a house.) (With examples, writing and hearing exercises, and German to English Glossary as applicable)				13
UNIT - II				
Dativ (the dative) (You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask “(To) whom?”) Der Plural (the plural)				13

<p>There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular.</p> <p>Das Personalpronomen (the personal pronoun) The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced.</p> <p>Die Formen des PersonalpronomenimNominativ (The nominative forms of the personal pronoun):</p> <p>Präpositionen (prepositions) German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But there are also prepositions which can be followed by both. In this case, the question “Where(to)?” (□ accusative) or “Where?” (□ dative) determines the case of the object.</p> <p>PräpositionenmitAkkusativ und Dativ (Prepositions with accusative and dative)</p> <ol style="list-style-type: none"> 1. PräpositionenmitAkkusativ (prepositions with accusative) 2. PräpositionenmitDativ (prepositions with dative) 3. PräpositionenmitAkkusativoderDativ (prepositions with accusative or dative) <p>(With examples, writing and hearing exercises, and German to English Glossary as applicable)</p>	
UNIT - III	
<p>Konjugation von VerbenimPräsens (Conjugation of verbs in present tense) Verbs are conjugated by attaching certain endings, depending on the person and number of the subject.</p> <p>Trennbare und untrennbareVerben (separable and inseparable verbs) Verbs with prefixes are distinguished between separable and inseparable verbs. The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be- kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen</p> <ol style="list-style-type: none"> 1. TrennbareVerben (separable verbs) 2. UntrennbareVerben (inseparable verbs) <p>Konjugation von VerbenimPerfekt (Conjugation of verbs in present perfect) The present perfect (Perfekt) describes something which happened in the past and is especially used in spoken German. It is formed with the present tense form of „haben“ or „sein“ and the past participle of the main verb.</p> <ol style="list-style-type: none"> 1. Die Bildung des Partizips (the formation of the past participle) 2. Die Bildung des Perfektsmit „haben“ und „sein“ (the formation of the present perfect with „haben“ and „sein“) <p>Modalverben (modal verbs) A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. While the main verb remains in the infinitive, the modal verb is conjugated. In German, there are 7 modal verbs: können (can/be able), dürfen (may/be allowed), wollen (want), müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like)</p> <ol style="list-style-type: none"> 1. Konjugation der Modalverben (Conjugation of the modal verbs) 2. Stellung des ModalverbsimSatz (Position of the modal verb within a sentence) <p>(With examples, writing and hearing exercises, and German to English Glossary as applicable)</p>	13

Course Outcomes: At the end of the course student will be able to																
1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.															
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er															
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.															
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases															
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.															
Course Outcomes Mapping with Program Outcomes & PSO																
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
	↓ Course Outcomes													1	2	
	HU1502-1.1						3			2	1		1			
	HU1502-1.2						3			2	1		1			
	HU1502-1.3						3			2	1		1			
	HU1502-1.4						3			2	1		1			
	HU1502-1.5						3			2	1		1			
1: Low 2: Medium 3: High																
TEXTBOOKS:																
1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, UnterrichtswerkfuerErwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989															
2.	Paul Coggle and HeinerSchenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden& Stoughton Educational, UK, 2101															
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2111															
REFERENCE MATERIALS:																
1.	Deutsche SprachlehrefürAusländer.															
2.	ThemenAktuell (Text and workbook).															
3.	Deutsch alsFremdsprache 1A.															
4.	Tangram Aktuell 1A/1B (Text and workbook).															
5.	Wherever required the Videos/Audios are also played in the class room sessions															
E-RESOURCES:																
1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. MilindBrahme IIT Madras															
2.	https://www.traingerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online															

