NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

College Calendar 2024-25

Department of Computer Science & Engineering

Syllabus of 4th Year

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

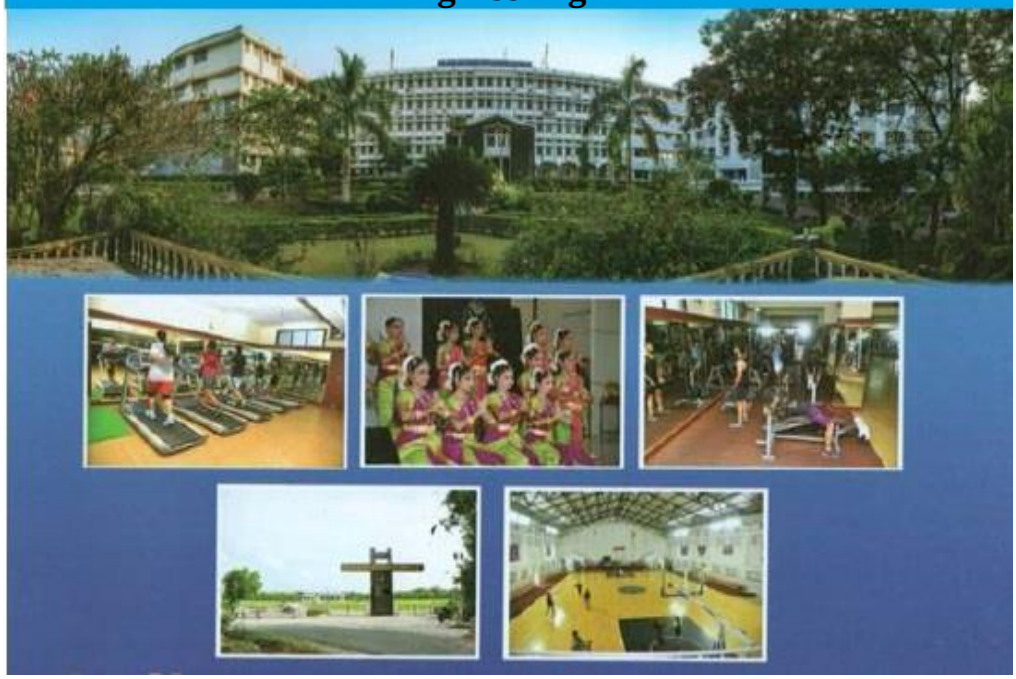
(An Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi)

Nitte - 574110, Karnataka, India

ISO 9001: 2015 Certified, Accredited by NAAC with 'A' Grade

VII & VIII SEMESTER

Department of Computer Science & Engineering



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 फ़ैलाती 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.

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COLLEGE CALENDAR
2024-25
(VII & VIII Semester)

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

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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

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.

8.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range S-E.

Letter grade 'F' in any course implies failure of the student in that course and no credits earned.

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

- Grade 'I': To a student having satisfactory attendance at classes and meeting the passing standard at CIE, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:

i) Illness or accident, which disabled him/her from attending SEE;
ii) A calamity in the family at the time of SEE, which required the student to be away from the College;

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

8.10 Grade Card

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

8.11 The Make Up Examination

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

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).

9. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two indices: SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

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

CGPA is computed as follows:

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

10. COMMUNICATION OF GRADES

The SGPA and CGPA respectively, facilitate the declaration of academic

performance of a student at the end of a semester and at the end of successive semesters. Both of them would be normally calculated to the second decimal position.

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

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

11.2 **A Student shall be declared fail if he / she**

(i) Has not satisfied the CIE requirements of any Course/s.

(ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements.

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

(a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.

(a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.

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

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

(a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year.

(a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The mandatory non-credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E/B.Tech. Programmes shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.

(b.1) In case, any student fails to satisfy the attendance requirement of the Courses Additional Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted

to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree.

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

(a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III year.

(a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.

(b) The prescribed mandatory non-credit Courses Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B. Sc holders admitted to III semester of B.E/B. Tech Programmes, shall attend the classes during the respective semesters to complete CIE and attendance requirements and to appear for the University examinations.

(b.1) In case, any student fails to satisfy the attendance requirement of the above said Courses; he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.

