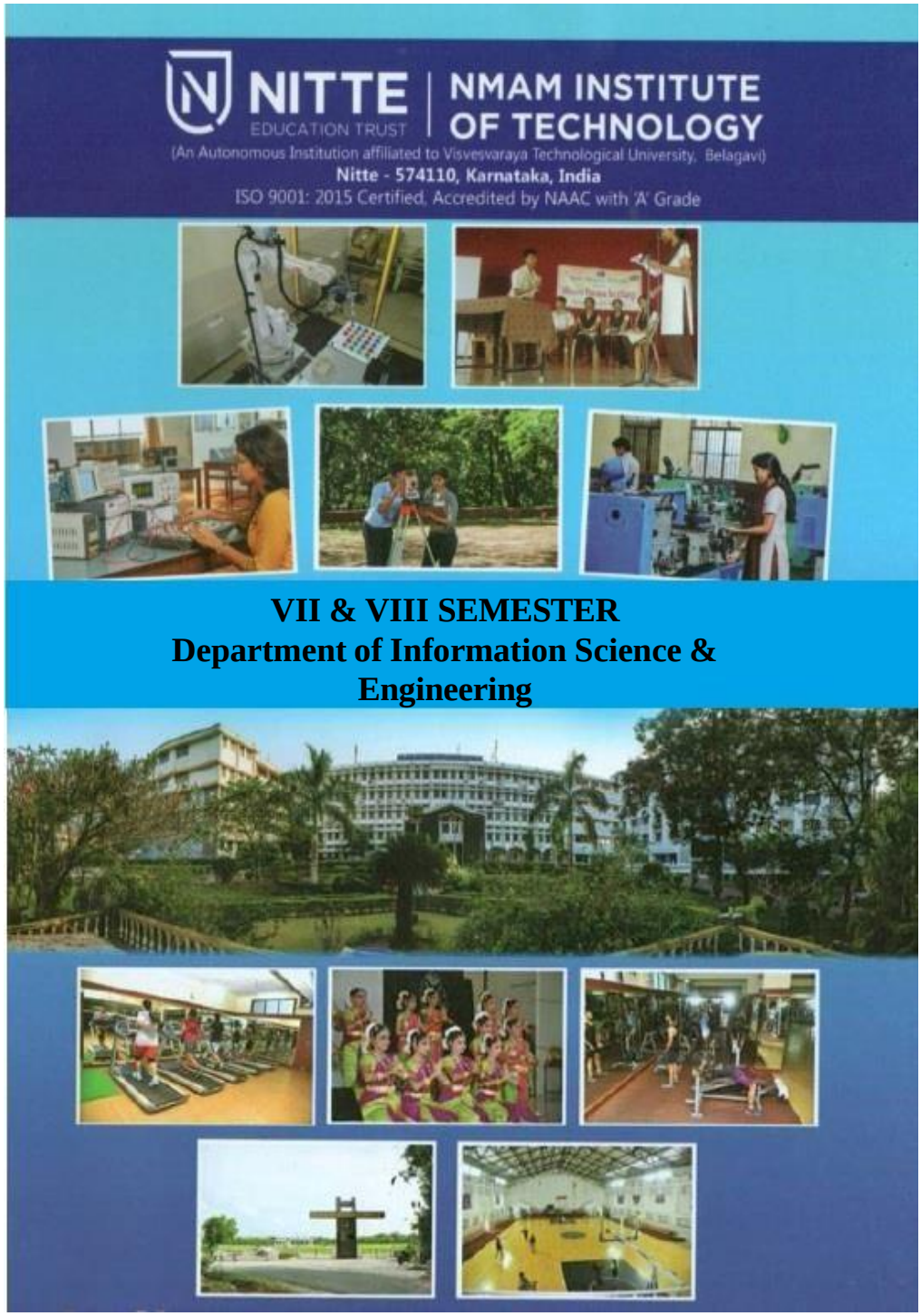
NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

College Calendar 2024-25

Department of Information Science & Engineering

Syllabus of 4th Year



College Calendar 2024-25

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
2024-25
(VII & VIII 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

NITTE EDUCATION TRUST | 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. Radhakrishna	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.	Dr. Roshan Fernandes	HoD, Cyber Security
18.	Dr. Durgaprasad	Incharge ACT
19.	Dr. Sushma	Incharge VLSI
20.	Mr. Bharath G Kumar	Head, Training & Placement Cell

INCHARGE OF INSTITUTION'S RESPONSIBILITIES

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

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
2.	Dr. Abhishek Bhardwaj	T&P Associate

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
8.	Dr. Murari M S	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. Santhosh Tiwari	Asso. Professor
5.	Dr. Aarti S. Bhat	Asst. Professor Gd III
6.	Dr. Subrahmanya Ishwar Bhat	Asst. Professor Gd III
7.	Dr. Sarvajith MS	Asst. Professor Gd III
8.	Dr. Ranjitha	Asst. Professor Gd III
9.	Dr. Shreya Kamath	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. 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. Manjunatha Suvarna	Hostel Manager, Gents Main Hostel
2.	Mr. Rajesh Ballal	Manager, Gents PG Hostel
3.	Mrs. Gayathri Kamath	Manager, Ladies PG Hostel
4.	Mrs. Chethana Sharma	Manager, Ladies Main Hostel
5.	Mrs. Hema S. Hegde	Superintendent, Hostel Office
6.	Mr. Kiran Kumar Annappa Kulal	Hostel Manager, Gents Main Hostel

REGULATIONS

2024-25

(Applicable for admission batch 2021-22 onwards)

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

CONTENTS

REGULATIONS

1. INTRODUCTION
2. DEGREE PROGRAMMES
3. REGISTRATION
4. ADD/DROP/AUDIT OPTIONS
5. COURSE STRUCTURE
6. ATTENDANCE REQUIREMENT
7. WITHDRAWAL FROM THE PROGRAMME
8. EVALUATION SYSTEM
9. EVALUATION OF PERFORMANCE
10. COMMUNICATION OF GRADES
11. VERTICAL PROGRESSION
12. AWARD OF CLASS
13. APPEAL FOR REVIEW OF GRADES
14. AWARD OF DEGREE
15. GRADUATION REQUIREMENTS AND CONVOCATION
16. AWARD OF PRIZES, MEDALS, CLASS AND RANKS
17. CONDUCT AND DISCIPLINE
18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE
19. LISTS OF MAJOR SCHOLARSHIPS

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 7^{th} 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 6^{th} 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 6^{th} & 7^{th} 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 O, A+, A, B+, B, C, P, 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: ≥40% (≥20 marks)
Terminal (SEE)	Score: ≥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) Absolute Grading – Letter Grade and its range

The grade point scale for absolute grading

Marks Range (%)	Grade Point	Letter Grade	Descriptor
90 & above	10	O	Outstanding
80-89	9	A+	Excellent
70-79	8	A	Very Good
60-69	7	B+	Good
55-59	6	B	Above Average
50-54	5	C	Average
40-49	4	P	Pass
00-39	0	F	Fails
Absent	0	AB	Absent

CGPA	Classification
7.00 & above	**First Class with Distinction**
6.00-6.99	**First Class**
5.00-5.99	**Second Class**
CGPA <5.00*	**Academic Probation / Non-compliance**

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.

a. **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.

b. 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).**

c. 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.**

d. 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).

a) 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.

b) 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).

iii) 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.

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

CGPA is computed as follows:

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

iv) 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.

v) VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)

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

b. **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.

c. **(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.

d. 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.

vi) 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	≥ 70%	Distinction
≥ 6.75	≥ 60%	First Class
< 6.75	< 60%	Second Class

Percentage = (GPA - 0.75) x 10

vii) 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.

viii) AWARD OF DEGREE

a. (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 XXX18XXXXX)
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 5^{th}.

(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 3^{rd} and 4^{th} semesters in first attempt only.

Requirements:

(i) Students shall maintain a grade $\geq$D in all courses from $5^{th}$to 8^{th}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 $5^{th}$to 8^{th}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 (≥ 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 chose 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.

b. (1) Noncompliance of CGPA ≥ 5.00 at the end of the Programme

(a) Students, who have completed all the courses of the Programme but not having a CGPA ≥ 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 ≥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 ≥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≥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.

c. 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 outs ide 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

<table>
<tr><th>Applicable to</th><th>Types of scholarship</th><th>Method</th><th>Website</th></tr>
<tr><td rowspan="2">For SC/ST Students</td><td>Income : Below Rs.2,50,000/-</td><td rowspan="2">Online application</td><td rowspan="4">SSP</td></tr>
<tr><td>Income : Above Rs.2,50,000/- to Rs.10,00,000/-</td></tr>
<tr><td rowspan="3">For Others</td><td>Category I : Income Below Rs.2,50,000/-</td><td>Online application</td></tr>
<tr><td>Category 2A, 3A, 3B Income Below Rs.1,00,000/-</td><td>Online application</td></tr>
<tr><td>GSB & Brahmins EWS Certificate upto Rs.8,00,000/-</td><td>Online application</td></tr>
<tr><td></td><td>Minority students Income Below Rs.2,50,000/-</td><td>Online application</td><td>NSP & SSP</td></tr>
<tr><td>Parents must have Beedi Id. Card</td><td>Beedi Scholarship</td><td>Online application</td><td>scholarships.gov.in or nsp.gov.in</td></tr>
</table>

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

INFORMATION SCIENCE
& ENGINEERING

VII & VIII SEMESTER

With
Scheme of Teaching
& Examination

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

VISION:

Excellence in information science and engineering through a strong research and teaching environment that address the emerging global challenges and market demands.

MISSION:

- To provide outstanding education and research training to the students for their productive careers in industry, academia and government.
- To provide a learning environment that promotes excellence and innovation, ethical practice and responsibility towards society.
- To prepare the students to practice their professions competently to meet the ever- changing needs of society and to continue learning their discipline, allowing them to move into other related fields.
- To promote active learning, critical thinking, and engineering judgment coupled with business and entrepreneurial skills.

Programme Educational Objectives (PEOs):

- Graduates must gain both theoretical and practical knowledge to identify, formulate & solve challenges in Information Science & Engineering problems.
- Graduates must work productively as Information Science Engineers, including supportive and leadership roles on multidisciplinary teams.
- Graduates must communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavours, and practice their profession with high regard to legal and ethical responsibilities.
- Graduates must engage in life-long learning, such as graduate study, to remain current in their profession and be leaders in our technological society.

Programme Outcomes (POs):

After successful completion of the program students will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals and Information Science & Engineering principles to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes

that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

4. Design solutions to the problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline.
5. Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequence responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcome (PSO):

1. Design, develop and test software systems to provide solutions to real world problems.
2. Equip students with skills to analyze, design and recommend the appropriate IT infrastructure required for the implementation of a project.

Graduate Attributes:

Sl. No.	Graduate Attributes
a	Engineering Knowledge
b	Problem Analysis
c	Design / development of solutions
d	Conduct investigations of complex problems

e	Modern tool usage
f	The engineer and society
g	Environment and sustainability
h	Ethics
i	Individual and team work
j	Communication
k	Project management and finance
l	Life-long learning

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING
SCHEME OF TEACHING AND EXAMINATION

VII SEMESTER B.E. **18 Hours / Week**

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	PCC	21IS701	Cloud Computing	IS	3	-	-	-	3	50	50	100	3
2	PCC	21IS702	Compiler Design	IS	3	-	-	-	3	50	50	100	3
3	PEC	21ISE1XX	Professional Elective Course-II	IS	3	-	-	-	3	50	50	100	3
4	PEC	21ISE2XX	Professional Elective Course-III	IS	3	-	-	-	3	50	50	100	3
5	OEC	21XX8XXX	Open Elective Course-II	IS	3	-	-	-	3	50	50	100	3
6	PROJ	21IS705	Major Project	IS	-	-	3	-	3	100	100	200	9
TOTAL					**15**	**-**	**3**	**-**	**18**	**350**	**350**	**700**	**24**

VIII SEMESTER B.E. **6 Hours / Week**

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	SEM	21IS801	Technical Seminar	IS	3	-	-	-	-	100	-	100	1
2	INT	21IS802	Research/Industry Internship	IS	-	-	-	-	3	100	100	200	15
TOTAL					**15**	**-**	**3**	**-**	**-**	**350**	**350**	**700**	**24**

ELECTIVE LIST

Elective Groups for 7th Semester B.E.

Professional Elective Course - 2 (Group 1)		Professional Elective Course - 3 (Group 2)	
Course Code	**Course Title**	**Course Code**	
IT Management			
21ISE111	Information Storage Management	21ISE211	NoSQL Database
21ISE112	Total Quality Management for	21ISE212	User Interface Design

	Sustainable Growth		
21ISE113	IOS App Development using Xcode and Swift	21ISE213	Supply Chain Management and Enterprise Resource Planning
21ISE114	Management and Entrepreneurship for IT Industry	21ISE214	Design Thinking
Software Engineering and Development			
21ISE121	C# and NET Technologies	21ISE221	Agile Technology
21ISE122	Full Stack Development	21ISE222	Multi agent Systems
21ISE123	Object Oriented Modeling and Design	21ISE223	Mobile Application Development
21ISE124	Software Testing	21ISE224	Business Intelligence and its Applications
Networks and Security			
21ISE131	Computing in Communication Networks	21ISE231	Cyber Security and Cyber Laws
21ISE132	Network Engineering	21ISE232	Blockchain Technology
21ISE133	Adhoc Networks	21ISE233	Digital Forensics
21ISE134	Software Defined Networks	21ISE234	Intrusion Detection Systems
Data Science and Machine Intelligence			
21ISE141	Fundamentals of Image Processing	21ISE241	Social and Web Analytics
21ISE142	Natural Language Processing	21ISE242	Data Mining
21ISE143	Front-end JavaScript Angular Framework	21ISE243	Artificial Intelligence
21ISE144	Computer Vision	21ISE244	Deep Learning
General			
21ISE151	Parallel Computer Architecture & Programming	21ISE251	Multimedia Processing
21ISE152	Computer Graphics	21ISE252	Innovation Management and Business Models
21ISE153	Operations Research	21ISE253	Virtual Reality
21ISE154	Robotic Process Automation Design & Development	21ISE254	Architecting with Google Compute Engine

Open Elective Course – 1 *(Offered by ISE Department to students of other programs)*	
Course Code	**Course Title**
21IS8X38	Introduction to Python Programming
21IS8X76	Web technologies
21IS8X83	Software Engineering Practices
21IS8X84	Introduction to Cyber Security

CLOUD COMPUTING			
Course Code	**21IS701**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives

1. Explain the technology and principals involved in building a cloud environment.
2. Understand concepts of virtualization and cloud architecture
3. Choose appropriate cloud model for a given application
4. Understand advanced topics in cloud
5. Use simulators and tools to understand working of cloud environment

UNIT – I

Introduction Cloud computing at a glance Historical development (T1: 1.1,1.2) **Principles of Parallel and Distributed Computing** Eras of computing Parallel vs distributed computing Elements of parallel computing Elements of distributed computing Technologies for distributed computing (T1: 2.1, 2.2, 2.3, 2.4, 2.5) **Virtualization** Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization. (T1: 3.1, 3.2, 3.3, 3.4, 3.5)

15 Hours

UNIT - II

Cloud Computing Architecture Introduction, The cloud reference model, Types of clouds, Economics of the cloud, Open challenges (T1: 4.1, 4.2, 4.3, 4.4, 4.5) **Cloud Platforms in Industry** Amazon web services, Google AppEngine, Microsoft Azure (T1: 9.1, 9.2, 9.3) **Cloud Applications** Scientific applications, Business and consumer applications (T1: 10.1, 10.2)

14 Hours

UNIT - III

Advanced Topics in Cloud Computing: Energy efficiency in clouds, Market-based management of clouds, Federated clouds/Inter Cloud, Third-party cloud services, (T1: 11.1, 11.2, 11.3, 11.4) Introduction to Software Defined Networks (R1), Network Function Virtualization. (R2) Introduction to Microservices in cloud (R3), Fog Computing (R4. R5).

10 hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the concepts and terminologies of cloud computing	L2
CO2	Illustrate virtualization, cloud frameworks and technologies	L2
CO3	Interpret appropriate cloud model for a given application	L2
CO4	Explain energy efficiency and basics of software defined networks in cloud	L2
CO5	Explain micro services and fog computing	L2

Mapping of POs & COs:

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
CO1	1	2											1	2
CO2	1	3											1	2
CO3	1	3											1	2
CO4	1	3											1	2
CO5	1	3											1	2

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3=High >70%)

TEXT BOOK:

1. Buyya, R., Vecchiola, C. and Selvi, S.T., 2013. "Mastering cloud computing: foundations and applications programming", Newnes.

REFERENCES

1. https://www.opennetworking.org/images/stories/downloads/sdn-resources/technical-reports/SDN-architecture-overview-1.0.pdf
2. https://web.archive.org/web/20161128071647/https://portal.etsi.org/NFV/NFV_White_ Paper.pdf
3. https://tsh.io/state-of-microservices-2020-by-tsh.pdf
4. https://www.cisco.com/c/dam/en_us/solutions/trends/iot/docs/computing-overview.pdf
5. Mahmud, Redowan, Ramamohanarao Kotagiri, and Rajkumar Buyya. "Fog computing: A taxonomy, survey and future directions." In Internet of everything, pp. 103-130. Springer, Singapore, 2018.

E-RESOURCE

1. https://nptel.ac.in/courses/106105167/
2. https://www.coursera.org/learn/cloud-computing-basics

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.

****

COMPILER DESIGN

Course Code	**:**	**21IS702**		**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 **09 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	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	L2
CO2	Develop top down parsers by applying the knowledge of context free grammar and parsing algorithms.	L2
CO3	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.	L2
CO4	Illustrate Syntax-Directed translation scheme for engineering problems. Apply three address code representations to generate an intermediate code for assignment statement and Boolean expressions.	L2
CO5	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.	L2

Mapping of POs & COs:

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
CO1	1	2	3		3				1			1	1	3
CO2	1	2	3		3				1			1	1	3
CO3	1	2	3		3				1			1	1	3
CO4	1	2	3		1				1			1	1	3
CO5	1	2	3		1				1			1	1	3

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3=High >70%)

TEXT BOOKS:

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 Louden, "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.

****

ELECTIVES
IT MANAGEMENT STREAM

INFORMATION STORAGE MANAGEMENT			
Course Code	**21ISE111**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Describe about different types of computer storage and its working.
2. Focus on the latest technologies which are used for data protection and storage.
3. Analyze requirement and suggest appropriate storage technology to store the data.
4. Use and compare different storage techniques and its pros and cons.
5. How computer storage techniques have evolved.

UNIT - I

STORAGE SYSTEM: INTRODUCTION TO INFORMATION STORAGE

Information Storage, Evolution of Storage and Architecture, Data Center Infrastructure, Virtualization and Cloud Computing.

(T1: 1.1-1.4)

DATA PROTECTION

RAID: RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares.

(T1: 3.1-3.7)

INTELLIGENT STORAGE SYSTEMS: Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.

(T1: 4.1-4.3)

STORAGE NETWORKING TECHNOLOGIES:

Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model**.**

(T2: 5.1-5.5)

11 Hours

UNIT - II

STORAGE NETWORKING TECHNOLOGIES: FIBRE CHANNEL STORAGE AREA NETWORKS

Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre

Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN.

(T1: 5.1-5.11)

NETWORK-ATTACHED STORAGE

General-Purpose Servers vs. NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operations, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File-Level Virtualization.

(T1: 7.1-7.9)

IP SAN: iSCSI, FCIP.

(T1: 6.1-6.2)

OBJECT-BASED AND UNIFIED STORAGE

Object-Based Storage Devices, Content-Addressed Storage, CAS Use Cases, Unified Storage.

(T1: 8.1-8.4)

14 Hours

UNIT III

BUSINESS CONTINUITY: INTRODUCTION TO BUSINESS CONTINUITY

Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions.

(T1: 9.1-9.6)

BACKUP AND RECOVERY

Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets.

(T1: 10.1-10.10)

CLOUD COMPUTING

Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing, Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges, Cloud Adoption Considerations.

(T1: 13.1-13.8)

SECURING THE STORAGE INFRASTRUCTURE

Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking.

(T1: 14.1-14.4)

14 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Outline the computer storage techniques evolution.	L2
CO2	Explain the latest technologies of storage.	L2
CO3	Illustrate and compare storage techniques.	L2
CO4	Analyze requirements and suggest the appropriate storage technology.	L2
CO5	Apply the techniques to secure and protect the data.	L2

Mapping of POs & COs:

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
CO1	3	2												1
CO2	3	2												2
CO3	3	2	1											2
CO4	3	2	1											2
CO5	2	3												2

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3 = High >70%)

TEXT BOOK:

1. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, Published by John Wiley & Sons, Inc.
2. Information Storage and Management by EMC Education Services.

REFERENCE BOOKS:

1. Storage Networks Explained by Ulf Troppen, Rainer Erkens, Wolfgang Muller.
2. Storage Networks by Robert Spalding.

E-RESOURCE:

1. http://nptel.ac.in/courses/106108058/

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.**

****

TOTAL QUALITY MANAGEMENT FOR SUSTAINABLE GROWTH			
Course Code	**21ISE112**	**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:

1. To gain a thorough understanding of Quality and features of quality.
2. To gain knowledge of various quality procedures.
3. To explore the fundamentals of TQM tools
4. To learn about the fundamental of quality audit.
5. To learn about various statistical tools required to access quality.

UNIT – I

Introduction – Evolution of quality, Definition, Concept and Features of TQM, Eight building blocks of TQM.
(T1:1,3)
TQM thinkers and Thought – Juran Trilogy, PDSA cycle, 5S, Kaizen, Crosby's theory on Quality Management, **Quality Performance Excellence Award-** Deming Application Award, European Quality Award, Malcolm Baldrige National Quality Award**.**
(T2:5) **15 Hours**

UNIT – II

TQM tools- Benchmarking: Definition, concepts, benefits, elements, reasons for benchmarking, process of benchmarking, FMEA, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept and need**.**
(T2:7)
Six Sigma- Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation.
(T1:7) **12 Hours**

UNIT-III

Statistical Process Control- Central Tendency, The seven tools of quality, Normal curve, Control charts, Process Capability**.**
(T2:15)
Quality Systems- ISO 9000, ISO 9000:2000, ISO 14000, other quality systems.
(T1:1, T2:8)
Introduction to Sustainable Development: Definitions and principles of Sustainable Development, History and emergence of the concept of Sustainable Development, Millennium Development Goals: Status (global and Indian), Impacts on approach to development policy and practice in India, future directions.
(T3:1 and Class Slides) **12 Hours**

Course Outcomes:
Students will be able to:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Understand the various approaches of TQM	L2
CO2	Identify and use appropriate tools and techniques for controlling, improving and measuring quality	L2
CO3	Analyse customer needs and perceptions of various tools utilization for quality improvement	L2
CO4	Apply statistical tools for continuous improvement of systems	L2
CO5	Apply the tools and technique for effective implementation of TQM	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2											1	2
CO2	1	3											1	2
CO3	1	3											1	2
CO4	1	3											1	2
CO5	1	3											1	2

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3 = High >70%)

TEXTBOOK:

1. Poornima M Charantimath, "Total Quality Management," Pearson Third Edition
2. Dale H. Besterfiled, et at., "Total quality Management," Pearson Education Asia, Third Edition, Indian Reprint 2006.
3. Kirkby. J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London, 1996.

REFERENCE BOOKS:

1. H.Lai, Lt. Gen ,Wiley Eastern Limited, 1990 , Total Quality Management
2. Bounds Greg , McGraw , Beyond Total Quality Management
3. Kanishka Bedi, Oxford Higher Education, Quality Management
4. James R.Evans and Williuam M Lindsay, Managing for Quality and Performance Excellence ,9th edition, Publisher Cengage Learning.

WEB-RESOURCES

1. http://www.evans.swlearning.com s
2. www.cengage.com/international

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.**

****

iOS APP DEVELOPMENT USING XCODE AND SWIFT			
Course Code	**21ISE113**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:

1. **Describe** the iOS interface builder and various UI elements.

2. **Develop** basic iOS App using various UI elements of Interface Builder
3. **Understand** the core data structure, system utilities and application design patterns
4. **Build** iOS App with IBactions, tables , navigation, segues and transitions.
5. **Develop** application to demonstrate networking, storing retrieving and modifying Data

UNIT – I

INTRODUCTION TO DEVELOPER TOOLS

Introduction to macOS; Introduction to Xcode and Swift.; Introduction to Interface Builder; New project setup in Xcode – Using Templates, Creating Projects and Playground, and Workspaces; Interface Builder to design and create UI of your app – introduction to various UI elements of Interface Builder; Cloning Projects; iOS simulator

INTRODUCTION TO iOS

App user interface designing – mobile UI Layout (Layout, View) UI Control (TextView, EditText, Button,ImageButton,ToggleButton,RadioGroup,RadioButton,CheckBox,ProgressBar,Spinner,DayPicker,TimePicker), Draw-able, Menu(Option, Context, Popup).

15 Hours

UNIT – II

CORE FOUNDATION, SYSTEM UTILITIES AND APPLICATION PATTERNS,

Loops and conditional statements, Array, Dictionaries, Data, String, Numbers etc.; Classes and Structures; Handling JSON Working with Files, Date/Calendar utilities, Preferences; Model View Controller (MVC) Design Pattern, IBOutlets, IBActions and linking various elements of UI, Subclassing and Delegation, Extensions and Protocols.

USER INTERFACE DEVELOPMENT

iOS User Interface (UI) design fundamentals iOS ; The view hierarchy – Views, Windows; Navigation View and Tab Bars; Text and Web Views; Alert Views and Action Sheets; Multi-touch, taps and gestures; Table views – delegates and data sources, view styles, custom cells; UIPickerview and UIDatePicker; Autolayout and setting constraints; Storyboards – adding scenes, segues, transitions

15 Hours

UNIT – III

NETWORKING

Network frameworks to access data on the Internet; JSON Handling; NSDataTask, NSURLSession; Webviews.