SUSTAINABLE DEVELOPMENT GOALS			
Course code	21ME8X75	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03
Course Learning Objectives: Sustainable Development Goals is a 2116 United Nations officially released Agendas for Sustainable approach environmental integrity, economic viability and a just society for present and future generations. It aims to provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Learn more and take action. This SDG program is organized in such a way to be research-led, applied interdisciplinary program that considers sustainability in both developed and developing societies, and addresses critical global challenges put forth by UN.			
UNIT – I			
The origin, development and idea of the SDGs History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals? SDGs and Society: Ensuring resilience and primary needs in society In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education			
			13 Hours
UNIT – II			
SDGs and Society: Strengthening Institutions for Sustainability In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions SDGs and the Economy: Shaping a Sustainable Economy In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption			
			13 Hours
UNIT – III			
SDGs and the Biosphere: Development within Planetary Boundaries In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land Realizing the SDGs: Implementation through Global Partnerships In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.			
			13 Hours

Course Outcomes:

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

CO 1	Summarize the UN's Sustainable Development Goals and how their aims, methodology and perspectives.
CO 2	Analyze the major issues affecting sustainable development and how sustainable development can be achieved in practice.
CO 3	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
CO 4	Evaluate the implications of overuse of resources, population growth and economic growth and sustainability & Explore the challenges the society faces in making transition to renewable resource use
CO 5	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

TEXTBOOKS:

1. Sachs, Jeffrey D. The age of sustainable development. Columbia University Press, 2115
2. Gagnon, B., Leduc, R., and Savard, L., Sustainable development in engineering: a review of principles and definition of a conceptual framework. Cahier de recherche / Working Paper 08-18, 2108.
3. Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge, 2119.
4. Sustainability: A Comprehensive Foundation by Tom Thesis and JonathanTomkin, Editors.

REFERENCE BOOKS:

1. Elliott, Jennifer. An introduction to sustainable development. Routledge, 2112.
2. Day, G.S., and P.J.H. Schoemaker (2111), Innovating in uncertain markets: 10 lessons for green technologies, MIT Sloan Management Review, 52.4: 37-45.

MOOC Resources:

1. <https://www.un.org/sustainabledevelopment/poverty/>

Course Articulation Matrix

Course Code / Name : 21ME/ SUSTAINABLE DEVELOPMENT GOALS														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	1	3	3	1	1	1		2	1	1
2	2	2	1	1	1	3	3	2	1	1		1	1	1
3	3	2	2	1	1	3	3	2	3	1		1	1	2
4	3	2	3	1	1	3	3	2	1	1		1	3	2
5	1	2	2	1	1	3	3	2	2	2		1	1	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

WEB TECHNOLOGIES			
Course Code	21IS8X76	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives (CLOs):

At the end of the course student should be able to:

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Illustrate the Database connectivity using PHP
- Examine JavaScript frameworks such as jQuery

UNIT - I

Introduction to HTML- Html tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

15 Hours

UNIT - II

Client side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

15 Hours

UNIT – III

PHP Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X52.1	Adapt HTML and CSS syntax and semantics to build web pages	L2
C8X52.2	Construct and visually format tables and forms using HTML and CSS	L3
C8X52.3	Experiment with the usage of Event handling and Form validation using Java script	L3
C8X52.4	Understand the principles of object oriented development using PHP and Database concepts	L2
C8X52.5	Inspect JavaScript frameworks like jQuery which facilitates developer to focus on core features.	L2

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,3	1.3.1,1.4.1,3.2.1,	L2
CO2	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L3
CO3	1,3	1.4.1,3.2.1,3.2.2,3.4.3	L3
CO4	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L2
CO5	1,3	1.4.1,3.2.1,3.2.2	L2

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X52.1	1	2		2								1	2	
C8X52.2	1			2								1	2	
C8X52.3	1	2		2	3							1	2	
C8X52.4	1	2		2	3							1	2	
C8X52.5	1			2	3							1	2	

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

- Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)

E RESOURCES:

- nptel.ac.in/courses/106105084/11

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabus & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

PROGRAMMING IN JAVA			
Course Code	21CS8X77	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable students to:

1. Learn fundamental features of object oriented language and JAVA programming constructs.
2. Develop and run simple Java programs using OOPS concepts of java
3. Create multi-threaded programs and event driven Graphical User Interface (GUI) programming using swing package.