(b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

(c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.

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

11.4 Termination from the programme

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

i) **Failure to secure a CGPA = 5.0 on three consecutive occasions.**

ii) **Failure to earn a credit of 160 (120 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).**

iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.

iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

12. AWARD OF CLASS

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

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

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

Percentage = (GPA - 0.75) x 10

13. APPEAL FOR REVIEW OF GRADES

a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when required. A

mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

14. AWARD OF DEGREE

14.1 (1) B.E. Degree

a) Students shall be declared to have completed the Programme of B.E./B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (160 credits for regular students registered for 4 year degree programmes & 120 for lateral entry students).

b) For the award of degree, a CGPA≥5.00 at the end of Programme shall be mandatory.

c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.

d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc. graduates.

e) (i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/Autonomous colleges under VTU to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eight semester Grade Card.

(ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be

considered for vertical progression.

In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(2) B.E. (Honors) Degree

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

These Regulations are applicable for the following students:

1. Admitted to **I semester** / I year from the academic year **2018-19** (i.e. USN 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 5th.

(iv) Students shall obtain CGPA of 8.5 and above at the end of fourth semester.

(v) For Diploma students, they shall complete Additional Mathematics I and II during 3rd and 4th semesters in first attempt only.

Requirements:

(i) Students shall maintain a grade ≥D in all courses from 5th to 8th semester in 'first attempt' only.

(ii) Students not having CGPA greater than or equal to 8.5 at the end of the B.E. programme shall not be eligible for the award of Honors degree, even if they have satisfied the requirement of additional credits.

(iii) Students shall take up additional course work, other than the regular courses prescribed by the University from 5th to 8th semester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 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.

14.2 (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.

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

15 GRADUATION REQUIREMENTS AND CONVOCATION

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

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

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

15.3 **Convocation**

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

16 AWARD OF PRIZES, MEDALS, CLASS & RANKS

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

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

17 CONDUCT AND DISCIPLINE

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

17.2 **As per the order of Honorable Supreme Court of India, ragging**

in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

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

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

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

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

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

17.6 Cases of adoption of unfair means and/or any malpractice in an examination

shall be reported to the Controller of Examinations for taking appropriate action.

18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE

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

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

18.3 The activities can be spread over the years (duration of the programme) any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.

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

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

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

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LIST OF MAJOR SCHOLARSHIPS

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

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

SCHEME

VII Semester													
SN	**Course Category**	**Course Code**	**Course Title**	**Teaching Department**	**Teaching Hours / Week**				**Examination**				**Credits**
					Lecture	**Tutorial**	**Practical/ Drawing**	**Self-Study Component**	**Duration**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**S**					
1	PCC	21CS701	Big Data Analytics	CS	3	0	0		3	50	50	100	3
2	PCC	21CS702	Cryptography and Network Security	CS	3	0	0		3	50	50	100	3
3	PEC	21CSE2XX	Professional elective Course-II	CS	3	0	0		3	50	50	100	3
4	PEC	21CSE3XX	Professional elective Course-III	CS	3	0	0		3	50	50	100	3
5	OEC	21CSXXX	Open elective Course-II	CS	3	0	0		3	50	50	100	3
6	Project	21CS703	Project work	CS					3	100	100	200	09
TOTAL									**18**	**350**	**350**	**700**	**24**

VIII Semester													
SN	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar	21CS801	Technical Seminar		-	-	-	-	-	100	--	100	01
2	Internship	21INT802	Research/Industry Internship*		-	-	-	-	-	100	100	200	15
TOTAL										**200**	**100**	**300**	**16**

Professional Elective Courses-II		ProfessionalElectiveCourses-III	
SubjectCode	Title	SubjectCode	Title
21CSE201	Object oriented Modelling and Design	21CSE301	Software Architecture and Design Patterns
21CSE202	Cyber Security	21CSE302	Deep Learning
21CSE203	Blockchain Technology	21CSE303	NoSql Data Base
21CSE204	Software Testing	21CSE304	Business Intelligence
21CSE205	Cloud Computing	21CSE305	Internet of Things
21CSE206	Embedded Secure Element	21CSE306	Parallel computer architecture & programming

Open Elective Courses-II		Value Added Course	
21CSXXX	Introduction to AI and ML	21CSV101	Foundations of Modern Software Systems
21CSXXX	Essentials of information technology	21CSV102	Programming with C++

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

Course Objectives:

This Course will enable students to:

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

UNIT – I

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

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

Chapter 2: Examining Big Data Types and its Sources.