CORE DATA

Overview of Core Data; Managed Objects; Persistent Store Coordinator; Entity Descriptions; Retrieving and Modifying Data

09 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	**Understand** the iOS developing tool like Xcode and Swift, projects, playground and iOS Emulator.	L2
CO2	**Design** simple iOS app using the fundamental UI elements, Layout and Views	L2
CO3	**Apply** the basic data structures, MVC design patterns, delegates, protocols and structures and classes to build more advanced iOS app	L2
CO4	**Develop** apps that uses advanced UI components like tables, different views and layouts and multiple screens.	L2
CO5	**Apply** the networking APIs and database APIs to design Apps that work real-time data.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3		1	1		2	2	1	2	1	2	3
CO2	3	3	3		1	1		2	2	1	2	1	2	3
CO3	3	3	3		1	1		2	2	1	2	1	2	3
CO4	3	3	3		1	1		2	2	1	2	1	2	3
CO5	3	3	3		1	1		2	2	1	2	1	2	3

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

TEXT BOOKS:

1. Matt Neuburg, "iOS 13 Programming Fundamentals with Swift: Swift, Xcode, and Cocoa" , Basics 1st Edition
2. Serhan Yamacli, "Beginner's Guide to iOS 13 App Development Using Swift 5.1: Xcode, Swift and App Design Fundamentals" 2019 edition.

REFERENCE BOOKS:

1. Kevin J McNeish, "iOS App Development for Non-Programmers Series: The Series on How to Create iPhone & iPad Apps" , 2012 Edition.
2. Jesse Feiler, "iOS App Development for Dummies", 2014 Edition.

E-Books / Online Resources:

1. https://developer.apple.com/swift/
2. https://developer.apple.com/videos/
3. https://code.tutsplus.com/series/learn-ios-sdk-development-from-scratch--mobile-14536

MOOC:

1. https://www.coursera.org/courses?query=ios%20app%20development
2. https://www.udemy.com/topic/ios-development/

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.**

****

MANAGEMENT AND ENTREPRENEURSHIP FOR IT INDUSTRY			
Course Code	**21ISE114**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:

1. Principles of management, organization and entrepreneur.
2. Discuss on planning, staffing, ERP and their importance.
3. Infer the importance of intellectual property rights and relate the institutional support.

UNIT - I

INTRODUCTION - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection.(T1)

DIRECTING AND CONTROLLING- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control.(T4)

15 Hours

UNIT - II

ENTREPRENEUR – Meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.(T4)

PREPARATION OF PROJECT AND ERP - meaning of project, project identification, project selection, project report, need and significance of project report, contents, formulation, guidelines by planning commission for project report.(T4)

15 Hours

UNIT - III

ENTERPRISE RESOURCE PLANNING: Meaning and Importance- ERP and Functional areas of Management – Marketing / Sales- Supply Chain Management – Finance and Accounting – Human Resources – Types of reports and methods of report generation.(T2)

MICRO AND SMALL ENTERPRISES: Definition of micro and small enterprises, characteristics and advantages of micro and small enterprises, steps in establishing micro and small enterprises. Institutional support: MSME-DI, NSIC, SIDBI, KIADB, KSSIDC, TECSOK, KSFC, DIC and District level single window agency, Introduction to IPR.(T3)

09 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the basic concepts of management, planning, Organizing and Staffing.	L2
CO2	Summarize the appropriate leadership styles, motivation theories, communications, Coordination and controlling, methods	L2
CO3	Interpret the meaning of entrepreneur, entrepreneurship and role in economic development on India. Along with Identification of business opportunities and feasibility study	L2
CO4	Inferring the new ideas, prepare project report based on guidelines of planning commission by utilizing the resources available effectively through ERP	L2
CO5	Explain the IPRs and institutional support in Micro and Small Enterprises as per the Indian Industrial Policy 2007	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	1					2	2						
CO2						2	2	2	2	2				1
CO3	1	2	3			2			2			2		1
CO4	1	2								2	2			
CO5	1	2				2	2	2			2	2		

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

Course Outcomes:

TEXT BOOKS:

1. Principles of Management -P. C. Tripathi, P. N. Reddy; Tata McGraw Hill, 4th / 6th Edition, 2010.
2. Dynamics of Entrepreneurial Development & Management -Vasant Desai Himalaya Publishing House.
3. Entrepreneurship Development -Small Business Enterprises -Poornima M Charantimath Pearson Education – 2006.
4. Management and Entrepreneurship – Kanishka Bedi- Oxford University Press-2017.

REFERENCE BOOKS

1. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier–Thomson.
2. Entrepreneurship Development -S S Khanka -S Chand & Co.
3. Management -Stephen Robbins -Pearson Education /PHI -17th Edition, 2003

ADDITIONAL STUDY MATERIAL & E-BOOKS:

1. Iyer, P.P., Engineering Project Management with Case Studies, Vikas Publishing, New Delhi, 2009.

2. Zikmund, W.G., Business Research Methods, 5th Edition, New York, The Dryden Press, Harcount Publishers, 1997.
3. M Govindarajan and S. Natarajan, Principles of Management, Eastern Economy Edition, 2005.

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.**

******

NOSQL DATABASE			
Course Code:	**21IS211**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph)
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Understand concepts of Map Reduce
4. Understand concepts of document database
5. Demonstrate the use of graph database

UNIT – I

Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access

Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes

(T1:1,2,3,4,5,6)

15 Hours

UNIT – II

Map-Reduce, Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.

Document Databases, What Is a Document Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, ECommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure
(T1:7,8,9)

15 Hours

UNIT – III

Graph Databases, What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.
(T1:11)

9 hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Illustrate the concept of NOSQL Database	L2
CO2	Apply aggregate and replication features	L3
CO3	Model map reduce applications	L3
CO4	Illustrate the concepts of document database.	L3
CO5	Illustrate the concepts of graph database.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2									1		1		
CO2	2	2								1		1		
CO3	2	3								1		1		3
CO4	2	2	3							1		1		2
CO5	2									1		1		2

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

TEXTBOOK:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

REFERENCES

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

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.**

****

USER INTERFACE DESIGN			
Course Code:	**21ISE212**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course learning Objectives:

This course will enable students to:

1. To study the concept of menus, windows, interfaces
2. To study about user interface design, pitfalls, commandments of design and usability aspects.
3. To study system menus and windows and layouts for effective communication.
4. To study the psychology of users and their action
5. To study about constraints, discoverability of features, feedback system and detecting and reporting error.

UNIT I

The User Interface- Introduction, Overview, The importance of user interface Defining the user interface, The importance of Good design, benefits of good design, Introduction to graphical user interface, A brief history of screen design.

The User Interface Design process- Obstacles, Usability, Important human characteristics in design, Human considerations in Design, Business definition and requirement analysis.

15 Hours

UNIT II

System menus- Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, Kinds of graphical menus.

Windows - Characteristics, Components of window, Window presentation styles, Types of window, Window management, Window operations, Characteristics of device based controls.

Screen based controls- Operable control, Text control, Selection control Provide effective feedback and Guidance assistance, Organize and Layout Windows and pages

12 Hours

UNIT III

The psychology of everyday actions: How people do things: The gulfs of execution and evaluation, The seven stages of action, The seven stages of action and The three levels of processing , Seven fundamental design principles.

Knowing what to do: constraints, discoverability, and feedback: four kinds of constraints: physical, cultural, semantic, and logical, constraints that force the desired behaviour, conventions the faucet: a case history of design, using sound as signifiers.

Human error? no, bad design: understanding why there is error, two types of errors: slips and mistakes, social and institutional pressures, reporting error, detecting error, designing for error, design principles for dealing with error.

12 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain various Graphical User Interface design aspects & measures to improve them.	L2
CO2	Summarise the basic principles of user interface and design	L2
CO3	Outline the differences between usability and user experience and the need for human factors in design.	L2
CO4	Infer user-interface design process and introducing common design scenarios.	L2
CO5	To understand the user psychology and enunciate the design principles from psychological aspects.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3							1	1		1	1	
CO2	2	3							1	1		1	1	
CO3	1	3	2						1	1		1	3	2
CO4	1	3	2						1	1		1	3	2
CO5		2	2						1	1		1	1	2

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

Textbook:

1. The Essential Guide to User Interface Design, Wilbert O. Galitz, 3rd Edition, 2007, John Wiley & Sons, Inc., ISBN: 0470146222.
2. The design of Everyday Things, Don Norman, 2013, Basic Books Publication, ISBN: 978-0-465-00394-5.

E-resource:

1. Coursera course: User Interface Design Specialization by Loren Terveen(16 weeks)

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.**

****

SUPPLY CHAIN MANAGEMENT AND ENTERPRISE RESOURCE PLANNING			
Course Code	**21ISE213**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Outline the concepts of a supply chain with various case studies and explain the strategic framework to analyze supply chains and their management.
2. Illustrate the role of transportation and coordination in a supply chain with design and comparison of various transportation modes and coordination methodologies.
3. Analyze the role of pricing and revenue management in a supply chain with key factors, tactics and get the idea of role of IT in a supply chain.
4. Understand and Analyze ERP.
5. Apply ERP to the Supply Chain Management.

UNIT – I

BUILDING A STRATEGIC FRAMEWORK TO ANALYZE SUPPLY CHAINS [2nd Textbook]:

1st Chapter: 1.4: Supply chain stages and decision phases process view of a supply chain. -**1.5:** Supply chain flows. **1.6:** Examples of supply chains. **2.1:** Competitive and supply chain strategies. **2.2:** Achieving strategic fit. **2.3:** Expanding strategic scope. **3.2:** Drivers of supply chain performance. **3.3:** Framework for structuring drivers – **3.5:** Inventory, **3.6:** Transportation, **3.4:** Facilities, **3.7:** Information. Obstacles to achieving fit. Case discussions.

TRANSPORTATION IN A SUPPLY CHAIN [2nd Textbook] 14th Chapter

14.1: Roles of transportation in a supply chain ,**14.2:** modes of transportation and their performance characteristics, **14.3:** transportation infrastructure and policies, **14.4:** design option for a transportation network, **14.5:** trade-offs in transportation design, **14.6:** tailored transportation, **14.7:** role of IT in transportation, **14.8:** risk management in transportation, Indian transportation system-in need of innovations to propel economic growth, **14.9:** making transportation decisions in practice.

15 Hours

UNIT - II

CORDINATION IN A SUPPLY CHAIN [2nd Textbook] 10th Chapter

10.1: Lack of supply chain coordination and bullwhip effect, **10.2:** the effect on performance of lack of coordination, **10.3:** Obstacles to coordination in supply chain, **10.4:**managerial levels to achieve coordination, building strategic partnerships and trusts within, **10.5:**continuous replenishment and vendor managed inventories, **10.6:**collaborative planning, forecasting and replenishment(CPFR), collaborative planning, forecasting and replenishment-Indian experiences, the role of IT in coordination.

TOTAL DISTRIBUTION COST ANALYSIS

Total cost concept, principles of logistic costing, logistics and bottom line, logistics and shareholder value, customer profitability analysis, direct product profitability, cost drivers and activity-based costing.

14 Hours

UNIT – III

IT ENABLED SUPPLY CHAIN [2nd Textbook] 17th Chapter

17.1: Introduction, **17.2:** changing role of IT, IT solution options, Electronic Data Interchange (EDI)

ERP OVERVIEW [3rd Textbook] 1st Chapter

1.10: Benefits, **2nd Chapter 2.1:** business engineering, **2.7:** ERP and management concerns, **3rd Chapter 3.1:** Business Modeling for ERP. **4th Chapter 4.1:** ERP implementation, **4.3:** customization, **4.5:** post implementation options.

ERP AND COMPETITIVE ADVANTAGE 5th Chapter

Marketing of ERP, **6th Chapter** ERP domain: **6.5:** SAP, **6.4:** BAAN, **6.6:** SAP r/3, **6.2:** MGF/PRO, **6.3:** IFS/Avalon.

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Illustrate the supply chains in the real world and methodologies for the supply chain profitability.	L2
CO2	Demonstrate the relation between concepts and activities of the supply chain to actual organizations.	L2
CO3	Apply a good pricing and revenue management system for a successful supply chain.	L3
CO4	Explain the role of technology in logistics and supply chain management.	L2
CO5	Apply Information Technology and ERP in a supply chain.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3											1	
CO2	2	3											1	
CO3	2	2	2										2	1
CO4	2	2	2										3	1
CO5	2	3											2	1

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

TEXTBOOKS:

1. Martin Christopher, Logistics and supply chain management.

2. Sunil Chopra, Peter Meindl, supply chain management strategy, planning, and operation, Pearson Education 2003.
3. Vinod Kumar Garg, N.K. Venkatakrishnan, Enterprise Resource planning concepts and Practice, PHI 1999.

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.**

****

DESIGN THINKING			
Course Code	**21ISE214**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

COURSE OBJECTIVES
1. Define and recognize the significance of Creativity and Innovation tools.
2. Discuss key design insights and strategy that guide innovative practices.
3. Explain developing and embedding design thinking practices, optimal design thinking practices and applications.

UNIT - I

INTRODUCTION: The Concept of Design Thinking and Its Role within NPD and Innovation, A Framework of Design Thinking, Design Thinking as a Nonlinear Process, The Principles and the Mind set of Design Thinking **(T1: Chapter 1)**

DESIGN THINKING TOOLS: Nine Criteria of an Inspirational Design Brief, Writing the Inspirational Design Brief, Research Findings about Inspirational Design Briefs, Three Pitfalls to Avoid, Keys to Success **(T1: Chapter 2)**

PERSONAS: Powerful Tool for Designers: Defining Personas, The Importance of Personas, Creating Personas, Illustrative Application of Personas **(T1: Chapter 3)**

CUSTOMER EXPERIENCE MAPPING: Inputs to the Experience Map, The Experience Mapping Process, The Experience Map as a Springboard to Innovative Solutions. **(T1: Chapter 4)**

DESIGN THINKING TO BRIDGE RESEARCH AND CONCEPT DESIGN: Challenges in Idea Generation, The Need for a Systematic Method to Connect to the User, The Visualize, Empathize, and Ideate Method, The Importance of Visualizing and Empathizing before Ideating, Applying the Method. **(T1: Chapter 5)**

CREATIVITY IN IDEA GENERATION USING DESIGN HEURISTICS: New Design Ideas Come From, A Tool to Assist with Idea Generation: Design Heuristics, How Design Heuristics Were Identified: The Evidence Base, Design Heuristics for Idea Generation, Use Design Heuristics to Generate Design Concepts, Evidence of the Value of the Design Heuristics Tool. **(T1: Chapter 6)**

KEY ROLES OF STORIES AND PROTOTYPES: A Design Thinking Product Development Framework, Story, Prototype, Putting It Together—Combining Stories and Prototypes, Employing Stories and Prototypes in Your Process. **(T1: Chapter 7)**

15 Hours

UNIT - II

INTEGRATING DESIGN INTO FUZZY FRONT END OF THE INNOVATION PROCESS: Challenges in the FFE, Design Practices and Tools for Assisting in Problem Definition, Design Practices and Tools for Assisting in Information Management, Design Practices and Tools for Assisting in Stakeholder Management, Integrate Design Professionals in FFE. **(T1:Chapter 8)**

Role of Design in Early-stage Ventures: The Basics, The Process, Troubleshooting Common Mistakes. **(T1: Chapter 9)**

DESIGN THINKING FOR NON-DESIGNERS: Non-Designers Need to Learn, Challenges Teams Face with Design Thinking, Three Team Strategies for Success. **(T1: Chapter 10)**

DEVELOPING DESIGN THINKING: GE Healthcare's Design Organization, The Menlo Innovation Ecosystem, The Significance of Design Thinking at GE Healthcare, Case Study. **(T1:Chapter 11)**

LEADING FOR A CORPORATE CULTURE IN DESIGN THINKING: The Critical Impact of Corporate Culture on Design Thinking, Corporate Culture - Corporate Forces that Undermine Design Thinking, Four Pillars of Innovation for Enabling Design Thinking, Four Stages of Transforming to a Culture of Design Thinking. **(T1: Chapter 12)**

KNOWLEDGE MANAGEMENT FOR INNOVATION: Designing Amidst Uncertainty, Knowledge Management Tasks for Breakthrough Innovation: From Intelligence Leveraging to Intelligence Amplification, KM and Selected Tools for Breakthrough Innovation, Organizational Implications. **(T1: Chapter 13)**

DESIGN THINKING FOR SERVICES: Products, Services, and Experiences, Design for Compelling Service Experiences, Designing a Service Experience Is Never Finished. **(T1: Chapter 16)**

OPTIMAL DESIGN FOR NEW PRODUCTS: Communicate the Challenge Goal toward Radically New Products, Shift Time Frames to Future and Past, Promote an Emerging Technology Focus across the Consumption Chain, Promote the Use of Analogical Thinking, Look for Novel Ways to Solve Simple Problems, Leverage More Ideators via Crowdsourcing. **(T1: Chapter 17)**

15 Hours

UNIT - III

BUSINESS MODEL DESIGN: Business Model, Need to Think about My Business Model, Value Expected from a Business Model Design, Method Used to Design a Business Model, Process of Designing a Business Model, Implementation My New or Revised Business Model. **(T1: Chapter 18)**

CONSUMER RESPONSES AND VALUES: Product Form Influences Consumer Product Evaluation, Product Form Characteristics and Consumer Perceptions, Product Form Impact Consumer Product Evaluation Practical Implications **(T1: Chapter 20)**

DRIVERS OF DIVERSITY IN CONSUMERS: Culture, Individual Characteristics, Situational Factors, Discussion **(T1: Chapter 21)**

FUTURE-FRIENDLY DESIGN: A Framework for Understanding Changing Consumer Values, Emerging Consumer Needs. **(T1: Chapter 22)**

USER INTERFACE AND INDUSTRIAL DESIGN: Divergent Paths: User Interface in Physical and Digital Products, Emerging User Interface Technologies, New Technology Demands a New Development Process,

Seven Questions to Guide the Integration of Industrial Design with User Interface Design. **(T1:Chapter 23)**

INTELLECTUAL PROPERTY PROTECTION FOR DESIGNS: "Design" in Intellectual Property, Utility Patents, Design Patents, Copyrightable Designs for Useful Articles, Trademark Rights for Product Design, Legal Overlap, Trade-Offs, and Strategic Considerations. **(T1:Chapter 24)**

9 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Demonstrate the significance of Creativity, Innovation tools and idea generation.	L2
CO2	Outline the challenges in idea generation and need of design heuristics	L3
CO3	Identify the design thinking process in innovation and its integration designs	L3
CO4	Develop a corporate culture in design thinking and knowledge management for innovation	L3
CO5	Explain the services for optimal design, challenges and IPR	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3										1	1
CO2	2	2	3					2	2	2			2	2
CO3	2	3	3										1	2
CO4	2	2	2						3	3			1	2
CO5	3	3	3										2	2

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

TEXTBOOK:

1. Michael G. Luchs, Scott Swan, Abbie Griffin, "Design Thinking: New Product Development Essentials," 1st edition, 2016, Wiley International.

REFERENCE BOOKS:

1. Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth Field Book: A Step-byStep Project Guide," 1st Edition, 2014, New York: Columbia University Press.
2. Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A Design Thinking Tool Kit for Managers," 1st Edition, 2011, Columbia University Press
3. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation," 1st Edition, Addison Wesley

4. Tom Kelley, "Creative Confidence: Unleashing the Creative Potential within Us All," 2011, MK Publish
5. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage," 2013, Wiley International.
6. Vijay Kumar, "Design Methods: A Structured Approach for Driving Innovation in your Organization," 2013, Pearson India.

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.**

****

SOFTWARE ENGINEERING AND DEVELOPMENT STREAM

C# AND .NET TECHNOLOGIES			
Course Code	**21ISE121**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

1. Inspect Visual Studio programming environment and toolset designed to build applications for Microsoft Windows
2. Understand Object Oriented Programming concepts in C# programming language
3. Interpret Interfaces and define custom interfaces for application.
4. Build custom collections and generics in C#
5. Construct events and query data using query expressions

UNIT - I

Introducing Microsoft Visual C# and Microsoft Visual Studio 2015: Welcome to C#, Working with variables, operators and expressions, Writing methods and applying scope, Using decision statements, Using compound assignment and iteration statements, Managing errors and exceptions

T1: Ch 1 – Ch 6

Understanding the C# Object model: Creating and Managing classes and objects, Understanding values and references, Creating value types with enumerations and structures, Using arrays

T1: Ch 7 to 10.

14 Hours

UNIT - II

Understanding parameter arrays, Working with inheritance, Creating interfaces and defining abstract classes, Using garbage collection and resource management.

T1: Ch 11 to 14

Defining Extensible Types with C#: Implementing properties to access fields, Using indexers, Introducing generics, Using collections

T1: Ch 15 to 18

15 Hours

UNIT - III

Enumerating Collections, Decoupling application logic and handling events, Querying in-memory data by using query expressions, Operator overloading

T1: Ch 19 to 22

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Develop and execute C# programs in Visual Studio 2015 IDE.	L2
CO2	Apply the knowledge of object orientation, exception handling, and memory management to develop efficient programs in .NET.	L2
CO3	Build custom interfaces, collections, and generics in C#	L2
CO4	Use operator overloading, generics, indexers, properties to create easy-to- understand programs in dot NET	L2
CO5	Apply enumerating collections in developing applications.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	3							1	1		1	1	1
CO2	1	3							1	1		1	1	1
CO3	2	2							1	1		1	1	2
CO4	2	2							1	1		1	2	2
CO5	1	3							1	1		1	1	1

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

TEXTBOOKS:

1. John Sharp, **Microsoft Visual C# Step by Step**, 8th Edition, PHI Learning Pvt. Ltd. 2016
2. **REFERENCE BOOKS:**
3. Christian Nagel, "**C# 6 and .NET Core 1.0**", 1st Edition, Wiley India Pvt Ltd, 2016. Andrew Stellman and Jennifer Greene, "**Head First C#**", 3rd Edition, O'Reilly Publications, 2013.
4. Mark Michaelis, "Essential C# 6.0", 5th Edition, Pearson Education India, 2016.
5. Andrew Troelsen, "**Prof C# 5.0 and the .NET 4.5 Framework**", 6th Edition, Apress and Dreamtech 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.**

FULL STACK DEVELOPMENT

Course Code:	**21ISE122**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Teaching Hours	**39**	**Credits**	**03**

Course Objectives:

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. Design the server-side database using MySQL
5. Develop the interactive web application using NodeJS framework

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.

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.

(**14 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.

(**13 Hours)**

UNIT-III

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.

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

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

(12 Hours)

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)

CO1	Describe the fundamental features of HTML5, CSS and Bootstrap and Design static web pages.	L2
CO2	Design and Implement the client-side validations using JavaScript.	L2
CO3	Illustrate the concept of PHP and Develop the server-side script using PHP.	L2
CO4	Design the server-side database using MySQL.	L2
CO5	Develop the interactive web application using NodeJS framework and MongoDB.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
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, 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 / MOOCs/ NPTEL

1. https://www.cs.uct.ac.za/mit_notes/web_programming.html
2. http://www.multitech.ac.ug/uploads/IntroductiontoWebProgramming.pdf
3. https://www.w3schools.com/php/
4. https://www.w3schools.com/bootstrap/
5. https://www.w3schools.com/nodejs/
6. http://nptel.ac.in/courses/106106156/2
7. https://www.coursera.org/learn/web-development
8. https://www.coursera.org/learn/server-side-nodejs

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.**

******

OBJECT ORIENTED MODELING AND DESIGN			
Course Code	**21ISE123**	**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 what is meant by object-oriented Modeling. Apply object-oriented Modeling techniques to the problem solving. Introduce various models that can be used to describe an object-oriented design
2. Show how the UML may be used to represent these models
3. Create class diagrams that model both the domain model and design model of a software system.
4. Create interaction diagrams that model the dynamic aspects of a software system.
5. Understand and analyse the basics of Design pattern.

UNIT – I

INTRODUCTION, MODELING CONCEPTS, CLASS MODELING

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

(T1: 1.1-1.5, 2.1-2.3, 3.1-3.4)

ADVANCED CLASS MODELING, STATE MODELING

Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages. State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior.

(T1: 4.1-4.11, 5.1-5.5)

15 Hours

UNIT – II

ADVANCED STATE MODELING, INTERACTION MODELING

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models. Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

(T1: 6.1-6.6, 7.1-7.3, 8.1-8.3)

PROCESS OVERVIEW, SYSTEM CONCEPTION, DOMAIN ANALYSIS

Process Overview: Development stages; Development life cycle. System Conception: 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.
(T1: 10.1-10.2, 11.1-11.3, 12.1-12.5)

15 Hours

UNIT - III

APPLICATION ANALYSIS

Application Analysis: Application interaction model; Application class model; Application state model; Adding operations.
(T1: 13.1-13.4)

CLASS DESIGN, IMPLEMENTATION MODELING

Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example.
(T1: 15.1-15.11)

Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing.
(T1: 17.1-17.5) **9 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the importance of object orientation, Modeling and design.	L2
CO2	Apply object-oriented techniques to design class and state models.	L2
CO3	Make use of UML for advanced state Modeling and interaction modelling.	L2
CO4	Apply domain analysis, system conception, application analysis to refine the model and design.	L2
CO5	Explain advanced concepts of object-oriented Modeling techniques.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2								1				1
CO2	1	2	2							3				3
CO3	1	2	2							3				3
CO4	1	2	2							3				1
CO5	1	2								1				1

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

TEXTBOOK:

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

REFERENCE BOOKS:

1. Rebecca Wirfs, Designing Object-oriented software, Prentice-Hall India, 1990.
2. Martin. J and Odell J, Object-oriented methods: A foundation, Prentice-Hall, 1995

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.**

****

SOFTWARE TESTING			
Course Code	**21ISE124**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Differentiate the various testing techniques
2. Analyze the problem and derive suitable test cases.
3. Apply suitable technique for designing of flow graph
4. Explain the need for planning and monitoring a process

UNIT – I

BASICS OF SOFTWARE TESTING: Basic definitions, Software Quality, Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies, Levels of testing, Testing and Verification, Static Testing.