UNIT – I

Introduction to Java: Java's magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Classes, Inheritance: Classes fundamentals; Declaring objects; Call by value and Call by Reference, array of objects, Constructors, this keyword, and usage of static keyword.

Inheritance: inheritance basics, using super, creating multi-level hierarchy, method Overriding, abstract classes, final classes.

15 Hours

UNIT – II

Exception handling, packages and interfaces: Exception handling in Java, use of try, catch blocks, multiple catch blocks, finally block, use of throw and throws clauses, creating custom exceptions. Packages, Access Protection, Importing Packages, Interfaces. IO Streams for file handling.

Multi-Threaded Programming:

What are threads? How to make the classes threadable; Extending threads; Implementing runnable interface; creating multiple threads, join and is Alive methods of Thread class, Thread Synchronization; achieving thread synchronization among multiple threads. Thread priorities, methods to get and set thread priority

15 Hours

UNIT – III

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model;

Swings:

The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

09 Hours

Course Outcomes:

Upon completion of this course, students will be able to:

1. Apply the object-oriented concepts to solve real world problems using JAVA programming features
2. Illustrate the basic constructs and object oriented features of the Java language
3. Design a multi-threaded program using Java with exception handling
4. Develop Java programs that includes packages and interfaces and perform file operations in Java
5. Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3			2				1	1		1	2	3	
CO2	1	2	2		1				1	1		1		3	
CO3	1	2	3		1				1	1		1		3	2
CO4	1	2	3		1				1	1		1	2	3	3
CO5	1	2	3		1				1	1		1		3	3

Graduate Attributes (GA)

This course will map the following GA as per NBA:

1. Design/Development of Solutions
2. Problem Analysis
3. Modern tool usage

TEXTBOOK:

1. Herbert Schildt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2107. (Chapters 2-11, 22-24, 29,30)

REFERENCE BOOKS:

1. Mahesh Bhawe and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2108, ISBN:9788131721806
2. Rajkumar Buyya, S Thamarasi selvi, xingchen chu, Object oriented Programming with Java, Tata McGraw Hill education private limited.
3. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

E-Books / Online Resources:

1. Online course material by Oracle :
<http://docs.oracle.com/javase/tutorial/index.html>
2. <https://www.udemy.com/courses/search/?q=java&price=price-free&view=grid>

MOOC:

1. Oracle: www.oracle.com/events/global/en/java.../java-a-beginners-guide-1721064.pdf
2. NPTEL: www.nptelvideos.com/java/java_video_lectures_tutorials.php

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

DATA STRUCTURES AND ALGORITHMS			
Course Code	21CS8X78	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable students to:

1. **Outline** the concepts of data structures, its types, structures and pointers.
2. **Understand** linear data structures, namely, stack, queue, singly linked list and doubly linked list.
3. **Analyze** nonlinear data structures, namely, binary tree and graphs.
4. **Analyze** the non-recursive and recursive algorithms and to represent Efficiency of these algorithms in terms of the standard Asymptotic notations.
5. **Explain** the various algorithm design techniques and apply them to solve various real world problems.

UNIT – I

INTRODUCTION:

Data Structure, Classification (Primitive and non-primitive), data structure operations.

POINTERS:

Definition and Concepts, Accessing variables through pointers, Arrays and pointers. Structures, pointers to structures.

LINEAR DATA STRUCTURES – STACKS:

Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks using C functions (Push(), Pop(), IsStackFull(), IsStackEmpty()).

LINEAR DATA STRUCTURES – QUEUES:

Introduction and Definition Representation of Queue: Array and Structure representation of queue, Operations on Ordinary Queue using C functions (Insert(), Remove(), IsQueueFull(), IsQueueEmpty())

15 Hours

UNIT – II

LINEAR DATA STRUCTURES - SINGLY LINKED LISTS:

Dynamic Memory allocation functions. Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List using C functions (Insert node at front, Remove a node from front, display singly linked list).