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

Chapter 3: Technology Foundations of Big Data.

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

Layer 4: Analytical Data Warehouses, Big Data Analytics, Big Data Applications. (Text book: chapter 1,2,4)

15 Hours

UNIT – II

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

Introduction to NoSQL, Uses, Features and Types, Need, Advantages, Disadvantages and Application of NoSQL, Overview of NewSQL. RDBMSs Are Important in a Big Data Environment. PostgreSQL relational database. Nonrelational Databases. Key-Value Pair Databases - Riak key-value database. Document Databases MongoDB, CouchDB . Columnar Databases, HBase columnar database. Graph Databases- Neo4J graph database.

Chapter 5 : MapReduce Fundamentals

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

(Text book: chapter 7,8) **15 Hours**

UNIT – III

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

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

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

(Text book: Chapter 9,10,12)

9 Hours

Course Outcomes:

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

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

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	**Program Outcomes (POs) Addressed**	**Performance Indicators (PI)**	**Bloom's Taxonomy Level (BTL)**
CO1	1,2	2.1.3, 2.2.3,2.2.4	L3
CO2	1,2, 3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L3
CO3	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1	L3
CO4	1,2, 3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L4
CO5	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.2	L4

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

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

TEXTBOOK:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

1. ftp://public.dhe.ibm.com/software/pdf/at/SWP 10/Big_aa_Analytics.pdf
2. https://www.wileyindia.com/big-data-analytics-2ed.html

MOOCs:

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

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

Course Objectives:

This Course will enable students to

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

UNIT – I

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

ConventionalEncryptionTechniques: SymmetricCipher Model, Substitution Techniques, Transposition Techniques, Steganography.

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

Number Generation . **15 Hours**

UNIT – II

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

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

15 Hours

UNIT – III

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

9 Hours

Course Outcomes:

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

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

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

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

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

MOOC:

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

SEE Scheme:

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

Professional Elective Courses-II

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

Course Objectives:

This course will enable students to:

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

UNIT – I

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

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

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

(Text Book-1: Chapter 1 to 4.3)

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

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

Advanced State Modeling: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips.

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

(Text Book-1: Chapter 4.4,5,6 ,7) **15 Hours**

UNIT - II

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

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

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

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

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

(Text Book-1: Chapter 14)

15 Hours

UNIT – III

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

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

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

(Text Book-1: Chapter 15,16,17,23 **9 Hours**

Course Outcomes:

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

1. **Acquire** Knowledge about different software systems modelling techniques, class design and associations by **making use of** concept diagrams
2. **Illustrate** Advanced Class, State and Interaction models of software systems **utlilizing**class, state and interaction diagrams
3. **Outline** the system concepts, Development Life Cycle, **Analyse** and D**efine** Problem Statement, **Analyse** the system domain, application, class, state and interaction models
4. **Overview** of system design, **estimate** performance, **divide** it into subsystems, managing resources, selecting appropriate architectural styles

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	**Program Outcomes (POs) Addressed**	**Performance Indicators (PI)**	**Bloom's Taxonomy Level (BTL)**
CO1	1,2	1.2.1, 1.3.1, 1.4.1, 1,4,2 2.1.1,2.2.3	L3
CO2	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L3
CO3	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1	L4
CO4	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 3.2.2	L4
CO5	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.2 2.2.1, 2.2.2	L3

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

5. **Describe** lass design, Implementation modelling, Legacy systems and Reverse engineering concepts, **realizing** use cases, associations, **Fine Tuning** Classes, **Constructing** Interaction and State models.