PROBLEM STATEMENTS: Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper.

7 Hours

FUNCTIONAL TESTING: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and
the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations.

T1: Chapter 1, Chapter 2, T2: Chapter 5, 6 & 7

7 Hours

UNIT - II

STRUCTURAL TESTING: Overview, Statement testing, Programme testing, Condition testing, Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slice-based testing, Guidelines and observations.

TEST EXECUTION: Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay.

T3: Section 6.2.1, T3: Section 6.2.4, T1: Chapter 9 & 10, T2: Chapter 17

7 Hours

PLANNING AND MONITORING THE PROCESS: Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team.

DOCUMENTING ANALYSIS AND TEST: Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports.

T2: Chapter 20, T2: Chapter 24.

8 Hours

UNIT - III

INTEGRATION AND COMPONENT-BASED SOFTWARE TESTING: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution.

5 Hours

LEVELS OF TESTING, INTEGRATION TESTING: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations.

T2: Chapter 21 & 22, T1: Chapter 12 & 13

5 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain a complete software testing life cycle, understanding of various terms and technologies used in the testing domain.	L2
CO2	Summarize different Functional Testing methods.	L2
CO3	Illustrate different Structural testing criteria and test execution.	L2
CO4	Outline Software testing planning, monitoring and documenting process.	L2
CO5	Construct test cases for any given problem using different testing techniques	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3								1		1		1
CO2	2	3								1		1		1
CO3	2	3								1		1	2	3
CO4	2	3								1		1	2	3
CO5		2	3							1		1	2	2

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

TEXTBOOKS:

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13)
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 3, 4, 16, 17, 20,21, 22,24)
3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008. (Listed topics only from Section 1.2 , 1.3, 1.4 ,1.5, 1.8,1.12,6. 2.1,6. 2.4)

REFERENCE BOOKS:

1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007.
2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.
3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995.
4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015.
5. Naresh Chauhan, Software Testing, Oxford University press.

E-RESOURCES:

1. Selenium.org -http://docs.seleniumhq.org/docs/

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.**

****

AGILE TECHNOLOGIES			
Course Code	**21ISE221**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives

1. Explain the principles involved in agile technologies.
2. Explain XP lifecycle
3. Understand concepts of XP practices, collaborating in agile methods.
4. Understand concepts of releasing, planning and developing in agile methods.
5. Explain the process of mastering agility.

UNIT – I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Do not Make Your Own Method, The Road to Mastery, Find a Mentor

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP**: Is XP Right for Us?, Go!, Assess Your Agility

(T1:1,2,3,4) **15 Hours**

UNIT – II

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, RootCause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done," No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning**: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating**. Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design ,Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

(T1:5,6,7,8,9)

15 Hours

UNIT - III

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

(T1:10,11,12,13)

9 hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain XP Lifecycle	L2
CO2	Illustrate the process of adopting XP	L2
CO3	Interpret XP practices and explain collaborating in agile technologies.	L2
CO4	Demonstrate the process of releasing, planning and developing in agile technologies.	L2
CO5	Explain the concept of improving the process, eliminate waste.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2											1	2
CO2	1	3											1	2
CO3	1	3											1	2
CO4	1	3											1	2
CO5	1	3											1	2

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

TEXTBOOK:

1. The Art of Agile Development James shore, Chromatic, O'Reilly 2007

REFERENCES

1. Agile Software Development, Principles, Patterns, and Practices Robert C. Martin Prentice Hall 1st edition, 2002
2. Agile and Iterative Development A Manger's Guide Craig Larman Pearson Education First Edition, India, 2004

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.**

****

MULTIAGENT SYSTEMS			
Course Code	**21ISE222**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Objectives

This Course will enable students to

1. To introduce the student to the concept of an agent and multi-agent systems, and the main applications for which they are appropriate.
2. To introduce the main issues surrounding the design of intelligent agents.
3. To introduce the main issues surrounding the design of a multi-agent society.
4. To introduce a contemporary platform for implementing agents and multi-agent systems.

UNIT - I

Multiagent Problem Formulation: Utility, Markov Decision Processes, Planning

(T1: Chapters 1 &2, T2: Chapter 1)

Distributed Constraints: Distributed Constraint Satisfaction, Distributed Constraint Optimization

(T1: Chapters 1 &2, T2: Chapter 1)

Standard and Extended Form Games: Games in Normal Form, Games in Extended Form, Self-interested agents, Characteristic Form Games, Coalition Formation

(T1: Chapters 3&4, T2: Chapter 3)

14 Hours

UNIT - II

Learning in Multiagent Systems:

The Machine Learning Problem, Cooperative Learning, Repeated Games, Stochastic Games, General Theories for Learning Agents, Collective Intelligence

(**T1: Chapters 5)**

Negotiation:

The Bargaining Problem, Monotonic Concession Protocol, Negotiation as Distributed Search, Ad-hoc Negotiation Strategies, The Task Allocation Problem.

(T1: Chapters 6&7)

Protocols for Multiagent Resource Allocation: Auctions:

Simple Auctions, Combinatorial Auctions
(T2: Chapter 11)

14 Hours

UNIT III

Voting and Mechanism Design:
The Voting Problem, Mechanism Design.
(T1: Chapters 8 &10)
Nature-Inspired Approaches:
Ants and Termites, Immune System
(T2: Chapter 10)

11 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the concept of a multi-agent systems and Distributed Constraints	L2
CO2	Explore the applications of computer and extended form games.	L2
CO3	Understand learning in Multiagent Systems	L2
CO4	Introduce a contemporary platform for implementing agents and multi-agent systems.	L4
CO5	Understand the main application areas of agent-based solutions, and be able to develop a meaningful agent-based system using a contemporary agent development platform	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	2												1
CO2	3	2												2
CO3	3	2	1											2
CO4	3	2	1											2
CO5	2	3												2

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

TEXTBOOK:

1. Fundamentals of Multiagent Systems by Jos´e M. Vidal, 2006, available online. http://jmvidal.cse.sc.edu/papers/mas.pdf
2. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, By Yoav Shoham, Kevin Leyton-Brown, Cambridge University Press, 2008, 2nd ed. http://www.masfoundations.org/mas.pdf

REFERENCE BOOKS:

1. Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence Gerhard Weiss The MIT Press 2000

E-RESOURCE:

1. http://nptel.ac.in/courses/106108058/

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.**

****

MOBILE APPLICATION DEVELOPMENT			
Course Code	**21ISE223**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:1:3**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives

This course will enable students to

1. Describe the architecture and overview of android.
2. Develop a mobile application on Android Platform using UI components and Android Components.
3. Develop applications supporting services and broadcast receivers.
4. Manage the data handling of the app using databases, shared preferences.
5. Support the application with the graphical features or animations and sensors.

FIRST WEEK:

Mobility Panorama, Mobile Platforms, App Development Approaches, Android Overview (T1 – 1.1, 1.2, 1.3, 1.4, 1.5), Setting up development Environment, Hello World Example, Traversing an Android App Project Structure, Installing and running App Devices (T1 – 2.2, 2.3, 2.4, 2.7)

Lab Experiment: Simple Program to display Hello World on App Screen and Looking into the res folder, Manifest.xml file, values folder and activity_main.xml file

SECOND WEEK:

App User Interface – UI Resources (Layout, View), UI Elements (Button, TextView, EditText, RadioButton, RadioGroup) (T1 – 4.1, 4.2, 4.3, 4.4, 4.5)

Lab Experiment: Mobile Application to develop a simple Calculator, Application to generate a random color on each button click, Application to change background color using radio buttons

THIRD WEEK:

UI Elements - ImageView, CheckBox, DatePicker, TimePicker (T1 – 4.4, 4.5)
Lab Experiment: Mobile Application to toast the list of items checked, Application to change image in Image View on button click, Application to select date and time and display it using Date Picker and Time Picker

FOURTH WEEK:
ListView, Options Menu, Context Menu (T1 – 4.4, 4.5)
Lab Experiment: Implement option menu and context menu to perform mathematical operations, Application to add items dynamically and statically to a list

FIFTH WEEK:
Activity – States and Life cycle, Interaction among Activities (T1 - 4.6, 4.7)
Lab Experiment: Mobile Application to demonstrate the activity life cycle by logging the activities in the LogCat, Application to demonstrate interaction between activities

SIXTH WEEK:
Threads and AsyncTask, UI Elements - ProgressBar, Spinner (T1 – 5.1, 5.2, 5.3, 5.4)
Lab Experiment: Implement an AsyncTask to count from 1 to 100 in background and display the progress using progress bar, Implement the same using threads

SEVENTH WEEK:
Service, Notifications, Intents – Implicit and Explicit Intents (T1 – 5.5, 5.6)
Lab Experiment: Implement a service to play music in background, Demonstrate sending of SMS, Call, Email using Intent class, Demonstrate usage of Browser and Maps using Intent class

EIGHTH WEEK:
Broadcast Receivers, Telephony and SMS (T1 - 5.8, 5.9, 5.10)
Lab Experiment: Implement broadcast receiver to read the battery percentage from cellphone and change background color based on level, Application to send SMS using SMS Manager, Application to read phone call state using Telephony APIs.

NINTH WEEK:
Mobile Databases – SQLite (T1 – 6.5)
Lab Experiment: Application to insert data entered by user into database and display the values in database (using SQLiteDatabase and DBHelper).

TENTH WEEK:
Shared Preferences, Content Providers (T1 – 6.3, 6.6)
Lab Experiment: Implement an application to store and retrieve data by using Shared Preference.

ELEVENTH WEEK:
Android Graphics, Android Animation (T1 – 7.2, 7.3)
Lab Experiment: Mobile Application to implement Android Graphics with different objects,
Application to implement Android Animations – Fade, Rotate, zoom, blink.

TWELFTH WEEK:
Audio, Video, Images, Playback (T1 –8.2, 8.3)
Lab Experiment: Mobile Application to capture image using Camera and set the image as background, Mobile Application to capture video and illustrate playback.

THIRTEENTH WEEK:
Sensors in Android, Android Sensor Framework, Motion Sensors - Accelerometer and Gyroscope. (T1 – 10.2, 10.3, 10.4)
Lab Experiment: Mobile Application to use Accelerometer and display coordinates, Application to use gyroscope and change Background color using sensor values.

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the architecture, project structure for Android and demonstrate mobile applications with UI Elements	L3
CO2	Build Mobile applications using activities.	L3
CO3	Develop mobile applications using services and Broadcast receivers.	L6
CO4	Design Mobile Applications that support data handling with Shared Preferences and Databases.	L6
CO5	Make use of graphical features, animations, multimedia and sensors in android applications.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	1	2	2						1		1		
CO2	1	2	3	3						1		1	2	1
CO3	1	2	2	3						1		1	3	2
CO4	1	2	3	3						1		2	3	2
CO5	1	1	2	2						1		1	2	1

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

TEXTBOOK:

1. Anubhav Paradhan, Anil V Deshpande, Mobile apps Development, 1st Edition, Publication: Wiley, 2014.

REFERENCE BOOKS:

1. Barry Burd, Android Application Development All in one for Dummies
2. Teach Yourself Android Application Development in 24 Hours, Publication: SAMS

E-RESOURCES:

1. https://developer.android.com/training/index.html
2. https://www.udacity.com/course/new-android-fundamentals--ud851
3. https://www.tutorialspoint.com/android/index.htm
4. https://www.javatpoint.com/android-tutorial
5. https://developer.android.com/guide/
6. https://www.udemy.com/course/learn-android-application-development-y/

****

BUSINESS INTELLIGENCE AND ITS APPLICATIONS			
Course Code	**21ISE224**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Comprehend the need of BI for a business enterprise.
2. Summarize the types of Digital data & its operation.
3. To outline the Need & Significance of data warehouse in BI applications.
4. Identify the types and step involved in ETL process.
5. To understand the measurement concept to evaluate business performance and build enterprise reports.

UNIT – I

BUSINESS VIEW OF INFORMATION TECHNOLOGY APPLICATIONS

Business Enterprise Organization, Its Functions, and Core Business Processes; Baldrige Business Excellence Framework; Key Purpose of Using IT in Business; The Connected World: Characteristics of Internet-ready IT Applications; Enterprise Applications (ERP/CRM, etc.) and Bespoke IT Applications; Information Users and Their Requirements; Case Studies

(T1: Ch-1.1 to 1.6)

TYPES OF DIGITAL DATA

Introduction; Getting into "GoodLife" Database; Getting to Know Structured Data; Getting to Know Unstructured Data; Getting to Know Semi-Structured Data; Difference Between Semi-Structured and Structured Data.

(T1: Ch-2.1 to 2.6)

INTRODUCTION TO OLTP AND OLAP

OLTP (On-Line Transaction Processing); OLAP (On-Line Analytical Processing); Different OLAP Architectures; OLTP and OLAP; Data Models for OLTP and OLAP; Role of OLAP Tools in the BI Architecture; Should OLAP be Performed Directly on Operational Databases? A Peek into the OLAP Operations on Multidimensional Data; Leveraging ERP Data Using Analytics

(T1: Ch-3.1 to 3.9) **15 Hours**

UNIT - II

GETTING STARTED WITH BUSINESS INTELLIGENCE

Using Analytical Information for Decision Support; Information Sources Before Dawn of BI? Business Intelligence (BI) Defined; Evolution of BI and Role of DSS, EIS, MIS, and Digital Dashboards; Need for BI at Virtually all Levels; BI for Past, Present, and Future; The BI Value Chain; Introduction to Business Analytics

(T1: Ch-4.1 to 4.8)

BI DEFINITIONS AND CONCEPTS

BI Component Framework; Who is BI for? BI Users; Business Intelligence Applications; BI Roles and Responsibilities; Best Practices in BI/DW; The Complete BI Professional; Popular BI Tools

(T1: Ch-5.1 to 5.8)

BASICS OF DATA INTEGRATION

Need for Data Warehouse; Definition of Data Warehouse; What is a Data Mart? What is Then an ODS? Ralph Kimball's Approach vs. W.H. Inmon's Approach; Goals of a Data Warehouse; What Constitutes a Data Warehouse? Extract, Transform, Load; What is Data Integration? Data Integration Technologies; Data Quality; Data Profiling

(T1: Ch-6.1 to 6.12)

MULTIDIMENSIONAL DATA MODELING

Introduction; Data Modeling Basics; Types of Data Model; Data Modeling Techniques; Fact Table; Dimension Table; Typical Dimensional Models; Dimensional Modeling Life Cycle.

(T1: Ch-7.1 to 7.8) **15 Hours**

UNIT - III

MEASURES, METRICS, KPIS, AND PERFORMANCE MANAGEMENT

Understanding Measures and Performance; Measurement System Terminology; Navigating a Business Enterprise, Role of Metrics, and Metrics Supply Chain; "Fact-based Decision Making" and KPIs; KPI Usage in Companies; Where Do Business Metrics and KPIs Come From? Connecting the Dots: Measures to Business Decisions and Beyond

(T1: Ch-8.1 to 8.7)

BASICS OF ENTERPRISE REPORTING

Reporting Perspectives Common to All Levels of Enterprise; Report Standardization and Presentation Practices; Enterprise Reporting Characteristics in OLAP World; Balanced Scorecard; Dashboards; How Do You Create Dashboards? Scorecards vs. Dashboards; The Buzz Behind Analysis. **(T1: Ch-9.1 to 9.8)**

BI ROAD AHEAD

Understanding BI and Mobility; BI and Cloud Computing; Business Intelligence for ERP Systems; Social CRM and BI.

(T1: Ch-10.1 to 10.4) **9 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Interpret the business view of information technology applications	L2
CO2	Summarize the types of Digital data & its operation.	L2

CO3	Outline the Need & Significance of data warehouse in BI applications	L2
CO4	Explain the basics of data integration including data quality and data profiling and implement various data integration approaches	L2
CO5	Identify Key Performance Indicators, Business Metrics, Future of BI, creation of Enterprise Reports.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1		2							1	1		1		1
CO2	2	2			2				1	1		1		3
CO3	2	2				2			1	1		1		3
CO4	2	2				2			1	1		1		3
CO5	2	2			2				1	1		1		2

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

TEXTBOOKS:

1. Prasad RN, Seema Acharya: Fundamentals of Business Analytics, First Edition, Wiley India Pvt. Ltd.
2. William H. Inmon: Building the Data Warehouse, 4th Edition, Wiley India Ed.
3. Infosys Reference Book on Business Intelligence

REFERENCE BOOKS:

1. David Loshin: Business Intelligence, First Edition, Elsevier Science, 2003.
2. Mike Biere: Business Intelligence for the Enterprise, First Edition, IBM Press, 2003
3. Larissa T. Moss and Shaku Atre: Business Intelligence Roadmap, Addison-Wesley Professional, 2003.

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.**

****

NETWORKS AND SECURITY STREAM

COMPUTING IN COMMUNICATION NETWORKS			
Course Code	**21ISE131**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Understand the need of computing in future communication networks
2. Learn the concepts like Network slicing, Mobile edge cloud and content distribution
3. Learn enabling technologies like software defined networking and network function virtualization.
4. Learn the importance of time sensitive networking
5. Explore various networking tools

UNIT – I

On the need of computing in future communication networks

Evolution of communication networks: The telephone networks: circuit-switched, The Internet: packet-switched, The cellular communication networks

The 5G communication system: The 5G Atom core: use cases, First tier: the technical requirements, Second tier: the concepts, Third tier: the softwarization technologies, Fourth tier: innovation and novelties

Softwarization: the game changer for network operators [Chapter 1]

14 Hours

UNIT – II

Network slicing: Introduction, Network slice: concept and life cycle, Network slicing architectures: Single owner, single controller, Single owner, multiple tenants – SDN proxy, Multiple owners, tenants, Network slicing in 5G.

Mobile edge cloud : Introduction, Concepts, Three Layer Architecture.

Content distribution: Content delivery networks, content distribution, Request routing

Software-defined networks: Introduction, SDN Architecture, SDN use cases

Network function virtualization: Logic structure of NFV, two-layer SDN-NFV architecture

13 Hours

UNIT – III

Integrating time-sensitive networking : Introduction to TSN, Time synchronization (IEEE 802.1AS), Packet shapers : Credit based shaper (IEEE 802.1Qav), Time aware shaper (IEEE 802.1Qbv)

Networking tools : Connectivity testing – ping, Basic network administration iproute2 (ip addr, ip link, ip route), Traffic generation – iPerf, Process monitoring – htop, Network traffic manipulation – TC, Traffic monitoring – tcpdump/Wireshark

13 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Understand the need of computing in future communication Networks	L2
CO2	Learn the concepts like Network slicing, Mobile edge cloud and content distribution	L2

CO3	Learn enabling technologies like software defined networking and network function virtualization.	L2
CO4	Learn the importance of time sensitive networking	L2
CO5	Learn various networking tools	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3						2	2	1	1		
CO2	3	3	2	2					2	2	1	1		
CO3	3	3	3	2	2		1	2	3	3	1	2		
CO4	3	3	3	2	2	2	2		3	4	1	1		
CO5	2	2	2	2							1	1		

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

TEXTBOOKS:

1. Computing in communication Networks: From Theory to Practice by Frank Fitzek, Fabrizio
2. Granelli, Patrick Seeling, published in 2020 by academic press ISBN 13: 9780128204887

REFERENCE BOOKS:

1. Software-defined networking and security: from theory to practice
2. CRC Press/Taylor & Francis Group , Ankur, Huang, Dijiang, Pisharody, Sandeep

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.**

****

NETWORK ENGINEERING			
Course Code	**21ISE132**	**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. Introduce the detailed aspects of TCP/IP stack optimizations.
2. Explore different approaches to minimize end to end latency.
3. Explain the importance of traffic control layer and queue disciplines.
4. Introduce different types of congestion signalling mechanisms.
5. Introduce the fundamentals of Data Center Networks and its performance issues.

UNIT – I

TCP/IP stack optimizations:

Optimizations proposed for improving the performance of TCP/IP: Building blocks of TCP and TCP Fast Open, Primer on Latency and Bandwidth: Busting the Myth, History of TCP/IP and Importance of Internet Standardization, Building Blocks of TCP and Slow Start Restart (SSR), TCP Window Scaling, Impact of TCP 3-way handshake and Slow Start on HTTP Traffic, TCP's AIMD Algorithm, Packet Loss Detection Techniques in TCP, TCP Tahoe and TCP Reno, Selective Acknowledgements (SACK) for TCP.
[Chapter 5 to 8 from [Grigorik 2013]

14 Hours

UNIT – II

Loss Recovery Techniques in TCP: Rate Halving and PRR (Proportional Rate Reduction)
Introduction to Queue Management Algorithms: Random Early Detection (RED), Gentle RED, Nonlinear RED and Self Configuring RED, Adaptive RED
Congestion Signalling Mechanisms: Explicit Congestion Notification (ECN), ECN+, ECN+/Wait, ECN+/TryOnce and ABE. [Chapter 5 to 8 from [Grigorik 2013]]

13 Hours

UNIT – III

Active Queue Management: Controlled Delay (CoDel) Queue Discipline, Proportional Integral (PI) Controller and PI Controller Enhanced (PIE) queue disciplines.
Introduction to Data Center Networks, Data Center TCP (DCTCP): Differences between the Internet architecture and DCN architecture, Performance problems in DCNs and existing solutions such as Data Center TCP (DCTCP).

13 Hours

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Understand different approaches for TCP/IP optimizations.	L2
CO2	Ability to appreciate the importance of reducing latency for real time applications.	L2
CO3	Understand the working of Linux queue disciplines, and use them to reduce latency	L2
CO4	Learn the different types of congestion signalling mechanisms	L2
CO5	Design and optimize networking protocols for Data Center Networks.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3						2	2	1	1		
CO2	3	3	2	2					2	2	1	1		
CO3	3	3	3	2	2		1	2	3	3	1	2		
CO4	3	3	3	2	2	2	2		3	3	1	1		
CO5	3	3	2	2							1	1		

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

TEXTBOOKS:

1. [Grigorik 2013] Grigorik, Ilya. High Performance Browser Networking: What every web developer should know about networking and web performance. " O'Reilly Media, Inc.", 2013.

REFERENCE BOOKS:

1. [Kurose and Ross 2012] Kurose, James F. Computer networking: A top-down approach featuring the internet, 6/E. Pearson Education India, 2005.
2. [Khan and Zomaya 2015] Khan, S. U., & Zomaya, A. Y. (Eds.). (2015). Handbook on Data Centers. Springer, 2015.
3. [Peterson and Davis 2007] Peterson, L. L., & Davie, B. S. Computer networks: A Systems Approach. Elsevier, 2007.
4. [Online Resources] Interactive animations, Video notes from Kurose and Ross 2012, Wireshark assignments, Presentation slides, interactive exercises from the following link: http://wps.pearsoned.com/ecs_kurose_compnetw_6/216/55463/14198700.cw/

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.**

****

ADHOC NETWORKS			
Course Code	**21ISE133**	**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 MAC layer functionalities of wireless networks.
2. Understand the working of major MAC layer protocols for Adhoc wireless networks
3. Classify and distinguish Network layer protocols for Adhoc wireless networks.
4. Identify the issues with TCP/IP Transport layer protocols with wireless networks. Study few solutions provided by Adhoc transport layer protocols.
5. Identify security and QoS issues and challenges with Adhoc wireless networks.

UNIT – I

AD HOC NETWORKS

Introduction, Issues in Ad Hoc wireless networks, Ad hoc wireless internet

(T1:5.1-5.3).

MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Introduction, Issues in designing a MAC Protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks

(T1:6.1-6.3).

CLASSIFICATION OF MAC PROTOCOLS. CONTENTION BASED PROTOCOLS

MACAW, Floor Acquisition Multiple Access Protocol, Busy Tone Multiple Access Protocols, MACA -By invitation, Media Access with Reduced Handshake. **(T1:6.5.1-6.5.5)** Contention based protocols with reservation mechanisms: Distributed Packet Reservation Multiple Access Protocol, Hop Reservation Multiple Access Protocol Five-Phase Reservation Protocol. **(T1:6.6.1,6.6.3,6.6.5)** Contention-based MAC protocols with scheduling mechanism: Distributed Priority Scheduling and Medium Access in Ad Hoc Networks.

(T1:6.7.1)

14 Hours

UNIT - II

ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Introduction, Issues in designing a routing Protocol for Ad hoc wireless Networks, Classification of routing Protocols.

(T1:7.1-7.3)

TABLE DRIVEN ROUTING PROTOCOL

Destination Sequenced Distance-Vector Routing Protocol, Wireless Routing Protocol, Cluster-Head Gateway Switch Routing Protocol.

(T1:7.4.1-7.4.3)

On-demand routing protocol

Dynamic Source Routing Protocol, Ad Hoc On-Demand Distance-Vector Routing Protocol, Location-Aided Routing, Flow-Oriented Routing Protocol.

(T1:7.5.1,7.5.2,7.5.4,7.5.7)

HYBRID ROUTING PROTOCOL

Core Extraction Distributed Ad Hoc Routing Protocol, Zone Routing Protocol. **(T1:7.6.1-7.6.2)** Hierarchical routing protocols: Fisheye State Routing Protocol. Metrics used by power aware routing protocols. **(T1: 7.8.2-7.9.1)**

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Introduction, Issues in designing a transport layer Protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks. **(T1:9.1-9.3)**

15 Hours

UNIT - III

TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORKS (contd.)

Classification of transport layer solutions, TCP over Ad hoc wireless Networks: TCP-F, TCP-BuS, ATCP, Split TCP.

(T1:9.4,9.5:9.5.1-9.5.7)

Security in Ad Hoc wireless networks, Network Security requirements, Issues & Challenges in security provisioning, Network security attacks, Key Management, Secure routing in Ad hoc wireless Networks: Security Aware Ad Hoc Routing Protocol, Security-Aware AODV.