LINEAR DATA STRUCTURES - DOUBLY LINKED LISTS:

Doubly Linked List: Representation. (Operations not included).

NONLINEAR DATA STRUCTURES – BINARY TREES:

Binary Trees: Properties, Linked representation of Binary Tree, Binary Tree Traversals, Introduction to Binary Search Tree.

INTRODUCTION TO ALGORITHMS:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving, understanding and representing graphs using adjacency matrix and linked list.

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms.

15 Hours

UNIT – III

DECREASE & CONQUER:

Concept of Decrease and Conquer, Graph traversal algorithms - Depth First Search, Breadth First Search.

DYNAMIC PROGRAMMING:

Concept of Dynamic Programming, Computing a Binomial Coefficient.

GREEDY METHOD:

Concept of Greedy technique, Prim's algorithm.

BACKTRACKING:

Concept of Backtracking technique, N-Queens problem.

9 Hours

Course Outcomes:

1. **Acquire** the fundamental knowledge of various types of data structures and pointers using that knowledge, analyze and design the programs using pointers
2. **Apply** the fundamental programming knowledge of data structures to analyze and design linear data structures, namely, stack, queue, singly linked list and doubly linked list and use them for solving problems.
3. **Implement** and apply the concept of binary trees and graph data structures and also understand their traversals.
4. **Analyze** non-recursive or recursive algorithm and to represent in terms of standard Asymptotic notations.
5. **Apply** Divide and Conquer, Decrease and Conquer, Dynamic programming, Greedy, and Backtracking algorithm design techniques to solve real time problems.

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2						1				1	3		
CO2	3	1	2					1				1	3		
CO3	3	2						1				1	3		
CO4	2	3												2	
CO5	2	2	3	2	3				1			1		3	
3: Substantial (High)				2: Moderate (Medium)						1: Poor (Low)					

TEXTBOOKS:

1. Aaron M. Tenenbaum, Yeddyah Langsam & Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2106.
2. Anany Levitin, “Introduction to the Design & Analysis of Algorithms”, 2nd Edition, Pearson Education, 2107.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2114.
2. Seymour Lipschutz, “Data Structures, Schaum’s Outlines”, Revised 1st edition, McGraw Hill, 2114.
3. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, “Introduction to Algorithms”, 2nd Edition, PHI, 2106.

MOOCs:

1. Introduction to Data Structures by edx , URL: <https://www.edx.org/course/>
2. Advance Data Structures by MIT OCW , URL: <https://www.mooclab.club/>
3. Data Structure by Harvard Extension School, URL: <http://www.extension.harvard.>
4. <http://nptel.ac.in/courses/106101060/>

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit –III**

ELECTRIC VEHICLE TECHNOLOGY			
Course Code	21EE8X79	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Eligible Students: For all engineering stream except E&E Engineering

Course Learning Objectives:

1. To Understand the fundamental laws and vehicle mechanics.
2. To Understand working of Electric Vehicles and recent trends.
3. Ability to analyze different power converter topology used for electric vehicle application.
4. Ability to develop the electric propulsion unit and its control for application of electric vehicles.

UNIT – I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **14 Hours**

UNIT – II

Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super capacitors.

Electric Propulsion:

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. **16 Hours**

UNIT – III

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

9 Hours

Course Outcomes:

At the end of the course student will be able to

1. Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
2. Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3. Model batteries, Fuel cells, PEMFC and super capacitors.
4. Analyze DC and AC drive topologies used for electric vehicle application.
5. Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes & PSO												
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
21EE8X .1	2	3										
21EE 8X .2	1	2	3									
21EE 8X .3	1	2	3									
21EE 8X .4	1	2	3									
21EE 8X .5	1	2	2									

1: Low 2: Medium 3: High

SEE QUESTION PAPER PATTERN:

- There will be **8** questions of **21** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit – I & Unit – II** and **1** full question from **Unit – III**.