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

TEXTBOOK:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

1. Object-Oriented Analysis and Design with Applications, Grady Booch, Robert A. Maksimchuk, Michael W. Engel, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Third Edition The Addison-Wesley Object Technology Series, 2007
2. Object-Oriented Modeling 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. Object-Oriented Design, https://www.coursera.org/learn/object-oriented-design
2. Object-Oriented Analysis and Design , https://nptel.ac.in/courses/106/105/106105153/#

SEE Scheme:

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

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

Course Objectives:

This Course will enable students to:

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

UNIT - I

INTRODUCTION TO COMPUTER SECURITY:

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

CYBER STALKING, FRAUD, AND ABUSE:

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

DENIAL OF SERVICE ATTACKS:

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

15 Hours

UNIT – II

MALWARE:

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

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

TECHNIQUES USED BY HACKERS:

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

INDUSTRIAL ESPIONAGE IN CYBERSPACE:

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

15 Hours

UNIT – III

COMPUTER SECURITY SOFTWARE:

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

SECURITY POLICIES:

Introduction, What Is a Policy, Defining User Policies – Passwords, Internet Use, Email Usage, Installing/Uninstalling Software, Instant Messaging, Desktop Configuration, Final Thoughts on User Policies; Defining System Administration Policies - New Employees, Departing Employees, Change Requests, Security Breaches, Virus Infection, Denial of Service Attacks, Intrusion by a Hacker; Defining Access Control, Developmental Policies, Standards, Guidelines, and Procedures.

9 Hours

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

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.3.1, 2.1.2, 2.2.2, 2.4.3	L2
CO2	1, 2	1.3.1, 2.1.2, 2.2.2, 2.4.3	L3
CO3	1, 2	1.3.1, 2.1.2, 2.2.1, 2.4.3	L2

CO4	1, 2	1.3.1, 2.4.4	L3
CO5	1, 2, 8, 12	1.3.1,2.4.4, 8.1.1,12.2.2	L3

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

Course Outcomes:

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

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

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

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

TEXTBOOK:

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

REFERENCE BOOKS:

1. William Stalling, "Cryptography and Network Security: Principles and Practice", Sixth edition, Pearson Education.
2. Karen Scarfone, Peter Mell"Guide to Intrusion Detection and Prevention Systems (IDPS)", NIST special publication 800-94.
3. Cyber Security –Nina godbole, SunitBelapure, Publication: John Wiley, 2012.
4. Allan Friedman and P. W. Singer, "Cybersecurity and Cyberwar: What Everyone Needs to Know", Oxford University Press, published in 2013.

5. Yuri Diogenes, ErdalOzkaya, "Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics (Kindle Edition)", published by Packt publishing ltd. 2018.
6. Don Franke, "Cyber Security Basics: Protect Your Organization by Applying the Fundamentals", CreateSpace Independent Publishing Platform, 2016.
7. Joseph Steinberg, "Cybersecurity for Dummies", John Wiley & Sons, 2019.
8. RaefMeeuwisse, "Cybersecurity for Beginners", Cyber Simplicity, 2017.
9. Amelia Phillips, Bill Nelson, and Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, 2009, fourth edition.
10. Scott Augenbaum, "The Secret to Cybersecurity: A Simple Plan to Protect Your Family and Business from Cybercrime", publisher-Simon and Schuster, 2019.

E-BOOKS / ONLINE RESOURCES:

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

MOOC:

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

SEE Scheme:

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

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

Course Objectives:

This Course will enable students to:

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

UNIT– I

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

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

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

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

(Test Book 1 : Chapter 1,6 TextBook 2 : Chapter 1) **15 Hours**

UNIT - II

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

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

(TextBook 2: Chapter 1,2,9,10 TextBook 3: Chapter 3,4,5,6,9,10) **15 Hours**

UNIT - III

Hyperlegder: Fabric,The reference architecture, Requirements and design goals of Hyperledger Fabric, Membership services, Blockchain services, Components of the

fabric, Chain code implementation, The application model, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric

(TextBook 2: Chapter 15) **9 Hours**

Course Outcomes:

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

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

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

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

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

MOOC Courses:

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

SEE Scheme:

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

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

Course Objectives:

This Course will enable students to:

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

UNIT – I

INTRODUCTION TO TESTING – WHY AND WHAT:
Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of STLC

SOFTWARE TESTING LIFE CYCLE – V MODEL:
SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing: Functional Testing, API Testing, Usability Testing, Exploratory Testing, Ad-hoc Testing.Static Testing**:** Static techniques, reviews, walkthroughs

BASICS OF TEST DESIGN TECHNIQUES:
Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

14 Hours

UNIT – II

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

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

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

16 Hours

UNIT – III

BASICS OF AUTOMATION TESTING:
Introduction to automation testing, why automation, what to automate, tools available for automation testing.