(T1:9.7-9.11,9.12: 9.12.2,9.12.3,9.12.5)

QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS

Introduction, Issues & challenges in providing QoS in Ad hoc wireless Networks,

(T1:10.1-10.3)

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the issues in designing a MAC Protocol for Adhoc wireless Networks	L2
CO2	Classify Adhoc MAC protocols based on contention and scheduling mechanism	L2
CO3	Compare the types of Adhoc routing protocols and identify the optimal routing protocol	L2
CO4	Illustrate the design issues of transport layer protocol in wireless networks	L2
CO5	Identify the various transport layer Protocols and Explain the requirements, QOS and solution for security	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3								1		1		2
CO2	2	3								1		1		2
CO3	2	3								1		1		2
CO4	2	3								1		1		2
CO5	2	3								1		1		2

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

TEXTBOOK:

1. Ad Hoc Wireless Networks: Architectures and Protocols, 2nd edition, C. Siva Ram Murthy and B S Manoj, Pearson Education, 2005.

REFERENCE BOOKS:

1. Ad Hoc Networks: Technologies and Protocols, Prasant Mohapatra and Srikanth Krishnamurthy, Springer Science, 2005.
2. Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications, Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, Auerbach Publications, 2007.
3. Guide to Wireless Ad Hoc Networks, Sudip Misra, Isaac Woungang, Subhas Chandra Misra, Springer-Verlag, 2009.
4. The Handbook of Ad Hoc Wireless Networks, Editor Mohammad Ilyas, CRC Press, 2003.
5. Ad hoc Mobile Wireless Networks: Protocols & Systems, C. K. Toh, Prentice-Hall PTR, 2002.
6. https://onlinecourses.nptel.ac.in/noc17_cs07/preview

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.**

****

SOFTWARE DEFINED NETWORKS			
Course Code	**21ISE134**	**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, student will be able to

1. Differentiate between traditional networks and software defined networks
2. Understand advanced and emerging networking technologies and Obtain skills to do advanced networking research and programming
3. Learn how to use software programs to perform varying and complex networking tasks

UNIT - I

INTRODUCING SDN

SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes-The Genesis of SDN

[T1: 2,3]

SDN ABSTRACTIONS

How SDN Works-The Openflow Protocol-SDN Controllers: Introduction

[T1: 4,5]

15 Hours

UNIT - II

SDN ABSTRACTIONS Contd.

General Concepts – VMware-Nicira – VMware/Nicira – OpenFlow-Related – Mininet – NOX/POX – Trema – Ryu – Big Switch Networks/Floodlight – Layer 3 Centric – Plexxi – Cisco OneP

[T1:5]

PROGRAMMING SDN'S:

Network Programmability-Network Function Virtualization – NetApp Development, Network Slicing

[T2:3]

14 Hours

UNIT - III

SDN APPLICATIONS AND USE CASES

SDN in the Data Center – SDN in Other Environments – SDN Applications – SDN Use Cases – The Open Network Operating System

[T1:7]

SDN'S FUTURE AND PERSPECTIVES

SDN Open Source – SDN Futures – Final Thoughts and Conclusions

[T1:8]

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the concept of software defined networks	L2
CO2	Analyse the operation of software defined network	L2
CO3	Identify the concept of software defined networks to develop network programming	L2
CO4	Apply the uses of software defined networks in different networking technologies	L2
CO5	Determine the future of software defined network	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2												1
CO2	2	2	3											2
CO3	2	2	3											2
CO4	1	3												
CO5	1	2												

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

REFERENCE BOOKS:

1. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014
2. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
3. Software Defined Networking with OpenFlow, Siamak Azodolmolky, Packt Publishing, 2013

E-Books / Online Resources:

1. https://www.tutorialspoint.com/sdn/index.htm
2. https://www.opennetworking.org
3. http://www.nec-labs.com/~lume/sdn-reading-list.html

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 – I**

****

CYBER SECURITY AND CYBER LAWS			
Course Code	**21ISE231**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning objectives:

This course will enable students to

1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic.
5. Infer legal Perspectives in cyber security

UNIT - I

INTRODUCTION TO CYBERCRIME [1st TEXTBOOK]

Cybercrime- Definition and Origins of the Word

Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **(1.2-1.5,1.9,1.10)**

Cyberoffenses: How Criminals Plan Them:

How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **(2.2-2.8)**

CYBERCRIME:

Mobile and Wireless Devices:

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. **(3.1-3.12)**

14 Hours

UNIT - II

TOOLS AND METHODS USED IN CYBERCRIME

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS At-tacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **(4.1-4.12)**

Phishing and Identity Theft: Introduction to Phishing, Identity Theft (ID Theft). **(5.2,5.3)**

UNDERSTANDING COMPUTER FORENSICS

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics. **(7.1,7.3-7.13)**

15 Hours

UNIT - III

Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. **(7.14-7.19)**

INTRODUCTION TO SECURITY POLICIES AND CYBER LAWS [2nd Textbook]

Need for An Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the

IT Act, 2000, Intellectual Property Issues, Overview of Intellectual Property Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License**. (4.1-4.11**)

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Outline the concept of cyber security to determine the threats	L2
CO2	Illustrate the current cybercrime attacks and preventive measures	L2
CO3	Apply tools and methods used in cyber crime	L3
CO4	Utilize the digital forensic techniques to mitigates the threats	L3
CO5	Summarize the Security Policies and Cyber Laws	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	2								1		1		1
CO2	2	2								1		1		1
CO3	2	2	3							1		1	2	2
CO4	2	3								1		1	2	2
CO5	2	2								1		1		2

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

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives," Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws." Dreamtech Press. ISBN: 9789351194736, 2015.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and
2. Investigating Intrusions," Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1.
3. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials," CRC Press, 15-Dec 2010.
4. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

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.**

****

BLOCKCHAIN TECHNOLOGY			
Course Code	**21ISE232**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

At the end of the course student should be able to

1. To provide conceptual knowledge of Block chain technology used to innovate and improve business processes
2. To provide theoretical and practical solution of Block chain technology
3. Identify the current and future trends in Block chain technology

UNIT – I

INTRODUCTION: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public v/s Private Block chain, Understanding crypto currency to Block chain, Permissioned model of Block chain, overview of security aspects of Block chain. **(R1, R2, R3, R4)**

BITCOIN AND BLOCK CHAIN: Creation of coins, Payments and double spending, Bitcoin scripts, Bitcoin P2P network, transaction in bitcoin network, Block mining, Block propagation and Block relay. **(R5,R6,R7,R8)**

WORKING WITH CONSENSUS IN BITCOIN: Distributed consensus in open environment, Consensus in Bitcoin network, Proof of Work (PoW)- basic introduction hash cash PoW, Bitcoin PoW, attacks on PoW, monopoly problem, proof of stake, proof of burn, and proof of elapsed time, the life of bitcoin miner, mining difficulty, mining pool. **(R9,R10,R11,R12)**

15 Hours

UNIT - II

PERMISSIONED BLOCK CHAIN: Permission model and use cases, design issues for permissioned Block chains, execute contracts, state machine replication, overview of consensus models for permissioned Block chain – distributed consensus in closed environment, Paxos, RAFT consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak Pease, BFT algorithm, BFT over asynchronous system. **(R13,R14,R15,R16,R17)**

ENTERPRISE APPLICATION OF BLOCK CHAIN: Cross border payment, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled trade, We trade-Trade finance network, supply chain financing, identity on Block chain**.(R18, R19,R20,R21)**

14 Hours

UNIT - III

BLOCK CHAIN APPLICATION DEVELOPMENT: Hyperledger fabric – architecture, fabric details and Channels, Fabric – Membership and Identity Management, Identities and Policies, Membership and Access Control, Writing smart contract using Ethereum.(**R24,R25,R26,R27,R28)**

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)

CO1	Explain the Blockchain Technology and its application in Crypto currency	L2
CO2	Make use of the bitcoin protocols for mining and select the optimal solution	L3
CO3	Identify the types of Blockchain protocols for permissioned and permission less environment	L3
CO4	Apply the blockchain protocols for enterprise applications	L3
CO5	Analyze the Blockchain based solutions and write smart contracts using solidity in Hyperledger Fabric and Ethereum Framework	L4

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	3								1		1		1
CO2	2	3	3							1		1		2
CO3	2	3	3							1		1		2
CO4	2	2	3							1		1		2
CO5	2	2	3							1		1		2

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

REFERENCE BOOKS:

1. Melanie Swan "Block Chain: Blueprint for a New Economy", O'Reilly, 2015.
2. Josh Thompsons, "The Block Chain for a Beginners – Guide To Block chain technology and Leveraging Block Chain Programming".
3. Daniel Dreschers ", Block Chain Basics", A press; 1st edition 2017.
4. Anhul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, New Delhi
5. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology and Decentralization, Smart Contracts Explained" Packt Publishing.
6. sh Modi, "Solidity Progamming Essentials: A Beginners Guide to build Smart Contracts for Ethereum and Block Chain" Packt Publishing.
7. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Navotny, Antony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Application with Hyperledger Fabric and Composer", Import 2018.

E-Resources

1. R1: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=9
2. R2: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=10
3. R3: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=11
4. R4: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=5&lesson=13
5. R5: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=14
6. R6: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=15
7. R7: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=16

8. R8: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=17
9. R9: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=6&lesson=18
10. R10: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=7&lesson=19
11. R11:https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=7&lesson=20
12. R12: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=7&lesson=21
13. R13: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=7&lesson=22
14. R14:https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=7&lesson=23
15. R15: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=8&lesson=24
16. R16: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=8&lesson=25
17. R17: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=8&lesson=26
18. R18: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=31&lesson=45
19. R19: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=31&lesson=46
20. R20: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=31&lesson=47
21. R21: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=31&lesson=49
22. R22: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=50&lesson=55
23. R23: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=32&lesson=57
24. R24: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=29&lesson=35
25. R25: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=29&lesson=36
26. R26: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=29&lesson=37
27. R27: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=32&lesson=60
28. R28: https://onlinecourses.nptel.ac.in/noc19_cs63/unit?unit=34&lesson=72

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.**

****

DIGITAL FORENSICS			
Course Code: 22ISE63	**21ISE233**	**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. To learn the basics of digital forensics
2. To learn about the different digital forensic systems and services
3. To learn about file recovery using various tools
4. To learn about processing the crime scene and preserving digital evidence
5. To demonstrate use of digital forensics tools.

UNIT – I

Overview of Computer Forensics Technology: Computer Forensics Fundamental- Types of Computer Forensics Technology, **Computer Forensics system and Services:** Types of Computer Forensics system

Computer Forensics Services, **Computer Forensics: Evidence Capture - Data Recovery and Data Seizure:** Data Backup and Recovery Test Disk Suite, Data-Recovery Solution, Hiding and Recovering Hidden Data, Evidence Collection and Data Seizure.

13 Hours

UNIT – II

Duplication and Preservation of Digital Evidence: Preserving the Digital Crime scene, Computer Evidence Processing steps, Legal aspects of Collecting and Preserving Computer Forensic Evidence, **Digital Forensics Tools and Platform:** Tools (Encase)- Building software, Installing Interpreters, Working with images and File Systems Forensics, **Network Forensics and Operating System Artifacts**
Network Forensic Scenario: Destruction of email, damaging computer evidence and System Testing. Operating System Artifacts: Windows System Artifacts, Linux System Artifacts.

13 Hours

UNIT – III

Congestion Mobile Forensics: Introduction to mobile forensics, understanding Android, Android forensic setup and predate extraction techniques, data recovery techniques, Contemporary issues. **Current computer forensics tools**- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

13 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Describe what a digital investigation is, the sources of digital evidence, and the limitations of forensics.	L2
CO2	Describe the legal requirements for use of seized data.	L3
CO3	Conduct data collection on backup drives.	L3
CO4	Capture and interpret network traffic	L2
CO5	Handle the challenges associated with mobile device forensics and Handling forensics challenges in social and cloud computing	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3												
CO2	1	3	2											3
CO3	1	3	2											3
CO4	2	3												
CO5	2	3												1

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

TEXTBOOKS:

1. Greg Gogolin,Digital Forensics Explained, Second Edition, CRC Press,2021.
2. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, British Library Cataloguing-in-Publication Data,2011

REFERENCE BOOKS:

1. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, Second Edition, Charles River Media,2005
2. Sathish Bommisetty, Rohit Tamma, Heather Mahalik, Practical Mobile Forensics, Kindle Edition, 2014

E-RESOURCE:

Digital Forensics Concepts by Coursera

SEE Question Paper Pattern:

There will be **10** 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 **Two full** question from **first two** units and **One** question from last unit**.**

****

INTRUSION DETECTION SYSTEM			
Course Code	**21ISE234**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:3:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

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

1. To become familiar with the basics of Intrusion Detection system
2. To learn concepts of network Intrusion Detection systems
3. To gain the knowledge of Snort rules and Procedures
4. To acquire knowledge of securing databases

UNIT - I

[1st Main Textbook]

Chapter 2: History of Intrusion detection, Audit, Concept and **2.1**- definition, Internal and external threats to data, attacks, **2.3 -** need and types of IDS, **2.3.7 -** Information sources, **2.3.7.2 -** Host based information sources, **2.3.7.1-** Network based information sources.

Intrusion Prevention Systems, Network IDs protocol-based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion, A model for intrusion analysis, techniques.

15 Hours

UNIT - II

[1st Reference book]

Chapter 1: Introduction to Snort, **Chapter 2: 2.1** - Snort Installation Scenarios, **2.2-** Installing Snort, **2.3 -** Running Snort on Multiple Network Interfaces, **2.4 -** Snort Command Line Options, **2.5-** Step-By-Step Procedure to Compile and Install Snort, **2.6 -** Location of Snort Files, **2.7 -** Snort Modes, **2.8 -** Snort Alert Modes.
Chapter 3: Working with Snort Rules, **3.5 -** Rule Headers, **3.6 -** Rule Options, **3.7 -** The Snort Configuration File etc. **Chapter 4:** Plugins, Preprocessors and Output Modules, **Chapter 5:** Using Snort with MySQL **Chapter 6:** Using ACID and SnortSnarf with Snort.

15 Hours

UNIT - III

[2nd Reference book]

Chapter 8 : Securing database-to-database communications : **8.1 -** Monitor and limit outbound communications , **8.2 -** Secure database links and watch for link-based elevated privileges, **8.3 -** Protect link usernames and passwords, **8.4 -** Monitor usage of database links, **8.5 -** Secure replication mechanisms, **8.6 -** Map and secure all data sources and sinks, **Chapter 9:** Trojans : **9.1 -** The four types of database Trojans, **9.2 -** Baseline calls to stored procedures and take action on Divergence, **9.3 -** Control creation of and changes to procedures and triggers, **9.4 -** Watch for changes to run-as privileges, **9.5 -** Closely monitor developer activity on production environments**, 9.6 -** Monitor creation of traces and event monitors, **9.7 -** Monitor and audit job creation and scheduling, **9.8 -** Be wary of SQL attachments in e-mails.

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Comprehend the basics of Intrusion Detection System and classify different types of intrusion detection systems	L2
CO2	Comprehend the basics of Intrusion Detection System	L2
CO3	Explain the concept on Snort rules	L2
CO4	Develop the Snort tools for attacking scenarios	L3
CO5	Illustrate the knowledge on different types of database security	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3												
CO2	2	3												
CO3	2	2											1	
CO4	2	2	3										2	
CO5	3	3											1	

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

TEXTBOOK:

1. Rebecca Gurley Base "Intrusion Detection" MacMillan Technology Series (MTP Series) ISBN 1578701856, 9781578701858

REFERENCE BOOKS:

1. Rafeeq Rehman "Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID", Prentice Hall PTR, 2003 ISBN 0-13-140733-3.
2. RonBen Natan, Implementing Database Security and Auditing, Elsevier, Indian reprint, ISBN: 9781555583347.

EXAMPLE ONLINE RESOURCE:

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

MOOC:

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

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.**

****

DATA SCIENCE AND MACHINE INTELLIGENCE STREAM

FUNDAMENTALS OF IMAGE PROCESSING			
Course Code	**21ISE141**	**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 theory behind the basics of digital image processing, the relation between the components of image processing system.
2. Make use of Electromagnetic Spectrum, find the equivalence between pixels.
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.
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. **(1.1 - 1.4)**

Digital Image Fundamentals - Elements of Visual Perception, Brightness Adaptation and Discrimination **(2.1)**, Light and the Electromagnetic Spectrum **(2.2**), Image Sensing and Acquisition, Image Sampling and Quantization **(2.3-2.4)),** Some Basic Relationships between Pixels. **(2.5))**

Image Enhancement in the Spatial Domain - Background, Some Basic Gray Level Transformations, Histogram Processing**. (3.1-3.3)**

7 Hours

Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. **(3.4-3.7)**

Image Enhancement in the Frequency Domain- Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters. **(4.1-4.3)**

8 Hours

UNIT- II

Sharpening Frequency Domain Filters, Homomorphic Filtering. **(4.4-4.5)**

Image Segmentation- Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, the Use of Motion in Segmentation. **(10.1-10.6)**

7 Hours

IMAGE COMPRESSION

Fundamentals Image Compression, Models Elements of Information, Theory Error-Free Compression, Lossy Compression **(8.1-8.5)**, Image Compression Standards. **(8.6 only JPEG)**

8 Hours

UNIT- III

MORPHOLOGICAL IMAGE PROCESSING

Preliminaries, Dilation and Erosion, Opening and Closing, the Hit-or-Miss Transformation Some Basic, Morphological Algorithms. **(9.1-9.5)**

COLOR IMAGE PROCESSING

Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. **(6.1-6.9)** Introduction to wavelet-based processing. **(7.1)**

9 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Apply Image Sampling and Quantization techniques	L2
CO2	illustrate an equivalence between Light and the Electromagnetic Spectrum and prove Some Basic Relationships between Pixels.	L2
CO3	Design and apply Smoothing Spatial Filters, Sharpening Spatial Filters	L2

CO4	Explain Image Compression Standard	L2
CO5	Summarize the concept of Morphological and color Image Processing.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	2							2	1		1	2	1
CO2	2	2							2	1		1	2	1
CO3	2	2							2	1		1	3	2
CO4	2	2							2	1		1	2	1
CO5	2	2							2	1		1	2	1

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

TEXTBOOK:

1. Rafel C Gonzalez and Richard E Woods, "Digital Image Processing," Pearson Education, 2nd Edition, 2003.

REFERENCE BOOKS:

1. Anil K Jain, "Fundamentals of Digital Image Processing," Prentice-Hall of India Pvt. Ltd., 1997.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision," Thomson Learning, Brooks/Cole, 2nd Ed. 2001.
3. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis," Prentice-Hall, India, 2002.
4. The Scientist and Engineers Guide to Digital Signal Processing – by Steven W. Mith, 2nd Edition, 1999, California Technical Publishing.

E-RESOURCES

1. https://www.coursera.org/learn/digital
2. http://nptel.ac.in/courses/106105032/
3. http://nptel.ac.in/courses/106105032/

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.**

****

NATURAL LANGUAGE PROCESSING			
Course Code	**21ISE142**	**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:

1. To introduce the fundamental concepts and techniques of Natural language Processing for analysing words based on Morphology and CORPUS.
2. To examine the NLP models and interpret algorithms for classification of NLP sentences by using both the traditional, symbolic and the more recent statistical approach.
3. To get acquainted with the algorithmic description of the main language levels that includes morphology, syntax, semantics, and pragmatics for information retrieval and machine translation applications.

UNIT – I

Introduction to NLP: Introduction to various levels of natural language processing, Ambiguities and computational challenges in processing various natural languages. Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, question answering, and machine translation.

Text Processing: Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis.

14 Hours

UNIT – II

Morphology: Inflectional and Derivation Morphology, Morphological Analysis and Generation using finite state transducers.

Lexical Syntax: Introduction to word types, POS Tagging, Maximum Entropy Models for POS tagging, Multiword Expressions.

Language Modeling: The role of language models, Simple N-gram models. Estimating parameters and smoothing, evaluating language models.

14 Hours

UNIT – III

Syntax and Semantics: Introduction to phrases, clauses and sentence structure, Shallow Parsing and Chunking, Shallow Parsing with Conditional Random Fields (CRF), Lexical Semantics, Word Sense Disambiguation, WordNet, Thematic Roles, Semantic Role Labelling with CRFs.

Applications of NLP: NL Interfaces, Text Summarization, Sentiment Analysis, Machine Translation, Question answering, Recent Trends in NLP. **11 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Understanding the principles and process the Human Languages Such as English and other Indian Languages using computers.	L2
CO2	Creating the few texts corpus and use linguistic method to solve the problem.	L2
CO3	Demonstrate understanding of state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.	L2
CO4	Select a suitable language modelling technique based on the structure of the language.	L2

CO5	Check the syntactic and semantic correctness of sentences using grammars and labelling and developing computational methods for real world applications and explore deep learning NLP.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2													
CO2	2	3	2										1	1
CO3	3	3	2	2									2	1
CO4	3	3	2	2									2	2
CO5	3	3	2	3									2	2

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

TEXTBOOK:

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing," 3rd edition, Prentice Hall, 2009.

REFERENCE BOOKS:

1. Chris Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing," 2nd edition, MIT Press Cambridge, MA, 2003.
2. Nitin Indurkhya, Fred J. Damerau "Handbook of Natural Language Processing," Second Edition, CRC Press, 2010.
3. James Allen "Natural Language Understanding," Pearson Publication 8th Edition, 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.**

****

FRONT-END JAVASCRIPT ANGULAR FRAMEWORK			
Course Code	**21IS143**	**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. To learn the basics of client-side JavaScript framework and the Angular framework
2. To learn implementing a functional front-end web application using Angular
3. To able to use various Angular features including directives, components and services

4. To able to use Angular Material and Angular Flex-Layout for designing responsive Angular applications
5. To able to use Observables and RxJS in the context of Angular applications

UNIT-1

Front-End JavaScript Frameworks: AngularJS Overview**,** Full-Stack Web Development: The Big Picture, Introduction to AngularJS, Models, Views and Controllers, Angular Filters, Task Runners, Angular Scope, Forms and Form Validation, Web Tools: Grunt and Gulp, Angular Scope, Angular Forms and Form Validation.

18 Hours

UNIT – II

Single Page Applications: Angular Factory, Service and Dependency Injection, Angular Templates, Angular ngRoute and Single Page Applications, Angular UI-Router for Single Page Applications.

8 Hours

UNIT – III

Client-Server Communication and Angular Testing: Client-Server Communication, Angular http Service, RESTful Services and Angular resource, Angular Testing, Web Tools: Yo and Yeoman. **13 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Outline introduction to front-end JavaScript frameworks, AngularJS and understand their components	L2
CO2	Interpret Angular router and its use in designing front end web application	L2
CO3	Apply from various angular features in designing angular JS web applications	L2
CO4	Extend reactive programming, Rex-layout and its use in AngularJS	L2
CO5	Explaining about Observables and RxJS in Angular applications.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2		2											
CO2	1		2											
CO3	1		2											
CO4	2		2											
CO5	1		2											

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

TEXTBOOKS:

1. Beginning AngularJS by Andrew Grant, Apress
2. AngularJS, JavaScript, and jQuery, Brad Dayley and Brendan Dayley, Sams Teach Yourself

E-RESOURCE:

1. https://books.goalkicker.com/AngularJSBook/

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.**

****

COMPUTER VISION			
Course Code	**21ISE144**	**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 goal and scope of computer vision
2. Learn the basics of image and image formation in computers.
3. Learn about camera projections and viewing in computer vision
4. Learn the basics image segmentation and feature tracking.
5. Understand and learn the principles of object detection and recognition in computer vision.

UNIT I

Introduction: Introduction to Computer Vision: Goal, areas, Human Vision, Segmentation, Perception, Semantic information, Special effects, Modeling, Applications; Linear Algebra: Vectors & matrices, Transformation matrices, Matrix inverse, Matrix rank, SVD.

Pixels, Features, and Cameras: Pixels and Filters: Images as functions, Linear Systems (filters), Convolution & Correlation. Edge detection: Simple, Canny, RANSAC; Feature detector: Local invariant, Harris, DOG, SIFT; Camera Model

14 Hours

UNIT - II

Camera: Pinhole Cameras, Cameras & lenses, Projection matrix, Intrinsic parameters, Extrinsic parameters; Stereo Vision: Epipolar geometry, Parallel images, Images rectification, Solving correspondence problem, Active Stereo Vision System.

Regions of Images, and Segmentation: Basic Concepts of Segmentation: Gestalt theory; Agglomerative, K-means & Mean-shift Clustering; Optical flow, Feature tracking, Applications;

15 Hours

UNIT - III

Advanced Image Parsing Topic and Applications: Binary, Image Matting; Figure-ground Segmentation Using Clustering Algorithms.

Recognizing Faces and Objects: Basic Concepts in Recognition & its pipeline, Nearest Neighbor Match; PCA and Eigenfaces; Tracking Millions of People: Detection, Tracklet Generation & Association.

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Outline basics of image processing	L2
CO2	Explain edge detection and feature description techniques.	L2
CO3	Summarize camera projections	L2
CO4	Apply image segmentation and feature tracking.	L2
CO5	Apply the techniques of recognizing faces and objects to appropriate problems	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	3							1	1		1	1	1
CO2	1	3							1	1		1	1	1
CO3	2	2							1	1		1	1	2
CO4	2	2							1	1		1	2	2
CO5	1	3							1	1		1	3	2

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

TEXTBOOKS:

1. Computer Vision: Algorithms and Applications, Richard Szeliski, Microsoft Research, Electronic draft (2010).
2. Computer Vision: A Modern Approach, David A. Forsyth& Jean Ponce, Prentice Hall; 2 edition (2011).
3. Multiple View Geometry in Computer Vision, Hartley & Zisserman, Cambridge University Press; 2 edition (2004).