TEXTBOOKS:

- Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2103
- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2105

REFERENCE BOOKS:

- Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2113.
- Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, OXFORD University, 2101
- Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2101

E-Books / MOOC:

- Introduction to Mechanics | Coursera
- NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
- Electric Vehicles - Part 1 - Course (nptel.ac.in)
- Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
- NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
- Electric Cars: Technology | My MOOC (my-mooc.com)

NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES			
Course Code	21HU8X81	Course Type	OEC
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Chemistry			
Course Learning Objectives:			
1.	To create evolved youth, who will be equipped to contribute in the development of the nation.		
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of a smart soldier and to inculcate the sense of authority by commanding the troop under him/her.		
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.		
4.	To understand and develop life skills, soft skills and to improve the emotional quotient of the student.		
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values		
UNIT – I			
NCC: Aims, Objectives and Organization NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.			7
Personality Development Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.			7
UNIT – II			
Naval Communication and Seamanship Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work. Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.			8
Disaster management and environmental awareness Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities. Dos and Don'ts, Fire services and Firefighting, Environmental Awareness and Conservation.			8
UNIT – III			
Naval Orientation Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy. Border and Coastal areas: Security Challenges & role of cadets in Border management			9

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

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
HU1505-1.1						3	3	1						
HU1505-1.2						3	3							
HU1505-1.3									1					

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Cadets Handbook, R.K. Gupta, Ramesh Publishing House, New Delhi.
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FUNDAMENTALS OF IMAGE PROCESSING – A PRACTICAL APPROACH			
Course Code	21EC8X82	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:1	SEE Marks	50
Total Hours	26:0:26	Credits	03

Course Learning Objectives:

This course will enable the students to

1. Understand basic operations on images.
2. Understand the concepts of colour models.
3. Explain image enhancement techniques.
4. Perform morphological operations on images.
5. Perform thresholding operation for image segmentation.

Software Tool Required: MATLAB

Image Fundamentals: Description of Image and Basic operations: Image Brightening, Darkening, Addition, Subtraction, Multiplication and logic operations, Binary and Gray scale images, Color Fundamentals.

Image Enhancement Techniques: Concept & Importance of Histogram, Basic gray level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening filters.

Morphological Operations and Thresholding: Introduction, Erosion and Dilation, Opening and Closing, Thresholding, segmentation methods.

26 Hours

List of Experiments:

1. Introduction to MATLAB.
2. Reading and analyzing images.
3. Image Conversions.
4. Basic operations on images.
5. Basic Arithmetic operations on images- Addition, Subtraction and Multiplication.

6. Exploring Image manipulation operations.
7. Histogram processing.
8. Demonstration of Effects of Filters on images-Smoothing.
9. Demonstration of Effects of Filters on images-Sharpening.
10. Exploring different color models.
11. Demonstration of Morphological Operations.
12. Demonstration of thresholding operations.
13. Exploring image segmentation methods.

Scheme of SEE

Laboratory based evaluation

Course Outcomes:

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

1. Demonstrate the understanding of basic operations on images
2. Apply image enhancement methods
3. Perform segmentation operation

Mapping of PO's/ PSO's & CO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO2	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO3	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
	3 – High				2 – Medium				1 - Low						

TEXTBOOKS:

1. R. C. Gonzalez and R. E Woods, “**Digital Image Processing**”, Pearson education (Asia)/Prentice Hall of India, 3rd Edition, 2109.
2. R. C. Gonzalez and R. E Woods, “**Digital Image Processing Using MATLAB**”, Pearson education (Asia)/Prentice Hall of India, 2nd Edition, 2111.
3. I.S. Jayaraman, S Esskairajan “**Digital Image Processing**”, illustrated, Tata McGraw-Hill Education, 2111.

NPTEL/ MOOC Link:

1. <https://nptel.ac.in/courses/117105135/>
2. <https://nptel.ac.in/courses/117105079>

INTRODUCTION TO YAKSHAGANA			
Course Code	21HU8X86	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning objectives:

The course will enable the students to:

1. Gain basic understanding of Thenku Thittu Yakshagana.
2. Perform basic movements.
3. Understand speech/dialogue, rhythm, Entry and improvisation skills.