BASICS OF AUTOMATION TESTING USING SELENIUM:
Introduction to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing, understanding TestNG framework with Selenium Web driver for automation testing, Introduction to Maven automation tool.

09 Hours

Course Outcomes:

Upon Completion of this course students will be able to:

1. Apply the knowledge of engineering to understand the various terms and techniques used in testing domain.
2. Identify the different phases of software testing life cycle and types of testing.
3. Analyze test management and test data management processes.

4. Analyze defect management life cycle and use open source tool for defect management.
5. Design test case and formulate automation testing with demonstration of open source testing tool.

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

Graduate Attributes (GA)

This course will map the following GA as per NBA:

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

1. https://www.softwaretestinghelp.com/selenium-tutorial-1/
2. http://softwaretestingfundamentals.com/software-testing-methods/
3. https://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf
4. http://docs.seleniumhq.org/docs/
5. http://www.seleniumhq.org/download/

MOOC:

1. http://nptel.ac.in/courses/106105150/
2. https://freevideolectures.com/course/3625/testing-with-selenium

CLOUD COMPUTING

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

Course Learning Objectives:

This course will enable students to:

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

UNIT – I

Eras of computing, Parallel vs. Distributed Computing, Elements of Parallel Computing- (What is parallel computing, hardware architecture for Parallel processing, approaches to parallel programming, levels of parallelism, Laws of caution). Elements of Distributed Computing- (General concepts and definitions, components of a distributed system, Architectural styles for distributed computing, models for inter-process communication, Technologies for distributed computing- Remote procedure call, Service oriented computing).

Classic data center, its elements, challenges and benefits. Data center management Steps in transitioning to cloud- consolidation, automation, IT as a service.

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

15 Hours

UNIT – II

Virtualization: – Introduction, Characteristics Of Virtualized Environments, Taxonomy Of Virtualization Technique- (Execution Of Virtualization, Other Types Of Virtualization-

Compute, Storage, Network, Desktop, Application). Virtualization And Cloud Computing, Pros And Cons Of Virtualization,

Technology Examples- Xen, Vmware, Microsoft Hyper-V.

Security Concerns, Risk Issues: - Cloud Computing- Security Concerns. A Closer Examination: Virtualization, A Closer Examination: Provisioning.

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

15 Hours

UNIT – III

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

Monitoring, the Opportunity for MaaS.

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

9 Hours

Course Outcomes:

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

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

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	**Program Outcomes (POs) Addressed**	**Performance Indicators (PIs)**	**Bloom's Taxonomy Level (BTL)**
CO1	1, 2	1.3.1, 2.2.2	L3
CO2	1, 2	1.4.1, 2.2.1	L3
CO3	1, 2	1.3.1, 2.2.3	L3
CO4	1, 2	1.4.1, 2.2.3	L3
CO5	1, 2	1.3.1, 1.4.1,2.2.2	L3

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

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

MOOCs:

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

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

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

Course objectives

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

UNIT - I

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

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

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

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

Java Card architecture: Comparison of Java Card Architecture - Java , why JCRE and JCVM; JCVM, JCRE, JC API, JC Applets, JC Library packages; Approach to Applet

development (tools, build flow, cap..); Data Objects, File Structure and command APDUs

17 Hours

UNIT - II

Java Card applet programming

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

17 Hours

UNIT – III

Global Platform for Secure Element content management

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

5 Hours

Course Outcomes

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

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

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

EBooks / Article

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

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Professional Elective Courses-III

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS						
Course Code	**:**	**21CSE301**		**CIE Marks**	**:**	**50**
Teaching Hours /Week (L:T:P:S)	**:**	**3-0-0-0**		**SEE Marks**	**:**	**50**
Total Hours	**:**	**39**		**Credits**	**:**	**03**

Course Objectives:

This Course will enable students to:

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

UNIT - I

INTRODUCTION:

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

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

15 Hours

UNIT - II

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

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

ARCHITECTURAL PATTERNS: Introduction, Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control. Adaptable Systems: Microkernel. ***(Text Book-2: Chapter 2: 2.1, 2.3,2.4,2.5)*** **15 Hours**