REFERENCE BOOKS:

1. Machine vision, Jain, Ramesh and Rangachar Kasturi and Brian G. Schunck; McGraw-Hill, Edition-1995.
2. Introductory computer vision and image processing, Low, Adrian; McGraw-Hill, Edition-1991.
3. Digital image processing, Gonzalez, Rafael C. and Richard E. Woods; Addison- Wesley, Edition: 3rd, Year:1998.

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.**

****

SOCIAL AND WEB ANALYTICS			
Course Code:	**21ISE241**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable students to,

1. Understand web and social media analytics and their potential impact.
2. Use various sources and collect data related to the metrics and key performance indicators.
3. Explore and analyse social media information.

UNIT – I

Introduction to Web and Social Analytics:

Overview of web and social media (websites, web applications, mobile applications and social media), Impact of social media on business, Social media environment, How to leverage social media for better services, Usability, User Experience, Customer Experience, Customer Sentiments, Web Marketing, Conversion Rates, ROI, Brand Reputation, Competitive Advantages, Need of using Analytics, Web Analytics Technical Requirements, Current Analytics Platforms, Open Source versus Licensed Platform, Choosing Right Specifications and Optimal Solutions, Web Analytics and 2.0 framework.

15 Hours

UNIT – II

Types of Data, Data Analysis, Key Performance Indicators / Metrics:

Data (Structured, unstructured, Metadata, Big Data and Linked Data), Participating people with people centric approach, Data Analysis Basics (Types of Data, Metrics and Data, Descriptive, Statistics and Comparing). Understand the Discipline of Social Analytics, Aligning Social Objectives with Business Goals, Identify Common Social Business Objectives, Developing KPIs – Standard versus Critical Metrics, PULSE Metrics (Page Views, Uptime, Latency, Seven – days Active Users) on Business and Technical Issues, HEART Metrics (Happiness, Engagement, Adoption, Retention, and Task Success), on User Behaviour Issues, Bounce Rate, Exit Rate, Engagement, strategically aligned KPIs, Measuring Macro and Micro conversions, On-site web analytics, The goal-signal-metric process.

15 Hours

UNIT – III

Exploring and Mining Twitter, Facebook:

Why is Twitter all the range? Exploring Twitter's API Fundamental twitter terminology, creating twitter API connection, Exploring Trending Topics, Searching for Tweets, Analysing the 140 characters, Extracting Tweet Entities, Analysing Tweets and its Entities with Frequency Analysis, Computing Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing the Frequency Data with Histograms.

[T1: 1.2 to 1.4]

Facebook Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analyzing Social Graph Connections, Analyzing Facebook Pages, Examining Friendships. Classification Algorithms, Clustering Algorithms, Transfer Learning in Heterogeneous Networks.

[T2: 2.1 to 2.3] **9 hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain web and social media analytics.	L2
CO2	Show how to leverage social media for better services.	L2
CO3	Summarize the categories of digital data.	L2
CO4	Develop KPI and build scorecards, dashboards to track KPIs.	L3
CO5	Apply data mining and analysis techniques to social media platforms like Twitter and Facebook.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2							1	1		1	1	1
CO2	2	2							1	1		1	1	1
CO3	1	2							1	1		1	2	1
CO4	2	2							1	1		1	1	1
CO5	2	2							1	1		1	3	1

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

TEXTBOOK:

1. Mathew A Russell, "Mining of Social Web", O'Reilly; 2 Edition (8 October 2013), ISBN-13: 978-1449367619.
2. Charu C Agarwal, "Social Network Data Analytics", Springer; 2011 Edition (1 October 2014), IISBN-13: 978-1489988935.

REFERENCES:

1. Hand, Mannila and Smyth, "Principles of Data Mining", Cambridge, MA: MIT Press, 2011, ISBN: 026208290X.
2. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", John Wiley and Sons: Pap/Cdr Edition (27 October 2009).
3. Tom Tullis, Bill Albert, "Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics", Morgan Kaufmann: 1st Edition (28 April 2008).
4. Jim Sterne, "Social Media Metrics: How to Measure and Optimize Your Marketing Investment", John Wiley and Sons (16 April 2010).
5. Brian Clifton, "Advanced Web Metrics with Google Analytics", John Wiley and Sons, 3rd Edition.

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 and contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **unit I** and **II** and **1** full question from **unit III**.

****

DATA MINING			
Course Code:	**21ISE242**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

UNIT – I

INTRODUCTION TO DATA MINING – Why Data Mining? What is Data Mining? What kind of data can be mined? What kinds of patterns can be mined? Issues in data mining.

GETTING TO KNOW YOUR DATA: Data Objects and Attribute Types, Basic Statistical Descriptions of Data **(2.2.1,2.2.2)**, Measuring Data Similarity and Dissimilarity.

DATA PREPROCESSING: Data Pre-processing: An Overview, Data Cleaning, Data integration, Data Reduction (3.4.1,3.4.6,3.4.7,3.4.8), Data transformation and Discretization **(3.5.1,3.5.2,3.5.3).**

MINING FREQUENT PATTERNS: Associations and Correlations - Basic Concepts, Frequent Item-set Mining Methods **(6.2.1, 6.2.2, 6.2.4)** – Apriori Algorithm, Generating Association rules from frequent item-sets. A Pattern growth approach for mining frequent item-sets, Which Patterns are interesting? **(6.3.1, 6.3.2)** **16 Hours**

UNIT – II

CLASSIFICATION: BASIC CONCEPTS: Basic Concepts, Decision tree induction **(8.2.1,8.2.2)**, Bayes Classification methods **(8.3.1,8.3.2)**

Rule based classification **(8.4.1,8.4.2,8.4.3**- Rule Induction Using a Sequential Covering Algorithm), Model evaluation and selection (**8.5.1)**. **14 Hours**

UNIT – III

CLUSTER ANALYSIS: **Basic concepts and methods-** Cluster Analysis **(10.1.1, 10.1.2,10.1.3),** Partitioning methods **(10.2.1,10.2.2)**, Hierarchical methods **(10.3.1,10.3.2)**, Evaluation of clustering. **9 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the functionalities, interesting patterns and kind of data for data mining & the need of pre-processing of data.	L2
CO2	To identify frequent patterns and develop the association's rules.	L3
CO3	Apply classification algorithms like Decision tree and Bayesian classification to classify the data.	L3
CO4	Experiment with rule-based classification method to classify the data.	L3
CO5	Apply partitional clustering and Hierarchical clustering methods to cluster the data and outline the evaluation of clustering methods.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	2								1		1		

CO2	2	2		2						1		1		2
CO3	2	2		2						1		1		2
CO4	2	2		3						1		1		2
CO5	3	3		2						1		1		3

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

TEXTBOOK:

1. Jiawei Han and Micheline Kamber, "Data Mining – Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. M. H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education. 2001.
2. D. Hand, H. Mannila and P. Smyth, "Principles of Data Mining", Prentice-Hall. 2001.
3. H. Witten and E. Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann. 2000.

E-RESOURCE

https://www.mooc-list.com/course/data-mining-weka-futurelearn

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 and contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **unit I** and **II** and **1** full question from **unit III**.

****

ARTIFICIAL INTELLIGENCE			
Course Code	**21ISE243**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives

This course enables students to

1. Understand basics of Artificial Intelligence and know its applications in real world.
2. Learn to define an AI problem and also solve it using appropriate problem-solving techniques.
3. Learn how to build a knowledge base and how it can be inferred by AI systems.
4. Asses the need of expert systems and understand the working of learning algorithms.
5. Learn the basics of Prolog Programming

UNIT - I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE, PROBLEM SPACES AND EXPERT SYSTEMS

INTRODUCTION:(Text Book1)

What is AI? Foundations of AI, History Of AI Current Status of AI,

INTELLIGENT AGENTS:

Agents and Environments, Concept of Rationality, Nature of Environments, The Structure of Agents **(2.4.1 to 2.4.6),** Problem specification. **(3.1,3.1.1,3.1.2, 3.2, 3.2.1, 3.2.2)**

EXPERT SYSTEMS (Textbook 2)

Introduction, Characteristics of Expert System, Need of an Expert system, Architecture of Expert System, Knowledge Acquisition, Issues with current expert systems

14 Hours

UNIT – II

PROBLEM SOLVING, KNOWLEDGE BASES AND REASONING (Textbook 1)

UNINFORMED SEARCHES- (3.4, 3.4.1, 3.4.3, 3.4.4, 3.4.5)

Breadth First Search, Depth First Search, Depth Limit Search

INFORMED SEARCHES-(3.5, 3.5.1, 3.5.2, 4.1, 4.1.1)

Greedy Best first search, A* Algorithm, Hill Climbing,

ADVERSARIAL SEARCH-(5.2,5.2.1, 5.3, 5.3.1)

Min Max Algorithm, Alpha Beta Pruning

KNOWLEDGE BASE (Textbook 1)

Knowledge based Agents, Wumpus World, Logic, Propositional logic, Propositional Theorem Proving, First Order Logic **(8.2)**, Using First order logic **(8.3)**

16 Hours

UNIT - III

INTRODUCTION TO PROLOG PROGRAMMING AND MACHINE LEARNING

PROLOG PROGRAMMING (T4:1.1,1.2,1.3)

Prolog syntax, Answering Queries, simple example program

MACHINE LEARNING: (Textbook 3)

Introduction to Learning **(T3:1.1,1.2),** Reinforcement learning **(T3: 18.1,18.3)**

9 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Summarize the basic concepts, terminologies and scope of artificial intelligence.	L2
CO2	Identify the need of Expert Systems	L2
CO3	Experiment with different approaches to solve an AI problem.	L3
CO4	Build knowledge bases and develop intelligent systems.	L3
CO5	Experiment with PROLOG Programming for AI and also different machine learning techniques.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2													

CO2	2	3										1	1
CO3	3	3										1	1
CO4	3	3										2	2
CO5	3	3		3								2	3

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

TEXTBOOKS:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence - A Modern Approach", Third Edition.
2. Elaine Rich, Kevin Knight and Nair, "Artificial Intelligence",ISBN-978-0-07- 0087705, TMH, Fifth Edition,2012.
3. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition.
4. Lecture Notes "An Introduction to Prolog Programming", By Ulle Endriss, University of Amsterdam (Email: ulle.endriss@uva.nl), Version: 1 September 2018

REFERENCE BOOKS:

1. Bratko, "Prolog Programming for Artificial Intelligence", TMH, Third Editon,2002.
2. Saroj Kausik, "Artificial Intelligence", ISBN:- 978-81-315-1099-5, Cengage Learning, First Edition, 2011.
3. Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005.

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.**

****

DEEP LEARNING			
Course Code	**21ISE244**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course objectives:

This course will enable students to

1. Summarize the principles and building blocks of Deep Neural networks.
2. Understand the structure and working of Autoencoders and Restricted Boltzmann Machines.
3. Understand the structure and working of Convolutional Neural Networks and Recurrent Neural Networks
4. Learn the basics of Deep Reinforcement Learning and Generative Adversarial Networks.
5. Summarize the need and techniques for regularization and optimization in deep learning.

UNIT – I

Foundations of Neural Network and Deep Learning

Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyperparameters(**Textbook 3: Chapter 2)**

Deep Learning Introduction: Historical trends in Deep Learning, Challenges motivating deep learning **(Textbook 2: 1.2,5.11)**

Common Neural Architectures: Shallow models, RBF networks, RBM, CNN, Hierarchical Feature Engineering and Pretrained Models**(Textbook 1: 1.6)**

Autoencoders

Basic Principles, Nonlinear activations, Deep autoencoders, Application outlier detection, Sparse feature learning.**(Textbook 1: 2.5.1 to 2.5.5)**

Restricted Boltzmann Machines

Introduction, Hopfield Networks, Boltzmann Machine, RBM, Deep Boltzmann Machines

(Textbook 1: 6.1,6.2.1,6.2.2,6.3, 6.4, 6.4.1, 6.7.3)

15 Hours

UNIT – II

Convolutional Neural Networks

Introduction, basic structure, Training CNN, Case study: Alexnet, VGG, Applications.

Recurrent Neural Networks

Introduction, Architecture, Challenges, LSTM, Applications

Deep Reinforcement Learning

Introduction, Stateless Algorithms, Basic framework of Reinforcement learning

General Adversarial Networks

Training GAN, comparison with variation autoencoder, using GAN to generate image data, CGAN

Limitations of Neural Networks

An aspirational goal: One Shot Learning, Energy Efficient Learning

(Textbook 1:7.1 to 7.3, 7.5,7.7, 8.1 to 8.4(8.4.1,8.4.3), 8.6,9.1 to 9.3,10.4,10.6)

16 Hours

UNIT – III

Regularization and Optimization for Deep Learning Models

Regularization: Parameter Norm Penalties, Dataset Augmentation, Multi-task Learning, Early Stopping, Parameter typing and parameter sharing, sparse representation, ensemble methods**,** Dropout**.** **(Textbook2: 7.1,7.4,7.7,7.8,7.9,7.10,7.11,7.12)**

Optimization: How learning differs from pure optimization, challenges in neural network optimization, Basic algorithms (**Textbook2: 8.1,8.2,8.3)**

8 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Summarize the basics of Neural Networks and Deep Learning Models	L2
CO2	Outline the principles, applications of Autoencoders and Restricted Boltzmann Machines	L2
CO3	Identify the use and application of Convolutional Neural Networks and Recurrent Neural networks	L3
CO4	Summarize the concepts of Deep Reinforcement learning and GANs	L2

CO5	Explain the need of regularization and optimization in deep learning	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	2											1	1
CO2	3	2	2	2									1	1
CO3	3	2	2	2	1								3	3
CO4	3	3	2	2									1	1
CO5	3	3	2	2									2	1

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

TEXTBOOK:

1. Charu C Agarval, "Neural Networks and Deep Learning", Springer International Publishing AG, part of Springer Nature 2018
2. Ian Goodfellow, Y. Bengio and A. Courville, "Deep Learning", MIT Press, 2016.
3. Josh Patterson, Adam Gibson,"Deep Learning A Practitioners' Approach", O'Reilly, First Edition.

REFERENCE BOOKS:

1. Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015
2. Li Deng and Dong Yu, "Deep Learning: Methods and Applications", 2013
3. Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009

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.**

****

GENERAL STREAM

PARALLEL COMPUTER ARCHITECTURE & PROGRAMMING			
Course Code	**21ISE151**	**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, Amdhal'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 multithreading, Hyper threading, SMT, Case Study of multi-core processors: Intel, AMD multi core 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:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Design a parallel program using the multithreading concept	L2
CO2	Develop parallel programs using parallel programming frameworks	L2
CO3	Describe the concept of multithreaded program debugging	L2
CO4	Develop GPU programs using CUDA	L2

CO5	Design a parallel program using the multithreading concept	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3		3	2				1			3			
CO2	3	3			2	2		1		2	3	3		
CO3	3	3	3		2	2		1		2	3	3		
CO4	3	3			2			1		2	3	3		
CO5	3	3	3		2	2		1		2	3	3		

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

TEXTBOOK

1. Introduction to Parallel Computing, by Niranjan 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 BOOK

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
3. www tutorials on introduction to parallel computing.

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.**

****

COMPUTER GRAPHICS			
Course Code	**21ISE152**	**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. Illustrate interactive computer graphics using OpenGL.
2. Illustrate geometric transformations on objects.
3. Infer the representation of viewing, Color and Illumination models in graphic

UNIT – I

INTRODUCTION [1st Textbook]

Chapter 1 : 1.1 - Applications of computer graphics; **1.2 -** A graphics system; **1.3 -** Images: Physical and synthetic; **1.4 -** Imaging Systems; **1.6 -** The synthetic camera model; **1.6 -** The programmer's interface; **1.7 -** Graphics architectures; **1.8 -** Programmable Pipelines; **1.9 -**Performance Characteristics **Chapter 2:** Graphics Programming: **2.1 -** The Sierpinski gasket; **2.2 -** Programming Two Dimensional Applications, **6.1 -** Basic Implementation Strategies; **6.2 -** Four major tasks, **2.10.3 -** Hidden Surface Removal; **6.12 -** Antialiasing.

Chapter 2: The OpenGL: 2.3 - The OpenGL API; **2.4 -** Primitives and attributes; **2.5 -** Color; **2.6 -** Viewing; **2.7 -** Control functions; **2.8 -** The Gasket program; **2.9-** Polygons and recursion; **2.10 -** The three-dimensional gasket; Plotting Implicit Functions.

14 Hours

UNIT – II

INPUT AND INTERACTION

Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations.

[Textbook 1] Chapter 3: Geometric Objects and Transformations - I: **3.1 -** Scalars, Points, and Vectors; **3.2 -** Three - dimensional Primitives; **3.3 -** Coordinate Systems and Frames; **3.6 -** Modeling a Colored Cube; **3.7 -** Affine Transformations; Rotation, Translation and Scaling; **3.9 -** Transformation in Homogeneous Coordinates; **3.10 -** Concatenation of Transformations.

15 Hours

UNIT – III

VIEWING [Textbook 1]

Chapter 4: 4.1 - Classical and computer viewing; **4.2 -** Viewing with a Computer; **4.3 -** Positioning of the camera; **4.5.1-** Simple projections; Projections in OpenGL; **4.9 -** Interactive Mesh Displays; **4.4 -** Parallel - projection matrices; **4.7 -** Perspective - projection matrices; **4.10 -**Projections and Shadows.

Chapter 5: LIGHTING AND SHADING [Textbook 1]

5.1 - Light and Matter; **5.2 -** Light Sources; **5.3 -** The Phong Lighting model; **5.4 -** Computation of vectors; **5.5 -** Polygonal Shading; **5.6 -** Approximation of a sphere by recursive subdivisions; **5.7: 5.7.1 -** Light sources in OpenGL; **5.7.2 -** Specification of materials in OpenGL; **5.9 -** Shading of the sphere model; **5.11 -** Global Illumination.

IMPLEMENTATION [Textbook 1]

Chapter 6: 6.3 - Clipping: **6.4 -** Line - segment clipping, **6.8 -** Rasterization: **6.9 -** Bresenham's Algorithm, **6.10 -** Polygon Rasterization.

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the concepts of the graphics system and its implementation strategies.	L2
CO2	Use OpenGL to create interactive computer graphics.	L2
CO3	Apply basic transformations on objects using OpenGL	L2
CO4	Demonstrate the viewing and projection matrices.	L2
CO5	Apply light materials to illuminate model for rendering 3D objects	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2													
CO2	2													
CO3	2	2											2	
CO4	2	2											2	
CO5	1	2											2	

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

TEXTBOOKS:

1. Edward Angel: Interactive Computer Graphics A Top Down Approach with OpenGL, 5th Edition, Pearson Education, 2008.

REFERENCE BOOKS:

1. Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version, 3rd Edition, Pearson Education, 2004.
2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3rd Edition, PHI, 2009.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

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.**

****

OPERATIONS RESEARCH			
Course Code	**21ISE153**	**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. To know the basics of OR, modelling and applications of OR.
2. Definition of linear programming model, formulation of linear programming model and application of linear programming model using different techniques.
3. To formulate the problem and solve the problem by using different techniques.
4. Describe mathematical formulation of an Assignment Problem and solve various scenarios by using different methods.
5. Understand and identify the project management techniques.

UNIT - I

INTRODUCTION: Introduction to OR, nature and meaning, applications, modelling in OR, phases of OR study. Linear Programming: Introduction to Linear Programming through an example, graphical method, formulation of LP model from practical problems, assumptions and properties of linear programming, simplex method.

T1: Chap 2, Chap 3, Chap 5

T2: Chap 1, Chap 3

7 Hours

Revised simplex method, Big M method, 2 phase method, Duality theory, Primal and dual relationship, Dual simplex method.

T1: Chap 5, Chap 6, Chap 7, Chap 8, Chap 9

8 Hours

UNIT - II

TRANSPORTATION PROBLEMS: Special types of main programming, transportation problems, methods to find initial feasible solution and modification to obtain optimal solution (Degeneracy in transportation problems, unbalanced transportation problems. **8 Hours**

Assignment problem Mathematical formulation of an assignment problem, unbalanced assignment problem, TSP, Hungarian method.

T2: Chap 5

T1: Chap 15, Chap 16

8 Hours

UNIT- III

CPM, PERT: Representation of a project by a network, activities and events, starting times, finishing times, floats, slacks, CPM, Idea of crashing probabilistic times and PERT analysis.

T1: Chap 31 **8 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the importance of OR and its applications.	L2
CO2	Apply the simplex method to solve linear programming problem graphically.	L2
CO3	Illustrate how to minimize the total transportation cost, and to optimize the distribution of available resources.	L2
CO4	Apply the concepts of assignment problem to solve the given problem in various scenarios.	L2
CO5	Develop the abilities in evaluating project management techniques like PERT, CPM and to handle complex tasks of time estimation & project scheduling.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2													
CO2	2	2												
CO3	2	2												
CO4	2	2												
CO5	2	2											2	

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

TEXTBOOKS:

1. Operations Research, S D Sharma, 15th edition.
2. Operations Research – An introduction, Hamdy A Taha, PHI, 7th Edition.

REFERENCE BOOKS:

1. Operation research, Kanti Swaroop, Man Mohan and Gupta.
2. Introduction to operation research, a computer oriented algorithmic approach, Gillett B G, McGraw Hill, 1976.

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.**

****

ROBOTIC PROCESS AUTOMATION DESIGN & DEVELOPMENT			
Course Code	**21ISE154**	**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. Learn the basic concepts of Robotic Process Automation
2. Understand processes which can be automated, associated business documentation basics, RPA journey of an organization
3. Develop familiarity and deep understanding of UiPath tools and prepare students to be Junior RPA Developer

FIRST WEEK – RPA Basics

History of Automation, Story of Work, Introduction to RPA, RPA vs. Automation, RPA and AI, RPA and emerging ecosystem, Industries best suited for RPA, Process that can be Automated

SECOND WEEK – Introduction to UiPath

UiPath and its products, Robots and their types, Studio Overview, Orchestrator, UiPath Studio Installation, The User Interface, Features of Studio – Managing Activities Packages, Managing Extensions, Reusing Automation Library, Version Control, Introduction to Automation Debugging, Activities Guide

Lab Experiments: Install UiPath Studio Extension in Browsers – Chrome Browser, Firefox Browser; Install Activity Packages in UiPath Studio – Excel Activity Package Installation, Email Activity Package Installation, PDF Activity Package Installation; Version Control using TFS; Build a workflow that prints "Hello World" in a message box.

THIRD WEEK – Variables and Arguments

Variables and its types, Variables Panel, Scope of Variable, Arguments, Arguments Panel, Argument Directions, Argument vs Variable

Lab Experiment: Build a workflow that swaps the values of two variables using a third variable

FOURTH WEEK – UI Automation & Selectors

UI interactions, Input actions and Input Methods – Input actions: Click, Type Into, Send Hotkey; Input Methods – Default, SendWindowMessages, Simulate Type/Click, Containers, Recording & its types, Selectors, Types of Selectors – Full and Partial, Containers and Partial Selectors, Dynamic Selectors, Wildcards in Selectors, UI Explorer, Anchors, Debugging selectors

Lab Experiments: Build a workflow that uses different input methods to input data in a Notepad; Build a workflow that opens a browser and then opens UiPath's website; Build a workflow using Web Recorder in UiPath Studio to Sign in to UiPath's website; Build a workflow that fills the form on RPAChallenge.com website with organized data from an excel file; Build a workflow that replaces double spaces with single spaces from a text stored in multiple Notepad files with different names.

FIFTH WEEK – Control Flow

Sequences, Control Flow and its types, Decision control – IF, Switch, IF vs Switch, Loops – Do While, While, For Each, Other control flow activities – Delay, Break, Assign, Continue, Parallel, Flowcharts – Introduction, Decisions in flowcharts, Loops in flowcharts, nesting flowcharts and sequences, Sequences vs. Flowcharts, Error handling – Errors, Exceptions, Error handling approach, Try Catch, Retry Scope, Global Exception Handler, Continue On Error, Best Practice for Error Handling

Lab Experiments: Build a workflow using if statement which tells a user whether he will get the second Marshmallow or not; Build a workflow using Switch activity that asks users' their eye colour and display their personality in a message box; Build a workflow for a 'Guessing Game'; Build a workflow using While loop that tells the user if the input is a prime number or not; Build a workflow to display file names from a folder in the Output panel and also store names in an MS World file; Build a workflow using Parallel activity; Build a workflow that asks user for his name and two-digit lottery number and displays if he is a winner; Build a workflow using Try Catch activity.

SIXTH WEEK – Data Manipulation

Data Manipulation and its importance – Introduction & operations, Data conversion, String Manipulations – Introduction & methods, RegEx, DataTable Manipulations, Collection, its types and manipulations – Lists, Dictionaries

Lab Experiments: Build a workflow using ToString method that converts an integer to string; Build a workflow using Format, Join, IndexOf, Split, and Substring methods that extracts key information from a

text and prints in a different format; Build a workflow using Split and Contains methods that extract sentences containing "RPA" from a UiPath webpage

SEVENTH WEEK

Lab Experiments -Build a workflow using data table activities to join two library databases using matching student ID and display output in a message box; Build a workflow using Concat and Join method that merges two lists containing the UK and Spain city names, sorts it, capitalizes the first letter of each item, and displays it in a message box.

EIGHT WEEK – Automation Concepts and Techniques

Extraction and its techniques – Screen scraping, Data scraping, PDF Extraction, Automation Techniques – Workbook and Excel automation (read/write), Email automation

Lab Experiments: Build a workflow using Screen Scrapper Wizard that scrapes text using Tesseract OCR scraping method from an image and stores in a Notepad

NINTH WEEK

Lab Experiments: Build a workflow using Screen Scrapper Wizard that scrapes text using Full-Text scraping method and stores in a Notepad file; Build a workflow using Data Scraping Wizard that scrapes blog post titles from UiPath Blog from multiple pages;

TENTH WEEK

Lab Experiments: Build a workflow using Read PDF Text activity and extract only Email IDs and Phone Numbers from a PDF file and store in an MS Word file; Build a workflow using Read Range and Append Range activity to read data from a workbook and append data to another workbook;

ELEVENTH WEEK

Lab Experiments: Build a workflow that calculates total monthly deposit of a bank from an Excel file and store output in a new sheet; Build a workflow that extracts attachments from the emails containing the word "Resume" in its subject.