UNIT – I

Introduction: Meaning and features, Origin and development, Difference between Thenkuthittu

and Badaguthittu yakshagana. A brief introduction to Thenkuthittu Yakshagana.

Thalas-Aadi thala, yeka thala, Kore thala and Asta Thala with biditha and mukthya- Practice. Dhingina – Practice.....

14 Hours

UNIT – II

Thalas- Rupaka Thala, Trivide Thala, Jampe thala etc. with biditha and mukthaya.

Dhigina – Practice

Rangasthala Pravesha steps and Eripada ettugade steps.

Revision of all Thalas.

14 Hours

UNIT – III

Yakshagana Prasanga Practice- Abhinaya and presentation.....

11 Hours

Performance: The final part of the course is the performance. A Prasanga will be chosen and taught

to the participants and they will perform the same in front of a live audience.

REFERENCE BOOKS:

1. Arthayana: Yakshagana Talamaddale Arthagarike: Ondu Vishleshane: Dr.Ramananda Banari.
2. Yaksha Naatyanjali Thenkuthittu- Sampadaka: Sathish Madivala, Karkala.
3. Yakshagna Shikshana Patya Pustka- Prathamika vibhaga (Karnatka Patya pusthaka sangha- Bengaluru)
4. Koralara: YakshaganaVimarsha Sankalana: Dr.M. Prabhakara Joshi
5. Vaagartha Gawrava: (Dr. Joshi Abhinandana Guchaha): Ga. Na. Bhat

MARKETING MANAGEMENT			
Course Code	21ME8X88	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Understand and learn the marketing concepts and their application to profit-oriented and non-profit oriented organizations.
2. Able to apply the marketing concepts to analyze the buying behavior & marketing segments to solve these problems.
3. Understand and learn the need for a customer orientation in product pricing & marketing research in the competitive global business environment;
4. Able to develop an understanding and acquiring skills in how to successfully design and implement marketing plans and strategies.
5. Understand and learn the concept of sales, advertising & distribution of marketing mix and its application in traditional and novel environments characterized by emerging information technologies.

UNIT - I

BASICS

Definition, Marketing Process, Dynamics, Needs, Wants & Demands, Marketing Concepts, Environment, mix, types, philosophies, Selling Vs. Marketing, organization, Industrial Vs. Consumer Marketing, Consumer goods, Industrial goods, Product hierarchy.

8 Hours

BUYING BEHAVIOUR & MARKET SEGMENTATION

Cultural, Demographic factors, Motives, types, Buying decisions, segmentation factors, Demographic, Psychographic & Geographic Segmentation, Process, Patterns.

8 Hours

UNIT - II

PRODUCT PRICING & MARKETING RESEARCH

Objectives, pricing, Decisions and Pricing methods, Pricing Management. Introduction, Uses, process of Marketing Research.

8 Hours

MARKETING PLANNING & STRATEGY FORMULATION

Components of a marketing plan, strategy formulations and the marketing process, implementation, Portfolio analysis, BCG, GEC grids.

8 Hours

UNIT - III

ADVERTISING, SALES PROMOTION & DISTRIBUTION

Characteristics, Impact, goals, types, Sales promotion-Point of Purchase, Unique Selling proposition.

Characteristics, Wholesaling, Retailing, channel design, logistics, Modern Trends in retailing.

7 Hours

Course Outcomes (CO):**At the end of the course the student will be able to**

CO1	Explain the basic marketing concepts
CO2	Interpret the buying behaviour of customers and role of marketing segments
CO3	Explain the role of product pricing and marketing research in the competitive global business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve the goals of marketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House, New Delhi, 1999

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1. Philip Kotler, "Marketing Management: Analysis, Planning, Implementation and Control", 1998.
2. Green Paul.E. and Donald Tull, "Research for Marketing Decisions", 1975.
3. Ramaswamy.V.S. and S.Namakumari, "Marketing Environment: Planning, Implementation and Control the Indian Context", 1990
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing Strategies.