UNIT - III

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

9 Hours

Course Outcomes:

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

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

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

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

MOOC:

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

SEE Scheme:

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

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

Course Objectives:

This course will enable students to:

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

UNIT – I

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

15 Hours

UNIT – II

Neural Networks Training: Learning in neural network: output vs hidden layers; linear

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

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

15 Hours

UNIT - III

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

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

9 Hours

Course Outcomes:

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

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

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

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

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

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

TEXTBOOK:

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

REFERENCE BOOKS:

1. Duda, R.O., Hart, P.E., and Stork, D.G.,"Pattern Classification", Wiley-Interscience. Second Edition. 2001.
2. Theodoridis, S. and Koutroumbas, K.,"PatternRecognition",Fourth Edition, Academic Press, 2008.
3. Russell, S. and Norvig, N, Artificial Intelligence: "A Modern Approach", Prentice Hall Series in ArtificialIntelligence. 2003.
4. Bishop, C. M.,"Neural Networks for Pattern Recognition", Oxford University Press. 1995.
5. Hastie, T., Tibshirani, R. and Friedman, J,"The Elements of Statistical Learning", Springer. 2001.

E-Books / Online Resources:

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

MOOC:

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

SEE SCHEME

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

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

Course Learning Objectives:

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

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

UNIT – I

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

15 Hours

UNIT – II

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

15 Hours

UNIT – III

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

9 hours

Course Outcomes:

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

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

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PIs)	Bloom's Taxonomy Level (BTL)
CO1	1, 2	1.1.1, 1.3.1	L2
CO2	1, 2	1.1.1, 1.3.1	L2
CO3	1, 2	1.1.1, 1.3.1	L2
CO4	1, 2	1.1.1, 1.3.1	L3
CO5	1, 2	1.1.1, 1.3.1, 2.2.3	L4

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

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

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

TEXTBOOKS:

1. Pramod J. Sadalage, Martin Fowler. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence". 1st Edition, Addison-Wesley,2012.

2. Seema Acharya, Subhashini Chellappan, "Big Data Analytics", 1st Edition, Wiley, 2015.

REFERENCE BOOKS:

1. Deepak Vohra, Nosql Web Development with Apache Cassandra, Cengage Learning, Inc; New edition, 2015.
2. Doug Bierer, MongoDB 4 Quick Start Guide: Learn the skills you need to work with the world's most popular NoSQL database, Packt, 2018.

E-Books / Online Resources:

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

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

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

Course Learning Objectives:

This Course will enable students to:

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

UNIT – I

INTRODUCTION TO BUSINESS INTELLIGENCE:

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

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

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

15 Hours

UNIT – II

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

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

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

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

15 Hours

UNIT – III

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

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

9 Hours

Course Outcomes:

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

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

Table-1: Mapping of COs to PIs, POs and BTL			
Course Outcomes	**Program Outcomes (POs)**	**Performance Indicators (PIs)**	**Bloom's Taxonomy Level**
CO1	1,2	1.4.1, 2.2.2	L 2
CO2	1,2,3	1.4.1, 2.2.3, 3.2.2	L 3
CO3	1,2,3	1.4.1, 2.1.1, 2.1.2, 3.2.2,3.2.3	L 3
CO4	1,2,3	1.4.1, 2.1.2, 2.2.2, 3.2.2	L 3
CO5	1,2	1.4.1,2.1.3,2.4.1	L 2

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

E-Books / Online Resources:

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

MOOC:

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

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

Course Objectives:

This Course will enable students to:

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

UNIT – I

Introduction

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

15 Hours

UNIT – II

Design Concepts:

IoT Logical Design:

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Profiles and Compliances, Application Protocols for IoT, The
Transport Layer, IoT Application Transport Methods.
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief Description of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary.
Arduino Programming concepts, Connecting the sensors and actuators, Arduino Based IoT Project Implementation, Cloud Services
(Text Book-1: Chapter 4,5,6 ,7)

15 Hours

UNIT – III

Raspberry Pi based IoT Project Implementation:

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

09 Hours

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

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

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

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

MOOC:**MOOC:**

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

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

Course Learning Objectives:

This Course will enable students to

1. Outline the principles of multi-core design.
2. Illustrate the concept of parallelization and develop threaded parallel programs.
3. Develop parallel programs on shared memory and distributed memory parallel comers.
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 multi threading, Hyper threading, SMT, Case Study of multi-core processors: Intel, AMD multicore processors. (Chapter-1 and chapter-2 of Textbook-1)

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

15 Hours

UNIT – II

Shared and distributed memory parallel programming:
MPI Model: Collective communication, Data decomposition, Communicators and topologies, point-to-point communication, MPI Library, OpenMP: Directives and clauses, environment variables, Programs using OpenMP and MPI. Introduction to intel TBB, Thread-Safeness.
(Chapter-4 Textbook-1)

Multithreaded program debugging:
Benchmarks and other performance analysis tools, vTune Performance Analyzer, Thread Checker, Thread Profiler, hotspots, performance issues in algorithms, branch misprediction, cache organization, cache loads, efficiency, hardware and software prefetch.
(Chapter-2,3, and 4 of Textbook-2)

15 Hours

UNIT – III

Introduction to GPUs and CUDA programming:
Introduction to GPU Computing, Evolution of Graphics Processing Units, CUDA Device Architecture - Architecture of Modern GPUs, Generalized structure of CUDA Enabled GPU Device, CUDA Enabled NVIDIA GeForce 8800 GPUs. CUDA Thread Model, CUDA Thread Scheduling, Compute Capability, SIMD and SIMT, CUDA Memory Model, Introduction to CUDA C Programming -Structure of a Typical CUDA C Program -Data Transfer Between the Host and Device, CUDA programs with 1D Grid of 1D Blocks, 2D Grid of 2D Blocks, Tile-based Algorithms using Shared Memory- Matrix multiplication.

(Chapter-7 Textbook-1) **9 Hours**

Course Outcomes:

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

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

Mapping of POs & COs:

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

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2	1.1.1, 2.1.3, 2.2.3	L3
CO2	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1,	L3
CO3	1,2	1.4.1, 2.1.3, 2.2.3, 2.3.1	L3
CO4	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.1, 3.2.2	L3
CO5	1,2,3	1.4.1, 2.1.3, 2.2.3, 2.3.2.1	L3

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

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

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

TEXT BOOKS

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, AartJ.C.Bik, Kevin B.Smith, Xinmin Tian, Intel press

REFERENCE BOOKS

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

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Value Added Courses

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

Instructor - Piyush Goel

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

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

1. Module-1: Introduction (3 hours)

a. Overview

i. Overview of a food delivery business such as Swiggy, Zomato.

ii. Different Components of the software powering such a business

b. Foundations of Software Systems

i. Storage, Compute, Networking

ii. Turtles All the way down!

2. Module-2: Storage (12 hours)

a. Data Types

b. Fundamentals of data storage (File systems, Serialisation, Compression, etc)

c. Structuring and Querying Data.

d. Databases

i. Relational

ii. Non-Relational

1. Key-Value

2. Document

3. Time-Series

e. Object Storage (Files, and Blobs)

f. Brief about advanced concepts such as CAP Theorem (Optional)

g. Practicals - Experiment, and play around with the various databases.

3. Module-3: Compute (8 hours)

a. Process, Threads, Memory.

b. Servers, Virtual Machines, and Containers.

c. Application Servers (Web Servers, FTP, Email)

d. Cloud Computing Basics.

e. Practicals - Playing with Cloud providers such as AWS.

4. Module-4: Networking (12 hours)

a. Building Blocks (OSI Layer Models, Network Topologies, Subnets, VPNs, etc)

b. Naming Systems (DNS)

c. Important Protocols i. TCP/UDP ii. HTTP iii. Web Sockets

d. Network Security (SSL/TLS)

e. Practicals - Intercepting Network Traffic and analysing it in detail. Basic commands for tinkering with computer networks.

5. Module-5: Assignment (6 hours)

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

6. Examination a. There will be a written examination of 75 mins. It will carry 50% weightage. b. The assignment presentation will carry another 50% weightage.

Mode of Instruction: Online, and Offline classes shall be conducted. The instructor might create a Telegram or an email group to engage the students into group discussions, and knowledge sharing sessions.