TWELETH WEEK – Orchestrator

Orchestrator overview, Publishing a Robot to Orchestrator, Orchestrator Functionalities, Orchestrator User Interface – Categories of functionalities – Automations – Processes, Triggers, Queues, Transactions, Assets, Management – Folders, Users, Roles, Robots, Environments, Machines, Packages, Libraries, Monitoring – Robots, Jobs, Queues, Logs

Lab Experiments: Create an Asset of Credential type in Orchestrator and display the credential asset username in Studio;

THIRTEENTH WEEK

Lab Experiments - Create a Queue in Orchestrator and add excel data values in the queue.

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)

CO1	To prepare students to be Junior RPA Developers	L2
CO2	Learn the basic concepts of Robotic Process Automation	L2
CO3	Develop familiarity and deep understanding of UiPath tools	L2
CO4	Develop the ability to independently design and create robots for business processes	L2
CO5	Develop skills required to pass UiPath RPA Associate v1.0 Exam	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2												
CO2	1	2												
CO3	1	2												2
CO4	1	2											2	
CO5	1	2												2

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

TEXTBOOK:

1. Alok Mani Tripathi: Learning Robotic Process Automation, 1st Edition, Packt Publishing Ltd., 2018.

REFERENCE BOOKS:

1. Power Point Presentations from UiPath.
2. Lab Guide from UiPath

WEB References:

1. https://academy.uipath.com/
2. https://www.uipath.com/rpa/academic-alliance

****

MULTIMEDIA PROCESSING			
Course Code:	**21ISE251**	**Course Type**	**PEC**
Teaching Hours/Week (L: T: P: S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39**	**CIE + SEE Marks**	**50+50**

Course Objectives:

1. Get the key concepts in current multimedia technology.
2. Summarize the representation of text, images, audio and video.
3. Classify and develop various compression techniques for text, images, audio and video.
4. Analyze and evaluate the strengths and limitations of various audio and video codecs.
5. Design codecs using the best techniques of compression, encoding and decoding.

UNIT 1

Multimedia Communications: Introduction to Multimedia Systems and Processing, multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.

Information Representation: text, images, audio and video,

Text compression: Text compression principles, Lossless compression, Lossy compression, static coding, dynamic coding, Static Huffman Coding, Dynamic Huffman coding, Arithmetic coding, Lempel – Ziv coding, Lempel – Ziv Welsh coding. transform encoding, entropy encoding, differential encoding,

Image compression: GIF format, TIFF format, digital Pictures, Raster scan principles, JPEG. **15 Hours**

UNIT II

Audio: Types, Audio compression: PCM, Adaptive PCM, Adaptive Differential PCM, Adaptive predictive coding, Linear predictive coding, code excited LPC, perceptual coding, MPEG audio coders, Dolby Audio coders

Video: broadcast TV, color signals, NTSC, PAL, Digital formats: 4:2:2, 4:2:0, HDTV format, SIF, CIF, QCIF, PC video.

Video compression: video compression principles, frame types, motion estimation and compensation, encoding of frames, implementation issues.

15 Hours

UNIT III

Video compression standards: H.261, H.263, MPEG 1, MPEG 2, MPEG 4 (scene composition, coder, decoders), MPEG 7, MPEG 21 multimedia framework. **09 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Describe how text, audio, image and video information can be represented digitally in a computer, so that it can be processed, transmitted and stored efficiently.	L2
CO2	Able to differentiate and design lossless and lossy compression techniques.	L2
CO3	Analyze and evaluate the possibility and limitations of multimedia data compression.	L2
CO4	Evaluate the audio coding techniques including predictive coding and more advanced techniques based around LPC and others.	L2
CO5	Apply various compressions, encoding and decoding techniques to solve the real problems in multimedia processing and adopt the best methods.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2	3							1	1		1	3	
CO2			3						1	1		1		3
CO3			3						1	1		1		3
CO4				3					1	1		1	3	
CO5				3					1	1		1	3	

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

TEXTBOOKS:

1. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols And Standards", Pearson education, 2001.
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004.

REFERENCE BOOKS:

1. Raif steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002.
2. John Billamil, Louis Molina, "Multimedia: An Introduction", PHI, 2002.

E Books / MOOCs/ NPTEL

1. NPTEL materials on multimedia processing, IIT Kharagpur: http://nptel.iitk.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Multimedia %20Processing/New_index1.html

****

INNOVATION MANAGEMENT AND BUSINESS MODELS			
Course Code	**21ISE252**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. To learn the basics and types of innovation, creativity
2. To learn about the Design thinking and entrepreneurship
3. To learn about business models
4. To learn about incubation and markets
5. To demonstrate innovation management and case studies.

UNIT – I

Innovation

Analyzing the Current Business Scenario, Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation, School of Innovation.

Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent V/s Convergent Thinking, Design Thinking and Entrepreneurship

Experimentation in Innovation Management, Idea Championship, Participation for Innovation, Co-creation for Innovation, Prototyping to Incubation.

Marketing of Innovation, Technology Innovation Process, Technological Innovation Management Planning, Technological Innovation Management Strategies, Technology Forecasting.

15 Hours

UNIT – II

Business Model

What is a Business Model, Who is an Entrepreneur, Social Entrepreneurship, Blue Ocean Strategy-I, Blue Ocean Strategy-II

Business Models and value proposition, Business Model Failure: Reasons and Remedies, Incubators: Business Vs Technology, Managing Investor for Innovation, Future markets and Innovation needs for India.

Exploration of business models for material efficiency services.

Case Studies

15 Hours

UNIT – III

Context and Pattern, SME'S strategic involvement in sustainable development

Management of Innovation, Innovation, Sustainability Innovation and Entrepreneurship, Innovation Sustainable Conditions, Innovation: Context and Pattern.

Case Study of Patents

9 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Acquire Knowledge on Innovation concepts, challenges and management	L2
CO2	Understand the experimentation and marketing of innovation	L3
CO3	Acquire Knowledge on business models, entrepreneur and investors	L2
CO4	Analyse the business case studies	L3
CO5	Understand the management of innovation	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2								1				1

CO2	1	2	2							3				3
CO3	1	2	2							3				3
CO4	1	2	2							3				1
CO5	1	2								1				1

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

TEXTBOOKS:

1. 8 Steps To Innovation: Going From Jugaad To Excellence- Book by Rishikesha T. Krishnan and Vinay Dabholkar
2. Innovation and Entrepreneurship Book by Peter Drucker
3. HBS series on Innovation and Entrepreneurship

REFERENCE BOOKS:

1. Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.
2. T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013) • Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation
3. Verstraete, T. and Laffitte, E.J. (2011). a Business Model of Entrepreneurship, Edward Elgar Publishing
4. Kelley, Tom (2011), The ten faces of innovation, Currency Doubleday

MOOC References

1. Innovation, Business Models and Entrepreneurship, By Prof. Rajat Agrawal, Prof. Vinay Sharma | IIT Roorkee. https://onlinecourses.nptel.ac.in/noc21_mg63/preview
2. Innovation by Design, By Prof. B.K. Chakravarthy | Industrial Design Centre, IIT Bombay, https://onlinecourses.swayam2.ac.in/aic19_de02/preview
3. Strategic Innovation: Building and Sustaining Innovative Organizations, Coursera, https://www.coursera.org/learn/strategic-innovation-building-and-sustaining-innovative-organizations

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.**

****

VIRTUAL REALITY			
Course Code	**21ISE253**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

1. To understand concepts of Virtual Reality & geometric modeling

2. To study about Virtual environment
3. To develop Virtual Hardwares and Softwares and Virtual Reality applications

UNIT – I

INTRODUCTION TO VIRTUAL REALITY

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation – Virtual environments –requirement – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Color theory – Simple 3D modeling Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image. (T1)

GEOMETRIC MODELLING

Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction. (T1)

15 Hours

UNIT - II

VIRTUAL ENVIRONMENT

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and non- linear translation - shape & object inbetweening – free from deformation – particle system- Physical Simulation: Introduction – Objects falling in a gravitational field– Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.(T1)

14 Hours

UNIT – III

VR HARDWARES & SOFTWARES

Human factors: Introduction – the eye - the ear- the somatic senses - VR Hardware: Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML. (T1)

VR APPLICATION

Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction. (T1)

10 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Explain the concepts of virtual reality in real-time applications	L2
CO2	Illustrate the concepts of geometric modelling for object transformations	L3
CO3	Apply the concepts of animation and simulation in developing a tool for virtual environment	L3

CO4	Select appropriate hardware and software for interacting with VR systems.	L2
CO5	Develop applications of VR toolkits for modelling virtual world simulators.	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2													
CO2	2	2												
CO3	2	2											1	
CO4	1				2									
CO5	2	2											2	

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

TEXTBOOK:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.

REFERENCE BOOKS:

1. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
2. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.
3. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design", Morgan Kaufmann, 2008.

E-RESOURCES:

1. www.vresources.org.
2. www.vrac.iastate.edu.
3. www.w3.org/MarkUp/VRML.

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.**

****

ARCHITECTING WITH GOOGLE COMPUTE ENGINE			
Course Code	**21ISE254**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. To learn the basics of Google Cloud Platform (GCP)
2. To learn about building Virtual Private Networks and Virtual Private Clouds in GCP
3. To learn about Big Data and Machine Learning features of GCP

Course Content:

UNIT - I

So, what is the Cloud anyway? – Cloud Computing, Cloud versus Traditional architecture, IaaS, PaaS, and SaaS, Google Cloud architecture. **Start with a Solid Platform –** The Cloud Console, Understanding projects, Billing in Google Cloud, Install and configure the Cloud SDK, Use Cloud Shell, Google Cloud APIs, Cloud Console Mobile App. **Use Google Cloud to Build Your Apps –** Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine (GKE). **Where Do I Store This Stuff –** Storage options in the cloud, Structured and unstructured storage in the cloud, Unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option.

15 Hours

UNIT-II

There is an API for That! – The purpose of APIs, Cloud Endpoints, Using Apigee Edge, Managed message services, Exploring Cloud SQL, Cloud Pub/Sub. **You Cannot Secure the Cloud, Right? –** Introduction to security in the cloud, The shared security model, Encryption options, Authentication, and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. **It Helps to Network –** Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing. **Let Google Keep an Eye on Things –** Introduction to Infrastructure as Code, Cloud Deployment Manager, Public and private IP address basics, Monitoring and managing your services, applications, and infrastructure, Google Cloud's operations suite.

15 Hours

UNIT-III

You Have the Data, but What Are You Doing With It? – Introduction to big data managed services in the cloud, Leverage big data operations with Dataproc, Build Extract, Transform and Load pipelines using Dataflow, BigQuery, Google's Enterprise Data Warehouse. **Let Machines Do the Work –** Introduction to machine learning in the cloud, Building bespoke machine learning models with AI Platform, AutoML, Google's pre-trained machine learning APIs.

9 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)

CO1	Illustrate VPC networks, virtual machines and implement data storage services in GCP.	L2
CO2	Explain the billing of GCP resources.	L2
CO3	Monitor resources using Stack Driver services.	L3
CO4	Demonstrate the Load Balancers.	L2
CO5	Perform autoscaling of VM instances.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	3	2												
CO2	3	2	2											
CO3	3	2	2											
CO4	3	2	2											
CO5	3	2	2											

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

REFERENCE MATERIALS:

1. PowerPoint Presentations provided by Google Cloud.

ADDITIONAL READING:

1. **Official Google Cloud Certified Associate Cloud Engineer Study Guide** – Published by Sybex, A Wiley Brand, authored by Dan Sullivan

WEB RESOURCES:

1. https://cloud.google.com/docs
2. https://cloud.google.com/certification/guides/cloud-engineer/

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.**

****

MAJOR PROJECT			
Course Code:	**21IS705**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**03**	**SEE Marks**	**100**
		Credits	**09**

Course Objectives:

1. The student should complete a project using the knowledge gathered from the courses successfully completed.
2. Conceptual development of a new idea in the field of Information Science and Engineering.

Students will carry out a detailed project in Computing either singly or in small groups to show case the extent of knowledge gained during the regular classes in the relevant and useful applications on the subject of electronic circuits, systems, using either or both hardware and software.
It is recommended that a group of 3-4 students be guided by one faculty member during this period.

Assessment Details (both CIE and SEE)

CIE procedure for project will be based on regular presentation, work progress, attendance, reports,
Semester End Examination:
SEE procedure:
Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

SCHEME OF EVALUATION:
Project demonstration, Viva voce
Total marks: 100 Marks

The distribution of marks shall be proportioned based on the type of the project and it is based on fulfilling the following requisites.

The evaluation of students is proposed to be done by internal faculty. The evaluation may be based on following criteria:

- Punctuality and Attendance ¨ Interpersonal relations
- Sense of Responsibility
- Clarity of concepts, principles and procedures
- Self-expression/communication skills
- Report Writing Skills
- Creativity/conceiving new and unusual ideas
- Problem-solving skills

At the end of the project work course students are required to submit a working model of the equipment they have designed and developed or if it is a theoretical or experimental work, they are expected to study a detailed analysis and findings from their work.

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

1. Design and model a system based on the requirements; implement, test and analyse the performance of the system.
2. Record and document the work done.

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	2	3	3	2	2	2	3	1	3	3	3	3
CO2	1	1	1	1	1	1	1	1	3	3	1	3	3	3

1: Low 2: Medium 3: High

TECHNICAL SEMINAR			
Course Code:	**21IS801**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**3**	**SEE Marks**	**-**
		Credits	**1**

Course Objectives:

1. This course is meant to provide students an avenue to understand the literature review, summarizing and presenting.

Every individual student need to give a seminar on selected topic. The CIE marks shall be awarded by a committee formed by the Head of the Department The CIE marks awarded for the seminar, shall be based on the evaluation of the presentation, slides, communication, report and viva-voce.

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

1. Understand a technical topic and collect related materials.
2. Communicate the technical knowledge presentation and prepare a report.

Program Outcomes→	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		**PSO↓**	
↓ Course Outcomes													**1**	**2**	**3**
CO1	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1
CO2	3	2	-	-	1	1	-	-	2	3	1	-	1	1	1

RESEARCH/INDUSTRY INTERNSHIP			
Course Code:	**21IS802**	**CIE Marks**	**100**
Teaching Hours/Week (L: T: P: S)	**-**	**SEE Marks**	**100**
		Credits	**15**

Course Objectives:

2. This course is meant to provide students an avenue to understand the work environment, ethics and practices in an industry/organization and take up assignments/jobs in the future.

The gap between the theoretical knowledge obtained in the classrooms and the practical skills required in the actual workplace scenarios is fast growing. This has put forth varied challenges to graduating students when it comes to job placements. As institutes cannot have a relevant facility to expose students to a real-time industrial environment, an industrial internship is an appropriate solution.

The main objective of the industry internship is to ensure that the intern is exposed to a real job world environment and gains practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, presentation skill, and viva-voce in the ratio of 50:25:25.

SEE: Contribution to the internship and the performance of each group member shall be assessed

individually in the semester-end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the report, presentation skill, and viva-voce in the ratio of 50:25:25.

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

3. Analyse and Develop technical solutions for a specific problem that is assigned to them.
4. Communicate ideas that are developed through brainstorming, presentation and prepare a report.
5. Understand and inculcate industry practices in their professional career.

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
CO1	3	2	-	-	1	1	-	-	2	3	1	-	1	1
CO2	3	2	-	-	1	1	-	-	2	3	1	-	1	1
CO3	3	2	-	-	1	1	-	-	2	3	1	-	1	1

OPEN ELECTIVES

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**

Course Learning Objectives (CLOs):

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

1. Construct Python programs using data types and looping.
2. Design object-oriented Python programs using classes and objects.
3. 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:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Demonstrate the basics of Python programming like data types and looping	L2
CO2	Apply the basic data structures in solving the problems	L3
CO3	Experiment with usage of functions in a given problem	L3
CO4	Develop Objects by creating classes and apply object-oriented features	L3
CO5	Develop applications in Python using File Programming &User Interface	L3

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2	1											
CO2	1	2	1										2	2
CO3	1	2	2										2	3
CO4	1	2	2										2	3
CO5	1	2	2										2	3

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

TEXTBOOK:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705

ADDITIONAL RESOURCES:

1. Think Python. PDF is free.

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.**

****

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:

1. Illustrate the Semantic Structure of HTML and CSS
2. Compose forms and tables using HTML and CSS
3. Design Client-Side programs using JavaScript and Server-Side programs using PHP
4. Illustrate the Database connectivity using PHP
5. 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:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)

CO1	Adapt HTML and CSS syntax and semantics to build web pages	L2
CO2	Construct and visually format tables and forms using HTML and CSS	L3
CO3	Experiment with the usage of Event handling and Form validation using Java script	L3
CO4	Understand the principles of object-oriented development using PHP and Database concepts	L2
CO5	Inspect JavaScript frameworks like jQuery which facilitates developer to focus on core features.	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	1	2		2								1	2	
CO2	1			2								1	2	
CO3	1	2		2	3							1	2	
CO4	1	2		2	3							1	2	
CO5	1			2	3							1	2	

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

TEXTBOOK:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)

E RESOURCES:

2. nptel.ac.in/courses/106105084/11

SEE Question Paper Pattern:

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.**

****

SOFTWARE ENGINEERING PRACTICES			
Course Code	**21IS8X83**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students:

1. Outline software engineering principles and activities involved in building large software programs.

2. Explain the importance of architectural decisions in designing the software.
3. Describe the process of Agile project development.
4. Recognize the importance of software testing and describe the intricacies involved in software evolution.
5. Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT – I

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.

Software Processes: Models: Waterfall Model, Incremental Model and Spiral Model; Process activities.

Requirements Engineering: Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.

15 Hours

UNIT – II

System Models: Context models, Interaction models, Structural models, Behavioral models.

T Architectural Design: Architectural design decisions. Architectural Views and patterns, Application architectures.

Design and implementation: Object oriented Design using UML.

Agile Software Development: Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.

15 Hours

UNIT - III

Project Management: Risk management, Teamwork.

Project Planning: Software pricing, Plan-driven development, Project Scheduling

Quality Management: Software quality, Reviews and inspections, Software measurement and metrics, Software standards.

09 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Recognise the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility	L2
CO2	Describe the waterfall, incremental and iterative models and architectural design in implementing the software	L2
CO3	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.	L2
CO4	Describe the methods for maintaining software system.	L2
CO5	Discuss project planning and management and illustrate the quality of software products	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1		3	1					2					1	2
CO2	1	3	1										1	2
CO3	1	1	3										2	3
CO4	1	3	2										1	2
CO5	1	2	2										1	2

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

TEXTBOOKS:

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2012. 82Syllabus of III & IV Semester B.E. / Computer Science & Engg.

REFERENCE BOOKS:

1. Roger S. Pressman: "Software Engineering-A Practitioners approach", 7th Edition,Tata McGraw Hill, 2017.
2. Pankaj Jalote: "An Integrated Approach to Software Engineering", Wiley, India, 2010.

E-RESOURCES

1. http://agilemanifesto.org/
2. http://www.jamesshore.com/Agile-Book/
3. https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx
4. https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx

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.**

****

INTRODUCTION TO CYBER SECURITY			
Course Code	**21IS8X84**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students:

1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic

UNIT – I

Introduction to Cybercrime: Cybercrime - Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. **[T1: 1.1-1.5]**

Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **[T1: 2.1-2.8].**

Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. **[T1:3.1-3.12]**

14 Hours

UNIT – II

Tools and methods used in Cybercrime:

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **[T1: 4.1-4.12]**

Phishing and Identity Theft Introduction to Phishing, Identity Theft (ID Theft). **[T1: 5.1-5.3]**

12 Hours

UNIT - III

UNDERSTANDING COMPUTER FORENSICS

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. **[T1: 7.1-7.19]**

13 Hours

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
CO1	Comprehend the Cybercrime and its origin	L2
CO2	Analyse the cybercrimes in mobile and wireless devices	L2
CO3	Apply tools and methods used in Cyber crimes	L2
CO4	Analyse Phishing and and ID Theft	L2
CO5	Comprehend Digital Forensics	L2

Mapping of POs & COs:-

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1	2					1		3						
CO2		3		1		2			2					
CO3		3	2										2	3
CO4	2					2								
CO5								3						

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

TEXTBOOKS:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1.
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials'', CRC Press, 15-Dec 2010. Anti- Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

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.**

****

OPEN ELECTIVE - (VII Semester) – 2024

Sl. No	Code	Name	Intake
1.	**21HU8X03**	**Intellectual property rights** *(for all except Robotics & except for those who have taken the subject in the VI semester)*	65
2.	**21CV8X07**	**Environment Impact Assessment** *(for all except Civil & except for those who have taken the subject in the VI semester)*	60
3.	**21ME8X08**	**Industrial Pollution Control** *(for all except Mechanical & except for those who have taken the subject in the VI semester)*	60
4.	**21EE8X10**	**Non-Conventional Energy Systems** *(for all except EE, Mech.)*	60
5.	**21CS8X15**	**Essentials of Information Technology** (for all except CS, CCE, AIML & IS)	60
6.	**21EC8X18**	**Consumer Electronics** (for all except EC)	60
7.	**21ME8X28**	**Operations Management and Entrepreneurship** *(for all exceot Robotics, Mechanical & except for those who have taken the subject in the VI semester)*	60
8.	**21ME8X33**	**Human Resource Management** (for all except Mechanical)	60
9.	**21HU8X37**	**Linguistics and Language Technology** (for all)	60
10.	**21BT8X40**	**Bio Fuel Engineering** (for all except BT & *except for those who have taken the subject in the VI semester)*	60
11.	**21ME8X65**	**Automotive Engineering** (For all except Mechanical)	60
12.	**21CV8X67**	**Disaster Management** (For all except Civil)	60
13.	**21HU8X68**	**Introduction to Yoga** *(for all except for those who have taken the subject in the VI semester)* ***(The classes will be conducted from 6.30 a.m. to 7.30 a.m.)***	50
14.	**21HU8X70**	**Overview of Indian Culture and Arts** (for all *except for those who have taken the subject in the VI semester)*	50
15.	**21HU8X71**	**Principles of 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) & for all *except for those who have taken the subject in the VI semester*	50
16.	**21HU8X72**	**Introduction to Japanese language** (for all) (Students with no backlogs, CGPA should be above 7.0 & who have intention to work for Japanese companies in India or Japan) – **Registration fee for this subject is Rs.1500/- & classes will be held on Saturday)**	60
17.	**21ME8X75**	**Sustainable Development Goals** (for all *except for those who have taken the subject in the VI semester)*	60
18.	**21CS8X80**	**Internet of Things** (for all except EC, CS, CCE, AIML, IS & Robotics)	30
19.	**21IS8X83**	**Software Engineering Practices** (for all except CS, AIML, CCE & IS)	60
20.	**21IS8X84**	**Introduction to Cyber Security** (for all except CS, CCE & IS)	60
21.	**21EC8X85**	**Space Technology & Applications** (for all except E&C)	60
22.	**21ME8X88**	**Marketing Management** (for all except Mechanical & *those who have taken the subject in the VI semester)*	60
23.	**21CC8X94**	**Next Generation Wireless Networks** (for all except CCE & *except for those who have taken the subject in the VI semester)*	60
24.	**21AI8X95**	**Introduction to Artificial Intelligence & Machine Learning** (for all except AIML, CCE, CS, IS & Robotics & *except for those who have taken the subject in the VI semester)*	60
25.	**21RI8X91**	**Micro Aerial Vehicle** (for all except Robotics)	40
26.	**21CV8X96**	**Sustainability Engineering** (for all)	60

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, 2017	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., 2007
2.	Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007
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 2001,
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 2000
8.	Wadehra, B. L. Law relating to patents, trademarks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2000
9.	Sinha, Prabhas Chandra Encyclopedia of Intellectual Property Rights, 3 Vols. Eastern Book Corporation, 2006.
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. 2010. 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, 2009. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2. Hanna, K.S. 2009. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.

NPTEL SOURCES

http://nptel.ac.in/courses/120108004/
http://nptel.ac.in/courses/120108004/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 So2, 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 **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**.

****

NON-CONVENTIONAL ENERGY SYSTEMS			
Course Code	**21EE8X10**	**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 and Mechanical Engineering

Prerequisite:
Students are expected to have a fundamental knowledge of Basic Electrical Engineering (18EE104)

Course Learning Objectives (CLO):

1. To illustrate the principle of extraction of energy from conventional, nonconventional sources.
2. To demonstrate the working principle and applications of solar based thermal, electrical and PV systems.
3. To justify the usage of energy storage techniques and understand the process of design and implement wind based energy conversion systems.
4. To understand the process of design and implement biomass based energy conversion systems.

UNIT – I

Energy Sources: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources, Conventional Energy Resources- Availability and their Limitations, Non-Conventional Energy Resources- Classification, Advantages, Limitations, Comparison of Conventional and Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

3 Hours

Solar Energy Basics: Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems), Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer.

5 Hours

Solar Thermal Systems: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, Concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green House.

4 Hours

Solar Electric Systems: Solar Thermal Electric Power Generation, Solar Pond and Concentrating Solar Collector(Parabolic Trough, Parabolic Dish, Central Tower Collector), Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array. Solar PV Systems- stand-alone and grid connected, Applications- Street lighting, Domestic lighting and Solar Water pumping systems.

4 Hours

UNIT – II

Energy Storage: Introduction, Necessity of Energy Storage and Methods of Energy Storage (Classification and brief description using block diagram representation)

4 Hours

Wind Energy: Introduction, Wind and its Properties, History of Wind Energy Wind Energy Scenario – World and India. Basic principles of WECS, Classification, Parts of a WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS. Wind site selection consideration, Advantages and Disadvantages of WECS.