Study Material: The relevant books, papers, and blogs will be recommended by the instructor when commencing each module.

Pre-Requisites for the students:

1. Access to Unix based laptops, or desktops.
2. Basic command over a scripting language such as Python, Ruby, PHP.
3. Most of all - Curious minds, and a deep hunger to learn.

Instructor: Piyush Goel (aka, Goel) is the SVP of Engineering at Capillary Technologies, an industry leader in Consumer Engagement software. Goel has more than 15 years of industry experience with stints at companies such as Capillary, InMobi Technologies, Travel Triangle Pvt Ltd, and Yahoo Inc. He holds a BTech, and MTech in Computer Science, and Engineeering from the Indian Institute of Technology, Kharagpur, and has over 8 publications in International conferences, and Journals. He is passionate about building software systems that impact human lives, and loves to teach, and mentor young engineers in his spare time. He likes to travel, and is on a spiritual pursuit via the Buddhist meditation practise of Vipassana.

LinkedIn - https://www.linkedin.com/in/piyushgoel1/

Twitter - https://twitter.com/pigol1

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PROGRAMMING WITH C++						
Course Code	**:**	**21CSV102**		**CIE Marks**	**:**	**50**
Teaching Hours /Week (L:T:P:S)	**:**	**2-0-0-0**		**SEE Marks**	**:**	**50**
Total Hours	**:**	**26**		**Credits**	**:**	**00**

List of Programs

1. Write C++ program to design a class called BankAccount. Include following data members like name of the depositor, account number and balance. Use following member functions a) to initialize values b) deposit an amount c) to withdraw an amount d) to display name and balance.

2. Write a C++ program to create a class called COMPLEX and implement the following
overloading function ADD that return a COMPLEX number.
i. ADD(a,c2);- where a is an integer(real part) & c2 is a complex no.
ii. ADD(c1,c2);- where c1 & c2 are complex nos. use Function overloading(ADD) and Friend function concept for the implementation

3. Write a C++ program with class Time with data members that represents hours and
minutes.Include appropriate member functions to compute time in hours and minutes . (Use of objects as arugemnts).

4. Given that an EMPLOYEE class ontains following members. Data members:Eno, Ename and salary Member functions: to read the data , to print data members.Write a C++ program to read the data of N employees and display detials of each employee.(use Array of objects concept).

5. Write a C++ program with two classes A and B with one integer data member in each class. Write member functions to read and display, place a friend function in these classes which takes the data members of these classes and computes maximum of two data members. Demonstrate
using main function.

6. Write a C++ program to demonstrate to uses of constructors in derived class concept. (Any inheritance you can use but constructors in base class should have at least one parameter.)

7. Write a C++ program to create a class sample with integer ,character and float data members. Demonstrate Constructor Overloading on this class with all types of constructors including default argument constructor.

8. Write a C++ program to demonstrate the working of dynamic constructors using a class STRNG with string as datamember inside the class, include appropriate member functions to display the object data and a member function to concatenate two strings.

9. Write a C++ program for the diagram using Hierarchical inheritance. Use your own data members and member functions to display student details.

10. Write a C++ program for the diagram using Hybrid inheritance. Use yourown data members and member functions to display student details.

11. Write a C++ program for the diagram using Virtual Base class concept. Use your own data members and member functions to display student details.Create an array of n objects of result class and demonstrate.

12. Create a base class shape to store two double type values. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data() to initalize base class data members and another function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the
derived classes to suit the requirements.(Area of rectangle=x*y, Area of triangle=1/2*x*y).

13. Write a C++ program to overload binary + and – operator to add and subtract two complex numbers. Define relevant data members and member functions for reading and displaying the complex objects

14. Write a C++ program to apply bubble sort on an array of integer and float use the concept of function template

15. Write a C++ program to implement queue operations for integer and float data types. Use concept of class template.

OPEN ELECTIVE - (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/

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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

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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**.

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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

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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**

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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**.

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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**.

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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**.

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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.

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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

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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**.

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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.

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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

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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

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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"

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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

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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**.

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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.**

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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.**

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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.**

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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
<u>Course Outcomes:</u> 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	

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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

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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;