4 Hours

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production

from waste biomass, Factors affecting biogas generation, types of biogas plants- KVIC and Janata model, Biomass program in India

6 Hours

UNIT – III

Energy From Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plant, Estimation of Energy – Single basin and Double basin type TPP (no derivations, Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle), Hybrid cycle, Site-selection criteria, Biofouling, Advantages & Limitation of OTEC

5 Hours

Emerging Technologies: Fuel Cell, Small Hydro Resources, Hydrogen Energy and Wave Energy (Principle of Energy generation using block diagrams, advantages and limitations)

4 Hours

Course Outcomes:

At the end of the course student will be able to

1. Describe non-conventional energy sources and solar radiation geometry to estimate and measure solar radiation.
2. Apply the principle of solar radiation into heat to understand the operation of solar thermal and solar electric systems.
3. Describe energy storage methods and wind–energy conversion systems to understand the factors influencing power generation.
4. Review the biomass conversion technologies to design biomass-based energy systems.
5. Describe tidal, ocean thermal and fuel cell energy conversion systems to understand emerging non-conventional energy technologies.

Course Outcomes: Mapping with Program Outcomes												
Program Outcomes→ ↓ **Course Outcomes:**	1	2	3	4	5	6	7	8	9	10	11	12
21EE8X10.1	2	3				1	2	1				
21EE8X10.2	2	3				1	2	1				
21EE8X10.3	2	3				1	2	1				
21EE8X10.4	2	3				1	2	1				
21EE8X10.5	2	3				1	2	1				

1: Low 2: Medium 3: High

SEE Question Paper Pattern:

- There will be **8** questions of **20** 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**.

TEXTBOOK:

1. Rai G. D., "Non-Conventional Sources of Energy", 4th Edition, Khanna Publishers, New Delhi, 2007

REFERENCE BOOKS:

1. Mukherjee D. and Chakrabarti, S., "Fundamentals of Renewable Energy Systems", New Age International Publishers, 2005.
2. Khan, B. H., "Non-Conventional Energy Resources", TMH, New Delhi, 2006
3. S. P. Sukhumi, J. K. Nayak "Solar Energy: Principles Collection and Storage", 3rd edition, McGraw-Hill Education (India) , 2009

******

ESSENTIALS OF INFORMATION TECHNOLOGY			
Course Code	**21CS8X15**	**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 fundamentals of python programming.
2. Implement the object oriented concepts using python programming.
3. Describe the basic concepts of Relational Database Management System.
4. Apply the normalization to the Databases and develop databases using SQL and PL/SQL Queries.
5. Develop the data base connectivity in integration with python and perform various Database operations.

UNIT - I

PROGRAMMING FUNDAMENTALS Introduction to Programming: Why Programming, What is Computer Program, What is an Algorithm, Flowchart, Pseudo Code; Python Fundamentals: – Introduction to python, Variables and Data Types, Comments, Input Function, Operators, Coding Standards, Integrated Development Environment(IDE) ;Control Structures: Selection Control Structures, ,Looping/Iterative Control Structures; Data Structures: String , List, Dictionary and Tuple ,Set, Functions: Built-in functions, User-defined Functions, Recursion.

OBJECT ORIENTED PROGRAMMING USING PYTHON Introduction to Object Oriented Paradigm: Abstraction and Entity, Encapsulation and Data hiding, Class and Object, Unified Modelling Language (UML), Object Oriented Approach, Class Variables, Class methods and Static Methods, Documentation, Inheritance & Polymorphism: UML: is-a relationship
(Generalization), Types of Inheritance, Multiple Inheritance, Polymorphism, Benefits of OOP,
Memory Management in Python, Relationships: has-a relationship: Aggregation & Composition, uses-a relationship; File handling, Exception Handling, Raising Exceptions

15 Hours

UNIT - II

RELATIONAL DATABASE MANAGEMENT SYSTEM Data and Need for DBMS: Data – Is it important, What is Data, Do we need to store data, How to Store / Handle Data, What is DBMS and its Models, Functional Needs of DBMS, Data perspectives in DBMS; Relational Model and Keys: What is RDBMS, Data representation in RDBMS, Keys in RDBMS; Database Development Life Cycle; Data Requirements; Logical Database Design: Different Approaches in Logical Design, ER Modeling, ER Notations, Steps in ER Modeling; Physical Database Design: Converting ER Model to Relational Schema ;Normalization: Functional Dependency, First
Normal Form: 1NF, Second Normal Form: 2NF, Third Normal Form: 3NF, Normalization
Guidelines;

Implementation with SQL: What is SQL, Data types and Operators in SQL, SQL Statements: SQL - Built-in Functions; SQL - Group by and Having Clauses Joins: Inner Join, Outer Join, Self-Join, Sub Queries: Independent Sub queries, Correlated Sub queries, Index, Views,
Transactions, PL/SQL

15 Hours

UNIT - III

PYTHON DATABASE INTEGRATION Why Database Programming, Python Database
Integration – Pre-requisites and Installation, SELECT Operation: Retrieve Data from Database, Attributes of Cursor object, Bind variables, CREATE and INSERT Operation: Creating a table, Insert Operation, Inserting Multiple Records, UPDATE Operation, DELETE Operation, Exception Handling.

9 Hours

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

1. Explain the basic program constructs of Python Programming.
2. Design and apply the object oriented programming construct using Python to build the real world application.
3. Summarize the concepts related to Relational Database Management System.
4. Design and develop databases from the real world by applying the concepts of Normalization using SQL and PL/SQL.
5. Perform the various Database operations by connecting Python with Database.

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		1				1	1		1		3	
CO2	1	2	3		1				1	1		1		3	3
CO3	1	2	3											3	
CO4	2	3												3	3
CO5	1	2	3		1				1	1		1		3	2

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

TEXTBOOKS:

1. Kenneth A. Lambert, “The Fundamentals of Python: First Programs, 2012”, Cengage Learning.
2. Magnus Lie Hetland, “Beginning Python from Novice to Professional”, Second Edition.
3. Mark Summerfield, Programming in Python 3 – “A Complete Introduction to the Python Language”, Second Edition.
4. Elmasri, Navathe, "Fundamentals of Database Systems", Third edition, Addison Wesley

REFERENCE BOOKS:

1. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, ISBN:9780-13274718-9, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: “Database Management Systems” (Third Edition), McGraw-Hill, 2003.

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**

****

CONSUMER ELECTRONICS			
Course Code	**21EC8X18**	**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. Learn and design operating principles of "real world" electronic devices
2. Study broader view of key principles of electronic device's operation and presents a block circuit diagram.
3. Learn to integrate the many different aspects of emerging technologies and able to build unique mix of skills required for careers.

UNIT – I

Sound: Properties of sound and its propagation, Transducers (Micro Phone, Loud Speakers), enclosures, mono-stereo, Amplifiers, Multiplexers, mixers, Synthesizers.
Vision: B/W TV, CTV concepts, B/W & Color Cameras, Displays.

15 Hours

UNIT – II

Recording and Playback: Optical discs; recording and playback, audio and video systems, Theatre Sound, Studios, Editing.
Communications and Broadcasting: Switching Systems, Land lines, Modulation, Carrier, Fiber optics, Radio and TV broad casting
Data Services: Data services, mobiles, terrestrial & Satellite Systems, GPS, Computers, internet Services.

15 Hours

UNIT – III

Utilities: Fax, Xerox, Calculators, Microwave ovens, Washing Machines, A/C & refrigeration, Dishwashers, ATMS, Set -Top boxes, Auto Electronics, Industrial Electronics, Robotics, Electronics in health / Medicine, nano- technologies.

9 Hours

Course Outcomes:

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

1. Recall basics of sound.
2. Recall basics of television and camera.
3. Explain basic working of Recording, storage devices,
4. Explain basics of communication and broadcasting.
5. Recall basic working of commonly used electronic gadgets

TEXTBOOKS:

1. Anand, **"Consumer Electronics",** Khanna publications, 2011.
2. Bali S. P., **"Consumer Electronics",** Pearson Education, 2005.

REFERENCE BOOK:

1. Gulati R. R., **"Modern Television Engineering",** Wiley Eastern

Scheme of SEE Question Paper

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**.

*****

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:

1. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books
2. **Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
3. **Statistical Quality Control**: RC Gupta, Khanna Publishers, New Delhi, 2005.
4. **Total Quality Management**: Dale H. Besterfield, Pearson Education, 2003.
5. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
6. **Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (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. 2005, 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:21ME8X28/ 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 **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**.

****

HUMAN RESOURCE MANAGEMENT			
Course Code	**21ME8X33**	**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) To develop a meaningful understanding of HRM theory, functions and practices.
2) To understand concepts and skills recruitment.
3) To understand the concepts of training and development.
4) To deal with employees' grievances, safety and health types of organizations.
5) To understand the concepts of e-HRM.

UNIT - I

Human Resource Management & HRP:
Introduction, meaning, nature, scope of HRM. Major functions of HRM, Personnel Management vs Human Resource Management, job design, job evaluation, job analysis, job specification, job enlargement, job enrichment. Role of HR Manager.HR Planning. Process HRP.
8 Hours

Recruitment: Definition, Sources and Methods of Recruitment
Selection: Definition and Process of Selection. Cost benefit analysis of selection.
Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation. Performance Appraisal methods
8 Hours

UNIT – II

Training and development: Training v/s development, stages in training, Training Methods, Executive Development, Methods and Development of Management Development, Career and Succession Planning.
Compensation: employee remuneration, rewards, Wage and Salary Administration, Bonus, fringe benefits. Internal Mobility, External Mobility, Trade union Act (Amendment) 2001.
7 Hours

Employee Grievances: Employee Grievance procedure. Discipline procedure
Collective bargaining; Characteristics, Necessity, Forms
Safety & Health; Industrial accidents, Safety
Quality circle; Meaning, Structure
8 Hours

UNIT – III
IHRM. Managing IHRM. e-HR Activities, Global recruitment, selection, expatriates. Industrial conflict – Causes, Types, Prevention and Settlement. **e-HRM**; Aspects of e-HRM,e-Job design & Analysis, Ethical issues in employment **8 Hours**
Course Outcomes (CO):
At the end of the course the student will be able to:
CO 1 Describe the basic concepts of HRM & HRP.
CO 2 Elucidate the HRM functions of recruitment, selections, appraisal etc.
CO 3 Apply the training, development and compensation methods in HRD.
CO 4 Identify the employee grievances and to spell out the remedial measures.
CO 5 Infer the concepts of e-HRM and I-HRM.
TEXTBOOK:
1. Essentials of Human Resource Management & Industrial Relations-P Courseba Rao, Third Revised Edition
REFERENCE BOOKS:
1) Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.
2) Human Resource Management-Flippo
3) Human Resource Management - Lawrence S. Kleeman, Biztantra , 2012.
4) Human Resource Management – Aswathappa K HPH
MOOC/NPTEL Resources:
1) http://edx.nimt.ac.in/courses/course-v1:nimtX+PGDM1212+2017_H1/about
2) http://nptel.ac.in/courses/122105020/

Course Articulation Matrix

Course Code / Name : 21ME8X33 / HUMAN RESOURCE MANAGEMENT														
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C- 21ME8X33.1	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-21ME8X33.2	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-21ME8X33.3	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-21ME8X33.4	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-21ME8X33.5	3	-	-	-	-	1	-	-	1	1	-	1	-	-

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

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**.

****

LINGUISTICS & LANGUAGE TECHNOLOGY

Course Code	**21HU8X37**	**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.	Introspect about the consciousness in one's language
2.	Learn pronunciation and how the process helps to communicate effectively.
3.	Build contextual speech and writing with the pedagogy in sentence structure.
4.	Improve skill of applying language to enunciate words.
5.	Progress on the speech aspects by understanding the acquisition of Second Language.

UNIT - I

Introduction to Linguistics Broad understanding of Linguistics, Language and characteristic features, Scientific Language, Levels of Linguistic Analysis (Phonetics, Phonology, Morphology, Syntax and Semantics); Approach to Linguistics (Traditional, Structural and Cognitive).	8
Phonology and Morphology Perspectives in Linguistics, Phonemes, Allophones, Phonemic Analysis, Morphology and Morphemes, Word building process, Morphological Analysis.	8

UNIT - II

Syntax Constituent structure (Simple Sentence, Noun Phrase, Verb Phrase, Prepositional Phrase, Adjective Phrase, Adverb Phrase, Structure Rules), Tree Diagrams, Case	16

UNIT – III

Sociolinguistics & Psycholinguistics, Artificial Intelligence Notion of Language Variety, Languages in Contact, Language and Mind, Error Analysis.	7

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

1.	Understand the importance of language and its facets.
2.	Demonstrate knowledge of sounds and competence in process of word building.
3.	Evolve to reason the constituent parts of a sentence.
4.	Understand the techniques of how 'meaning' is applied.
5.	Analyze errors in day-to-day-conversations and how language is related to society.

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	PSO↓ 2
CO1		1			1	1			1			2		
CO2			2						2	2				
CO3	2	3		3					3	2				
CO4					2				1	2				
CO5		2				2	1					1		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Akmaijan, A, R. A. Dimers and R. M. Harnish. Linguistics: An Introduction to Language and Communication. London: MIT Press, 1979.
2.	Chomsky, Noam. Language in Mind. New York: Harcourt Brace Jovanovich, 1968.
3.	Fabb, Nigel. Sentence Structure. London: Routledge, 1994.
4.	Hockett, C. A Course in Modern Linguistics. New York: Macmillan, 1955.
5.	O'Grady, W., O. M. Dobrovolsky and M. Aronoff. Contemporary Linguistics: An Introduction. New York: St. Martin's Press, 1991.
6.	Pride, J. B. and J. Holmes. Sociolinguistics. Harmondsworth: Penguin, 1972.
7.	Richards, J. C. Error Analysis: Perspectives in Second Language Acquisition. London: Longman, 1974.
8.	Salkie, R. The Chomsky Update: Linguistics and Politics. London: Unwin Hyman Ltd., 1990.
9.	Sinclair, J. M. C. H. and R. M. Coulthard. Towards an Analysis of Discourse. Oxford: OUP, 1975.
10.	Thomas, Linda. Beginning Syntax. Oxford: Blackwell, 1993.
11.	Verma, S. K. and N. Krishnaswamy. Modern Linguistics: An Introduction. New Delhi: OUP, 1989.
12.	Wekker, Herman and Liliane Haegeman. A Modern Course in English Syntax. Kent: Croom Helm, 1985.

****

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 H_2 Production; Photobiological H_2 Production: Biophotolysis and Photofermentation; H_2 Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H_2 production, Carbon sources, Detection and Quantification of H_2. 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, 2008.
2. Jonathan R.M, *Biofuels – Methods and Protocols (Methods in Molecular Biology Series)*, Humana Press, New York, 2009.
3. Olsson L. (Ed.), *Biofuels (Advances in Biochemical Engineering/Biotechnology Series*, Springer-Verlag Publishers, Berlin, 2007.
4. Glazer, A. and Nikaido, H. *Microbial Biotechnology – Fundamentals of Applied Microbiology*, 2 Ed., Cambridge University Press, 2007.
5. Godfrey Boyle (Ed). *Renewable Energy- Power for sustainable future*, 3rd Ed. Oxford. 2012.
6. Ramachandran, T. V. *Management of municipal solid waste*. Environmental Engineering Series. Teri Press, 2016.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (20 marks/Qn)	3	3	2
Questions to answer	2	2	1

****

AUTOMOTIVE ENGINEERING			
Course Code	**21ME8X65**	**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	Get an idea on the different components of an engine and its types with lubrication system.
2	Understand the fuel supply system and ignition systems used in automobiles.
3	Demonstrate the working of transmission system.
4	Explain the importance of suspension system, steering geometry and drives in automobiles
5	Know the concept of braking system, tyres and emission control.
UNIT – I	

ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS:
SI & CI engines, Cylinder-arrangements and their relative merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, valve and port timing diagrams, Choice of materials for different engine components, engine positioning, cooling requirements, methods of cooling, thermostat valves, different lubrication arrangements, crankshaft/flywheel position sensor, accelerator pedal sensors, engine coolant water temperature sensor.

8 Hours

FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Fuel mixture requirements for SI engines, types of carburetors, simple carburetor, multi point and single point fuel injection systems, CRDI, fuel transfer pumps: AC Mechanical Pump, SU Electrical Pumps, injectors, Fuel gauge sensor, Throttle position sensor, Mass air flow sensors.

5 Hours

IGNITION SYSTEMS:
Battery Ignition systems, magneto Ignition system, Transistor assisted contacts. Electronic Ignition, Automatic

Ignition advance systems, Lighting systems, Rain/Light sensors, starting device (Bendix drive)

2 Hours

UNIT – II

POWER TRAINS:

Clutches- Single plate, multiplate and centrifugal clutches. Gear box: Necessity for gear ratios in transmission, Constant mesh gear box, Synchromesh gear box, principle of automatic transmission, Vehicle Speed Sensors, calculation of gear ratios, Types of transmission systems. No numerical.

8 Hours

DRIVE TO WHEELS:

Propeller shaft, universal joints, Hotchkiss. and torque tube drives, differential, rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe-in & toe-out, condition for exact steering, power steering, over steer, under steer & neutral steer, Steering angle sensors, numerical problems.

5 Hours

SUSPENSION AND SPRINGS:

Requirements, leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front Wheel, Air suspension system**.**

2 Hours

UNIT – III

BRAKES:

Types of brakes, mechanical, compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes.

5 Hours

TYRES

Desirable tyre properties, Types of tyres.

1 Hour

AUTOMOTIVE EMISSION:

Automotive exhaust emissions, sources and emission control method: EGR, SCR, Emission Standards, Exhaust sensors.

Electric Vehicles.

3 Hours

Course Outcomes (CO):

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

CO 1	**Describe** and demonstrate the layout of an automobile and components of an automobile engine. Explain cooling and lubrication systems.
CO 2	**Explain** and demonstrate the fuel supply and Ignition systems for SI and CI engines.
CO 3	**Describe** and demonstrate the transmission system
CO 4	**Explain** and demonstrate the components of drive to wheel and suspension system, calculate the parameters of steering geometry.
CO 5	**Describe** and demonstrate automotive braking system. Explain types and construction of tyres and wheels. Explain the significance of automotive emissions and its controlling methods.

TEXTBOOKS:

1. Automotive Mechanics by S. Srinivasan, Tata McGraw Hill, 2003
2. Automobile Engineering, Kirpal Singh, Vol I and II, 2013.
3. Automotive Electrical and Electronics, A. K. Babu, Khanna Publishers, 2nd edition, 2016

REFERENCE BOOKS :

1. Automobile Engineering, R. B. Gupta, Satya Prakashan, 4th Edn., 1984 .
2. Automobile Engineering, Narang, Khanna Publishers 2002
3. Automotive Mechanics, Crouse, McGraw Hill 2002
4. Automotive Mechanics, Joseph Heithner 2000
5. Automobile Mechanics by N. K. Giri, Khanna publishers 2002
6. Newton and Steeds Motor Vehicle, Butterworth, 2nd Edn. 1989.
7. Automobile Engineering by K. K. Jain and R. B_ Arshana, Tata McGraw Hill, 2002
8. Automobile Mechanics, A.K. Babu & S.C. Sharma, T.R. Banga, Khanna Book Publishing
9. A Textbook of Automobile Engineering, R.K. Rajput, Laxmi Publications

List of proposed Experiments in Automotive Laboratory: 4 Hours

1. Study of Automotive - Chassis & superstructure/body and its functions. Also involves study of cut section of wheel & tyres (bias and radial types).
2. Study of more commonly used tools and equipment in automotive shop.
3. Study of carburetors and petrol & diesel fuel injection systems
4. Demonstration and study of Front axle and steering system
5. Demonstration and study of various suspension systems
6. Power train - Dismantling and assembly of single/multi cylinder Engine.
7. Power train - Study of clutch mechanism. Demonstration and study of dry friction clutches - Single plate & multi-plate types
8. Power train - Demonstration and study of transmission system - Gear box
9. Power train - Demonstration and study of Universal joints, propeller shaft, final drives, differential, and rear axles
10. Demonstration and study of brake mechanism (hydraulic type) and study of disc and drum brakes
11. Field visit to Automotive Servicing Station - Study of electrical system, wheel alignment (measuring and adjustment of castor, camber, king-pin inclination, toe-in and toe-out), automotive emission control systems.

(The details of each experiment to be given out as handout to each student or may be uploaded in Intranet)

Course Articulation Matrix:

Course Code / Name: 21ME8X65 / Automotive Engineering														
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X65.1	3	1	-	-	-	1	-	-	3	1	-	1	3	3
C-21ME8X65.2	3	1	-	-	-	1	-	-	3	1	-	1	1	3
C-21ME8X65.3	3	1	1	-	-	1	-	-	3	1	-	1	3	3
C-21ME8X65.4	2	3	1	-	-	1	-	-	3	1	-	1	2	3
C-21ME8X65.5	3	1	1	-	-	1	1	1	3	1	-	1	2	3

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

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**.

****

DISASTER MANAGEMENT			
Course Code	**21CV8X67**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

1. Understand difference between Disaster, Hazard, Vulnerability, and Risk.
2. Know the Types, Trends, Causes, Consequences and Control of Disasters
2. Apprehend Disaster Management Cycle and Framework.
3. Know the Disaster Management in India
4. Appreciate Applications of Science and Technology for Disaster Management.

UNIT – I

Understanding Disasters: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.

Types, Trends, Causes, Consequences and Control of Disasters: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters

15 Hours

UNIT – II

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR,YokohamaStretegy, Hyogo Framework of Action

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter-Governmental Agencies

15 Hours

UNIT – III

Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India

Case Studies: Study of Recent Disasters (at local, state and national level)

Preparation of Disaster Risk Management Plan of an Area or Sector,

Role of Engineers in Disaster Management

Course Outcomes:

After completion of this course the students will be able to

1. **Explain** Concepts, Types, Trends, Causes of Disasters
2. **Describe** Consequences and Control of Disasters
3. **Explain** Disaster Management Cycle and Framework:
4. **Explain** the lesson learnt from the disasters in India and **discuss** the financial mechanism, roles and responsibilities of Non-Government and Inter-Governmental Agencies for Disaster management
5. **Describe** the Applications of Science and Technology recent disasters, role of engineers for Disaster Management and **prepare** a report of Disaster Risk Management Plan.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	2				1	2			
CO2						3	2				1	2			
CO3						3	2				1	2			
CO4						3	2				1	2			
CO5						3	2				1	2			

Note:1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

REFERENCE BOOKS:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. https://nidm.gov.in/PDF/pubs/DM%20in%20India.pdf, Disaster Management in India, MHA, 2011.
3. World Disasters Report, 2018. International Federation of Red Cross and Red Crescent, Switzerland
4. Encyclopedia of disaster management, Vol I, II and III Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
5. Encyclopedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
6. Disasters in India Studies of grim reality, AnuKapur& others, 2005, 283 pages, Rawat Publishers, Jaipur.
7. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
8. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
9. Disaster Management Act 2005, Publisher by Govt. of India
10. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management, https://ndma.gov.in/en/publications.html#
11. NIDM Publications https://nidm.gov.in/books.asp
12. High Power Committee Report, 2001, J.C. Pant
13. Disaster Mitigation in Asia & Pacific, Asian Development Bank
14. National Disaster Management Policy, 2009, GoI
15. Disaster Preparedness Kit, 2017, American Red Cross,http://pchs.psd202.org/documents/mopsal/1539703875.pdf.
16. Subramanian R., "Disaster Management", 2018 Vikas Publishing House Pvt Ltd.

Note: 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.

****

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**

Teaching Department: Mechanical Engineering

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

UNIT – I

Yoga: Meaning and initiation, definitions and basis of yoga, History and development, Astanga yoga, Streams of yoga.Yogic practices for healthy living. General guidelines for Yoga practices for the beginners: Asanas, Pranayama.	**09 Hours**
Classification of Yoga and Yogic texts:Yogasutra of Patanjali, Hatha yogic practices- Asanas, Pranayama, Dharana, Mudras and bandhas.	**07 Hours**

UNIT – II

Yoga and Health: Concept of health and Diseases-Yogic concept of body – pancakosaviveka, Concept of disease according to Yoga Vasistha.	**06 Hours**
Yogic concept of healthy living- rules & regulations, yogic diet, ahara, vihara. Yogic concept of holistic health.	**04 Hours**
Applied Yoga for elementary education:Personality development- physical level,mental level,emotional level. Specific guidelines and Yoga practices f**or** - Concentration development,Memory development	**04 Hours**

UNIT - III

Yoga and physical development: Mind-body, Meditation, Yogasanas and their types. Different Yoga practices and Benefits.	**05 Hours**
Specific guidelines and Yoga practices for – Flexibility, Stamina, Endurance (Surya Namaskara)	**04 Hours**

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

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

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						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

TEXTBOOKS:	
1.	B.K.S. Iyengar, "Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority", Thorsons publisher 2016.
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 (2016).
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**	**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.	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

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		

1: Low 2: Medium 3: High

******

PRINCIPLES TO PHYSICAL EDUCATION			
Course Code	**20HU8X71**	**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 FirstAid, Scope of FirstAid, 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	PSO↓ 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:

i. A. K. Uppal, "Physical Education and Health"
ii. M. L. Kamlesh, "Fundamental Elements of physical Education",
iii. Swami Ramdev, "Yog its philosophy and practice", Divya Prakashan
iv. 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) **Grammar –** Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense **Vocabulary –** Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips	13
UNIT - II	
(Lessons 7-13) Communication skills – Time, Addective, Seasons, Conversation, Q&A Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc**.**	13
UNIT - III	
(Lessons 14-20) Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji Characters, and sentence making, Video Clips	13

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 (120) 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

****

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 2016 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, 2015
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, 2008.
3. Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge, 2019.
4. Sustainability: A Comprehensive Foundation by Tom Thesis and JonathanTomkin, Editors.

REFERENCE BOOKS:

1. Elliott, Jennifer. An introduction to sustainable development. Routledge, 2012.
2. Day, G.S., and P.J.H. Schoemaker (2011), 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 **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**.

****

INTERNET OF THINGS – (IoT)			
Course Code	**21CS8X80**	**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 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, Tagging and Tracking, Embedded Products; IoT Design, (U) SIM Card Technology, IoT Connectivity and Management, IoT Security & IoT Communication.

(Text Book-1:, Chapter 1 to 4)

15 Hours

UNIT – II

Design Concepts:

IoT Logical Design:

Data types, Data structures, Control flow, Functions, Modules, Packages, File Handling, Date and time operation, Classes, Python packages of IoT, IoT Physical Design, Basic building blocks, Raspberry Pi, Linux on Raspberry Pi, Interfaces, Programming on Raspberry Pi with Python, Arduino Based IoT Project Implementation, Arduino for Project development, Internet enabled Arduino powered garage door opener, Irrigation control system, Light controller Message, controller and cloud Services

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

15 Hours

UNIT – III

09 Hours

Raspberry Pi based IoT Project Implementation:

Raspberry Pi for Project Development: Raspberry Pi platform, GPIO, Establishment and setting, of Raspberry Pi software, LAMP project, Home temperature, monitoring system, Webcam and Raspberry Pi camera project

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

Course Outcomes:

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

1. Acquire the fundamental knowledge of IoT Definitions, Design aspects
2. Identify the IoT hardware and software requirements
3. Design IoT logical and physical architecture
4. Implement Arduino based IoT Projects
5. Implement Raspberry Pi based IoT Projects

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	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	3
CO5	3	2			3			1	1			1	1	3	3

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

TEXTBOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach,Vijay Madisetti", 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, Rachit Thukral 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

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
2. Object-Oriented Modelling and Design with UML, James R Rumbaugh, Michael R. Blaha Pearson Education, 21-Nov-2011
3. Object-Oriented Analysis and Design, Ramnath, Sarnath, Dathan, Brahma, ISBN 978-1-84996-522-4,, Springer Publications, 2011.

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/

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 ENGINEERING PRACTICES			
Course Code	**21IS8X83**	**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:

1. Outline software engineering principles and activities involved in building large software programs.
2. Explain the importance of architectural decisions in designing the software.
3. Describe the process of Agile project development.
4. Recognize the importance of software testing and describe the intricacies involved in software evolution.
5. Identify several project planning and estimation techniques and explain the importance of software quality.

UNIT – I

Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Case Studies.
Software Processes: Models: Waterfall Model, Incremental Model and Spiral Model; Process activities.
Requirements Engineering: Functional and non-functional requirements, Requirements engineering processes, Requirements Elicitation and Analysis, Requirements specification, Software requirements document, Requirements validation & management.

15 Hours

UNIT – II

System Models: Context models, Interaction models, Structural models, Behavioral models.

T Architectural Design: Architectural design decisions. Architectural Views and patterns, Application architectures.

Design and implementation: Object oriented Design using UML.

Agile Software Development: Agile methods, Plan-driven and agile development, Extreme Programming, Agile project management.

15 Hours

UNIT – III

Project Management: Risk management, Teamwork.

Project Planning: Software pricing, Plan-driven development, Project Scheduling

Quality Management: Software quality, Reviews and inspections, Software measurement and metrics, Software standards.

9 Hours

Course Outcomes:

Students will be able to:

Sl. No.	Course Outcomes
1.	Recognise the basics of software system, component, process and Software Requirement Specification to meet desired needs within realistic constraints and outline the professional and ethical responsibility
2.	Describe the waterfall, incremental and iterative models and architectural design in implementing the software
3.	Make use of the techniques, skills, modern engineering design tools and agile methods necessary for engineering practice.
4.	Describe the methods for maintaining software system.
5.	Discuss project planning and management and illustrate the quality of software products

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
IS2504-1.1		3	1					2					1	2
IS2504-1.2	1	3	1										1	2
IS2504-1.3	1	1	3										2	3
IS2504-1.4	1	3	2										1	2
IS2504-1.5	1	2	2										1	2

1: Low 2: Medium 3: High

TEXTBOOK:

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2012. 82Syllabus of III & IV Semester B.E. / Computer Science &Engg.

REFERENCE BOOKS:

1. Roger S. Pressman: "Software Engineering-A Practitioners approach", 7th Edition,Tata McGraw Hill, 2017.
2. Pankaj Jalote: "An Integrated Approach to Software Engineering", Wiley, India, 2010.

E-RESOURCES

1. http://agilemanifesto.org/
2. http://www.jamesshore.com/Agile-Book/
3. https://www.mooc-list.com/course/uml-class-diagrams-software-engineering-edx
4. https://www.mooc-list.com/course/enterprise-software-lifecycle-management-edx

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**fullquestions from **Unit-I & Unit – II** and **1**fullquestion from **Unit– III.**

****

INTRODUCTION TO CYBER SECURITY			
Course Code	**21IS8X84**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students:

1. Define the area of cybercrime and forensics.
2. Explain the motive and causes for cybercrime, detection and handling.
3. Investigate Areas affected by cybercrime.
4. Illustrate tools used in cyber forensic

UNIT – I

Introduction to Cybercrime: Cybercrime- Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cyber Crimes. **[T1: 1.1-1.5]**

Cyberoffenses: How Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing. **[T1: 2.1-2.8].**

Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops. **[T1:3.1-3.12]**

14 Hours

UNIT – II

Tools and methods used in Cybercrime:
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **[T1: 4.1-4.12]**

Phishing and Identity Theft Introduction to Phishing, Identity Theft (ID Theft). **[T1: 5.1-5.3]**

12 Hours

UNIT – III

UNDERSTANDING COMPUTER FORENSICS

Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics. **[T1: 7.1-7.19]**

13 Hours

Course Outcomes:

Students will be able to:

Sl. No.	Course Outcome
IS2503.1	Comprehend the Cybercrime and its origin
IS2503.2	Analyse the cybercrimes in mobile and wireless devices
IS2503.3	Apply tools and methods used in Cyber crimes
IS2503.4	Analyse Phishing and and ID Theft
IS2503.5	Comprehend Digital Forensics

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
IS2503-1.1	2					1		3						
IS2503-1.2		3		1		2			2					
IS2503-1.3		3	2										2	3
IS2503-1.4	2					2								
IS2503-1.5								3						

(L/1 = Low 30%-49%, M/2 = Medium 50%-69%, H/3=High >70%)

TEXTBOOKS:

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013.

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cyber security: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 -84965 -1.
2. James Graham, Ryan Olson, Rick Howard, "Cyber Security Essentials", CRC Press, 15-Dec 2010. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw-Hill.

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**fullquestions from **Unit-I & Unit – II** and **1**fullquestion from **Unit– III.**

****

SPACETECHNOLOGYANDAPPLICATIONS			
Course Code	**21EC8X85**	**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 the general laws governing satellite orbits and its parameters.
2. Discuss effect of space environment on satellite signal propagation.
3. Illustrate various segments employed in satellite and ground station.
4. Calculate the uplink/downlink sub system characteristics.
5. Know the effects on the EM waves in propagation through space.
6. Explain the satellite launch in the space and their applications in remote sensing.
7. Discussthethedifferentcommunicationsystemsusedforsatelliteaccess.
8. Summarise Advanced space systems for mobile communication, VSAT, GPS.

UNIT – I

Satellite communications: Introduction, Kepler's laws, definitions, orbital element, apogeeandperigeeheights, orbit perturbations, inclined orbits.

Space environment: Earth's Atmosphere, Ionosphere and Meteorological effects on space systems, propagation of signal, Transmission losses in space environment.

Satellite Technology: Space segment, Ground segment, Quality and Reliability, Satellite Communication systems, Antennas.

15 Hours

UNIT – II

LaunchVehicles: Working,stages,Fuel,payloadprotection,Navigation,guidanceandcontrol,Reliability,launchingi ntoouter space and launch bases. Types of launch vehicles.

Space Applications: Digital DBS TV, DBS-TV System Design, Master Control Station and Uplink Antennas. Introduction, Radio and Satellite Navigation,

Remote Sensing: Introduction to Remote Sensing, Concepts and Applications of satellite Remote sensing.

14 Hours

UNIT – III

Satellite Access: Introduction, Single Access, Pre-assigned FDMA, Demand-Assigned FDMA, Spade system.

Advancedspacesystems: Satellitemobileservices,VSAT,Radarsat,orbitalcommunication**.**GlobalPositioning Satellite System (GPS).

10 Hours

Course Outcomes:

At the end of the course student will be able to

1. Discuss the fundamental principles of Satellite communication systems.
2. Discuss the Propagation impairments of satellite link.
3. Explain various segments employed in satellite and ground station.
4. Discuss the satellite launch mechanism and roll of those satellite in remote sensing.
5. Explain the different communication systems used for satellite access and list the recent satellites that have been launched for mobile communication, GPS.

Course Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	-	-	-	-	-	-	-
CO2	-	3	-	-	2	1	-	-	-	-	-	-
CO3	3	-	-	1	-	1	1	-	-	-	-	-
CO4	--	-	-	-	-	1	3	-	-	-	-	-
CO5	--	-	-	-	-	3	3	2	-	-	-	-

High Assessment Details (both CIE and SEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.The student must obtain minimum of 20 marks out of 50 in CIE and 20 marks out of 50 in SEE and 40%intotaltoobtainapassgrade.Semester End Exam(SEE)is conducted for 100 marks (3Hoursduration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1. **Methods recommended:** Two Tests (80%), Written Quiz (16%) and module assignments (4%).Course coordinator will announce the evaluation procedure at the beginning of the semester and will be recorded in the course plan.

Semester End Examination:

1. There will be 8 questions of 20 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 1fullquestion from Unit– III.

TEXTBOOKS:

T1. Dennis Roddy, **"Satellite Communications"**, McGraw Hill 1996.
T2.TimothyPratt,**"SatelliteCommunications"**,WileyIndiaLtd,2006.
T3.KRamamurthy,**"RocketPropulsion"**,McMillanPublishersIndiaLtd,2010.

REFERENCE BOOKS:

R1. George Joseph, **"Fundamentals of Remote Sensing"**, Universities press, India 2003.
R2.BC Pande, **"Remote sensing and Applications"**, VIVA Books pvtltd, 2009.
R3. Meynart Roland, **"Sensors systems and next generation satellites"**, SPIE Publication.
R4.Thyagarajan ,**"Space Environment"**, ISRO Hand Book Publication.

E-Books / MOOC:

https://nptel.ac.in/courses/101106046

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-orientedand 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 inretailing.

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 competitiveglobal business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve the goals ofmarketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House, NewDelhi, 1999

REFERENCE BOOKS:

1. Philip Kolter, " Marketing Management: Analysis, Planning, Implementation and Control ", 1998.
2. Green Paul.E. and Donald Tull, " Research for Marketing
3. Ramaswamy.V.S. and S.Namakumari, " Decisions ", 1975.
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing, Environment: Planning, Implementation and Control the Indian Context ", 1990

NEXT GENERATION WIRELESS NETWORKS			
Course Code	**21CC8X94**	**CIE Marks**	50
Number of Contact Hours/Week	**3:0:0**	**SEE Marks**	50
Total Number of Contact Hours	**39**	**Exam Hours**	03
Credits – 3			

UNIT - I	**Contact Hours**
Historical Trend for Wireless Communication- Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept **5G Architecture**: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture –High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment.	15
UNIT - II	
Massive Multiple-Input Multiple –Output Systems : MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO. **D2DCommunications**: from4Gto5G–Radio Resource Management for Mobile Broadband D2D–Multi-hop D2D Communications for Proximity and Emergency Services – Multi-operator D2D Communication.	15
UNIT – III	
Wi-Fi 6 Protocol and Network: Introduction Wi-Fi Generations 1 to 5 Overview Wi-Fi Generation 6 (802.11ax) Wi-Fi6 and 5G 60 GHz Wi-Fi , Introduction to 6G and Networks	9
Course Outcomes: Upon completion of this course, students will be able to: 1.Describe and explain the evolution of 5G, system concepts and spectrum challenges 2.Illustrate and explain the 5G functional and physical architecture and its requirements 3 Illustrate and explain the fundamentals, resource allocation and transceiver algorithms for Massive MIMO 4. Describe and explain the requirements and fundamental techniques for D2DCommunication 5. Understand, Implement, explain the Wi-Fi 6 Protocol and Network	
TEXTBOOKS: • Asif Oseiran, JoseF. Monserratand Patrick Marsch, "5GMobile and Wireless Communications Technology,"Cambridge University Press,2016 • Jonathan Rodriquez, "Fundamentalsof5GMobileNetworks," Wiley, 2015 Sundar Gandhi Sankaran, Susinder Rajan Gulasekaran, **Wi-Fi 6 Protocol and Network, Artech House, 2021**	
REFERENCE BOOK: • Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018	

****

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	**21AI8X95**	**CIE Marks**	**50**
Number of Contact Hours/Week	**3:0:0**	**SEE Marks**	**50**
Total Number of Contact Hours	**40**	**Exam Hours**	**03**

Credits – 3

Course Learning Objectives:

This Course will enable students to:

1. Understand the history of AI and machine learning.
2. Learn principles and algorithms of supervised learning.
3. Explain various applications of Techniques in association analysis.
4. Use different unsupervised learning techniques to solve the problem specification.
5. Understand the methods of parametric and non-parametric methods on real time data analysis and combined learners.

UNIT – I	**Hours**
Introduction to AI: what is AI, Acting Humanly: The Turing Test approach, Thinking Humanly: The cognitive modelling approach, thinking rationally: The laws of thought approach, Acting Rationally: The rational agent approach. The state of art **Branches Of Artificial Intelligence:** Machine Learning, Deep Learning, Natural Language Processing, Robotics, Expert Systems, Fuzzy Logic. **Intelligent Agents:** Agents and Environments, Good behavior: The concept of rationality, The nature of environments, properties of task environments, Structure of Agents: Agent Programs, Types of agent programs. **Solving Problems by Searching:** Problem solving Agents, well defined problems and solutions, formulating problems, Example problems: Toy problems: Vacuum world, 8-Queen's problem, Real world problem: Airline Route finding problem **Textbook 1: Chapter 1, 2 ,3** **Foundations of Machine Learning** What is machine learning? Applications of Machine learning, Understand Data. **Types of machine learning:** Supervised, Unsupervised, Reinforcement Learning. **Supervised Learning:** Linear Regression: Introduction, univariate linear regression, multivariate linear regression, regularized regression, Logistic regression, Support Vector Machines. Artificial Neural Networks. **Textbook: Chapter 1 , 2.** **Classification:** Preliminaries; General approach to solving a classification problem; Confusion Matrix, Decision tree induction, how decision tree works, Hunt's algorithm, Design issues, Methods for expressing attribute test conditions, Measures for selecting best fit, Algorithm for decision tree induction; Rule-based classifier: How rule-based classifier works, Rule ordering schemes, Nearest-neighbor classifier: Selecting K value, KNN algorithm. **Textbook 3: Chapter 4, 5** Tutorials: 1. Handling the missing values using orange tool. 2. Visualize: Scatter Plot (for univariate), Scatter Plot Matrix (for multivariate) using orange tool. **3.** iris classification using different algorithm.	15

UNIT - II	
Unsupervised Learning: **Association Analysis–1:** Problem definition, Frequent item set generation, Apriori principle, Candidate generation and pruning, Rule Generation in Apriori algorithm. **Association Analysis – 2:** FP-Growth algorithm, Evaluation of association patterns, Effect of skewed support distribution, Sequential patterns. **Cluster Analysis:** Different types of clustering: Hierarchical vs partitional, Exclusive vs overlapping, Fuzzy clustering, Complete vs partial. Types of clusters: Well separated, Prototype based clusters, Graph based clusters, Density based clusters, Conceptual clusters, K-means clustering algorithm, centroids and objective functions, Choosing initial centroids, time space complexity of K-means, K-means additional issues, Strengths and weakness of k-means, Agglomerative hierarchical clustering,	15

Key issues in hierarchical clustering, Strengths and weaknesses, DBSCAN algorithm. **Textbook 3: Chapter 6, 7, 8, 9.** Tutorials: 1. Diabetes classification using orange tool. 2. Association analysis using orange tool. **3.** Trying different evaluation matrix using orange tool.	
UNIT – III	
Parametric Methods: Introduction, Maximum Likelihood Estimation, Bernoulli Density, Multinomial Density, Gaussian (Normal) Density, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification **Nonparametric Methods**: Introduction, Nonparametric Density Estimation, Histogram Estimator, Kernel Estimator, k-Nearest Neighbor Estimator, Generalization to Multivariate Data, Nonparametric Classification, Condensed Nearest Neighbor. **Textbook 2: Chapter 4, 8.**	10
Course Outcomes: Upon completion of this course, students will be able to: 1. Basics of AI, branches of AI and ML. 2. Develop an appreciation for what is involved in learning models from supervised learning and algorithms on classification. 3. Apply association analysis on structured data. 4. Apply different unsupervised learning techniques to solve the problem specification. 5. Interpret methods of parametric and non-parametric methods on real time data analysis and know the combined learning.	
TEXTBOOKS: 1. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson 3rd Edition, 2016. 2. Introduction to Data Mining-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2009. 3. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2004.	
REFERENCE BOOKS: 1. T. M. Mitchell, "Machine Learning", McGraw Hill, 1997. 2. R. O. Duda, P. E. Hart and D. G. Stork Pattern Classification, Wiley Publications, 2001 3. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 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. 6. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012. 7. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.	

MICRO AERIAL VEHICLES

Course Code	**21RI8X91**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P: S)	**(3:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**3**

Course Learning Objectives:

This Course will enable students to:

- Comprehend the basic aviation history and UAV systems.
- Acquire the knowledge of basic aerodynamics and performance.
- Understand the stability and control air vehicles
- Understand the propulsion, loads and structures.
- Develop and test the remote controlled, autonomous aerial vehicles

UNIT - I

Introduction Aviation History and Overview of UAV systems, Definitions and Terminology, **Classification of UAV's,** Classes and Missions of UAVs, UAV fundamentals, Examples of UAV systems-very small, small, Medium and Large UAV

The Air Vehicle

Basic Aerodynamics:

Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings, Total Air-Vehicle Drag

Performance:

Overview, climbing flight, Range and Endurance – for propeller-driven aircraft, range- a jet-driven aircraft, Guiding Flight. **15 Hours**

Pedagogy	Chalk and talk, Power point presentation,

UNIT - II

Stability and Control

Overview, Stability, longitudinal, lateral, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot.

Propulsion Overview, Thrust Generation, Powered Lift, Sources of Power, The Two-Cycle Engine, The Rotary Engine, The Gas Turbine, Electric Motors, and Sources of Electrical Power. Loads and Structures Loads, Dynamic Loads, Materials, Sandwich Construction, Skin or Reinforcing Materials, Resin Materials, Core Materials, Construction Techniques. **15 Hours**

Pedagogy	Chalk and talk, Power point presentation,

UNIT - III

Mission Planning and Control: Air Vehicle and Payload Control, Reconnaissance/Surveillance Payloads, Weapon Payloads, Other Payloads.

Data-Link Functions and Attributes, Data-Link Margin, Data-Rate Reduction, Launch Systems, Recovery Systems, Launch and Recovery Trade-offs

9 Hours

Course outcome (Course Skill Set)

At the end of the course student will be able to

1. Explain the basics of aerodynamics performance and apply the basic concepts of UAV systems and experimentally study the integration of drones.
2. Explain the stability and control required for UAV and Select the propulsion system, materials for structures.
3. Develop and test remote controlled autonomous aerial vehicles. Experimental study on remote controlled and autonomous UAV.
4. Design air vehicles for different payloads and design standards. Experimental study on autonomous and remote-controlled Vertical Take-off and Landing UAV
5. Develop and test rotary wing aerial vehicles. Experimental study on Unmanned aerial vehicles and fixed wing UAV

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 has to 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:

The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). CIE for Theory is for 50 marks and CIE for Lab component is 50marks. The final CIE for these IPCC courses is for 50 marks with 60% weightage of theory & 40% weightage of lab component CIE.

Theory Component	
MSE I	20 Marks
MSE II	20 Marks
Task-I	5 Marks
Task-II	5 Marks
Total	50 Marks

Semester End Examination:

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**.

Suggested Learning Resources:

BOOKS:

1. Paul Gerin Fahlstrom, Thomas James Gleason, Introduction to UAV Systems, Wiley Publication, 4th Edition,2012.
2. **Landen Rosen, Unmanned Aerial Vehicle, Alpha Editions**
3. Unmanned Aerial Vehicles: DOD's Acquisition, Alpha Editions
4. **Valavanis, Kimon P , Unmanned Aerial Vehicles , Springer, 2011**
5. Valavanis, K., Vachtsevanos, George J , Handbook of Unmanned Aerial Vehicles , Springer, 2015.

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc22_me38/preview

COURSE ARTICULATION MATRIX:

Course Code / Name : / Micro Aerial Vehicles															
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	3	2	1	-	-	-	-	-	-	-	-	-	2	-	2
	3	2	1	-	-	-	-	-	-	-	-	-	2	-	2
	3	2	1	-	-	-	-	-	-	-	-	-	2	-	2
	3	2	1	-	-	-	-	-	-	-	-	-	2	-	2
	3	2	1	-	-	-	-	-	-	-	-	-	2	-	2

1: 1ow 2: Medium 3: High

****

SUSTAINABILITY ENGINEERING

Course Code:	**21CV8X96**	**CourseType:**	**OE**
Teaching Hours/Week (L:T:P: S):	**3:0:0:0**	**Credits:**	**03**
Total Teaching Hours:	**39**	**CIE + SEE Marks:**	**50+50**

Teaching Department: Civil Engineering

Course Objectives: This Course will enable students to:

1.	Understand the relevance, the concept and the role of engineers in sustainable development
2.	Understand green building concepts, materials, certifications, and sustainable practices through case studies in sustainability engineering.
3.	Master Life Cycle Assessment principles for environmental, social, and economic analysis in engineering applications.

4.	Enable students to understand and apply sustainability reporting frameworks like GRI, Dow Jones, and prepare comprehensive sustainability reports.
5.	Develop skills to integrate sustainability principles into civil engineering design processes, employing sustainable strategies and measuring sustainability effectively.

UNIT - I

Sustainable Development

Sustainable development- Need- various agreements and Role of Engineering- Sustainable Development and Engineering Profession. Sustainable Engineering concepts, Goals of Sustainability, System Thinking, Life cycle Thinking and circular economy

Green Building: Concept, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA) , leadership in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system

15 Hours

UNIT - II

Fundamentals of Life Cycle Assessment

Energy systems, Buildings and the Built Environment, Life cycle inventory, Life Cycle Impact Assessment, Interpretation and presentation of Results, Iterative Nature of LCA, Methodological Choices, LCI Databases and LCA Softwares, Strength and Limitations of LCA. Environmental Life Cycle Costing, Social Life Cycle Assessment, Life Cycle Sustainability, **LCA Applications in Engineering:** Environmental Product Declarations and Product Category Rules, Carbon and Water Foot Printing,

Sustainability Reporting: GRI, Dow Jones Sustainability Index, Analysis and Research; Prerequisites of a sustainability Report, structure of a sustainability Report, Case Study: Sustainability Report Preparation.

15 Hours

UNIT - III

Integrating Sustainability in Civil Engineering Design:

Integrating Sustainability in Engineering Design: Problems Solving in Engineering, conventional to Sustainable Engineering Design Process, Design for Life Guidelines and Strategies, Measuring Sustainability, Sustainable Design through sustainable procurement criteria, Case studies on sustainable Engineering Design Process – Sustainable Process Design, Sustainable construction planning and Design, sustainable materials design in Civil Engineering.

09 Hours

Course Outcomes: At the end of the course students will

1.	Be proficient in applying sustainable engineering concepts, integrating system and life cycle thinking to address global challenges in the engineering profession.
2.	Adeptly apply green building principles, materials, certifications, and sustainability engineering case studies to contribute effectively to sustainable urban development.
3.	Master Life Cycle Assessment principles for comprehensive engineering analysis, integrating environmental, social, and economic dimensions effectively.
4.	skillfully prepare sustainability reports using GRI standards and Dow Jones Sustainability Index, applying theoretical knowledge to practical case studies for effective reporting.
5.	Adeptly integrate sustainability principles into civil engineering design, applying life cycle strategies and sustainable procurement criteria through case studies analysis.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
↓ Course Outcomes															
-1.1															
-1.2															
-1.3															
-1.4															
-1.5															

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Sreenivasan Sundarrajan, (2018). "Sustainable Development: Principles, Frameworks, and Practices", Springer
2.	S. S. Bhavikatti , (2016). "Sustainable Engineering: Concepts and Applications" Publisher: I.K. International Publishing House Pvt. Ltd.

3.	Gaurav Biswas, (2019). " Engineering Sustainable Communities: Principles and Practices ", CRC Press
4.	"Green Buildings Pay" by Brian W. Edwards (2013, TERI Press)
5.	"Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes" by Sam Kubba (2017, Butterworth-Heinemann)
6.	"Life Cycle Assessment: Theory and Practice" Bhupendra Kumar Sharma 2017 TERI Press
7.	"Life Cycle Assessment: Principles, Practice and Prospects" Author: R. K. Goel Publisher: TERI Press Year of Publication: 2017
8.	"Sustainability Reporting: GRI, Dow Jones Sustainability Index, Analysis and Research" Author: Zabihollah Rezaee Publishing Year: 2017 Publisher: John Wiley & Sons
9.	"Sustainable Engineering: Concepts, Design and Case Studies" by David T. Allen, 2019, Wiley.
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.nptel.ac.in/noc24_de01/preview; Strategies for Sustainable Design.
2.	https://onlinecourses.nptel.ac.in/noc24_hs77/preview; Energy Resources, Economics, and Sustainability;