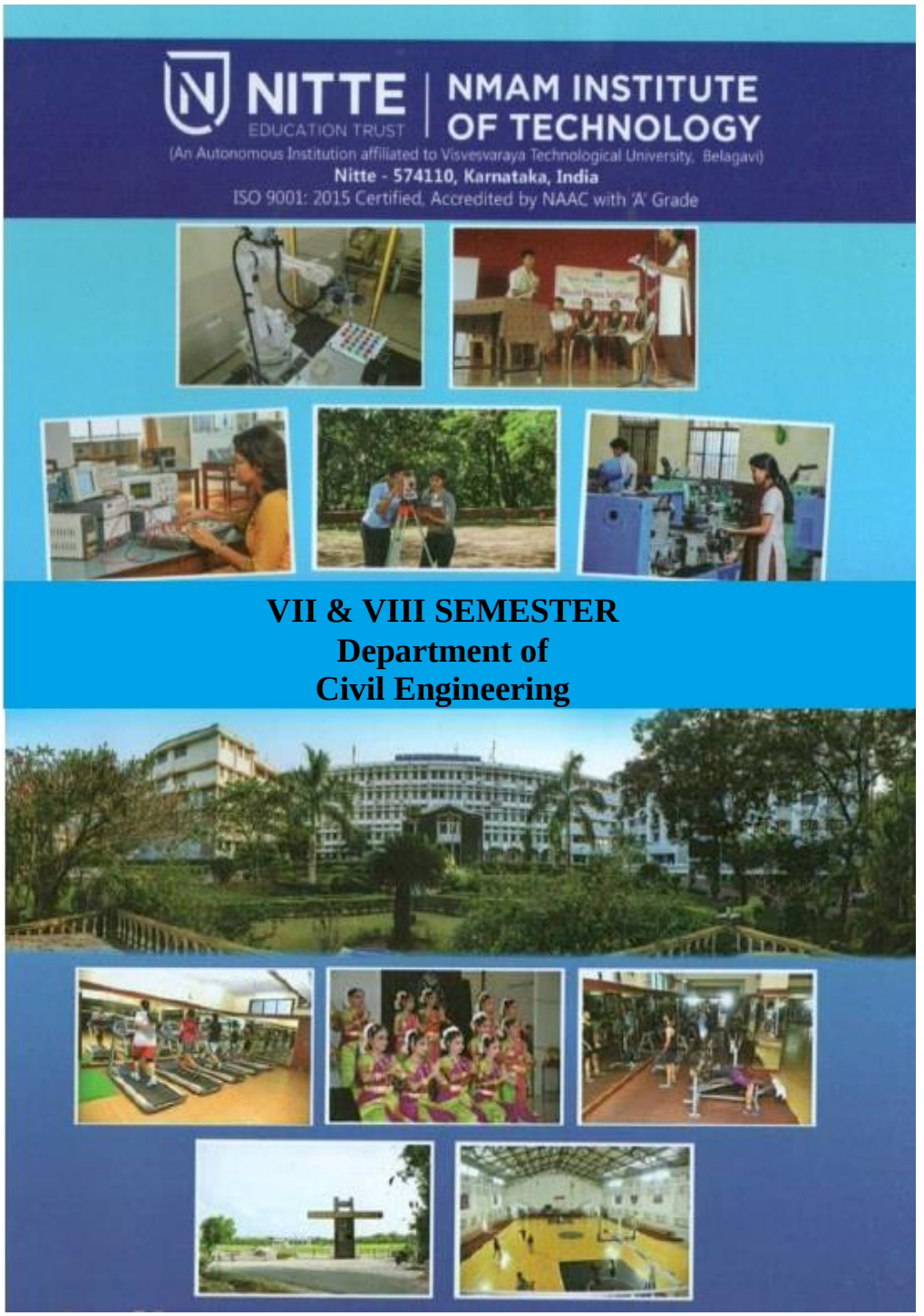
NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

College Calendar 2023-24

Department of Civil Engineering

Syllabus of 4th Year



College Calendar 2023-24

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.

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

COLLEGE CALENDAR
2023-24
(VII & VIII Semester)

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

Vision Statement

Pursuing Excellence, Empowering people, Partnering in Community Development

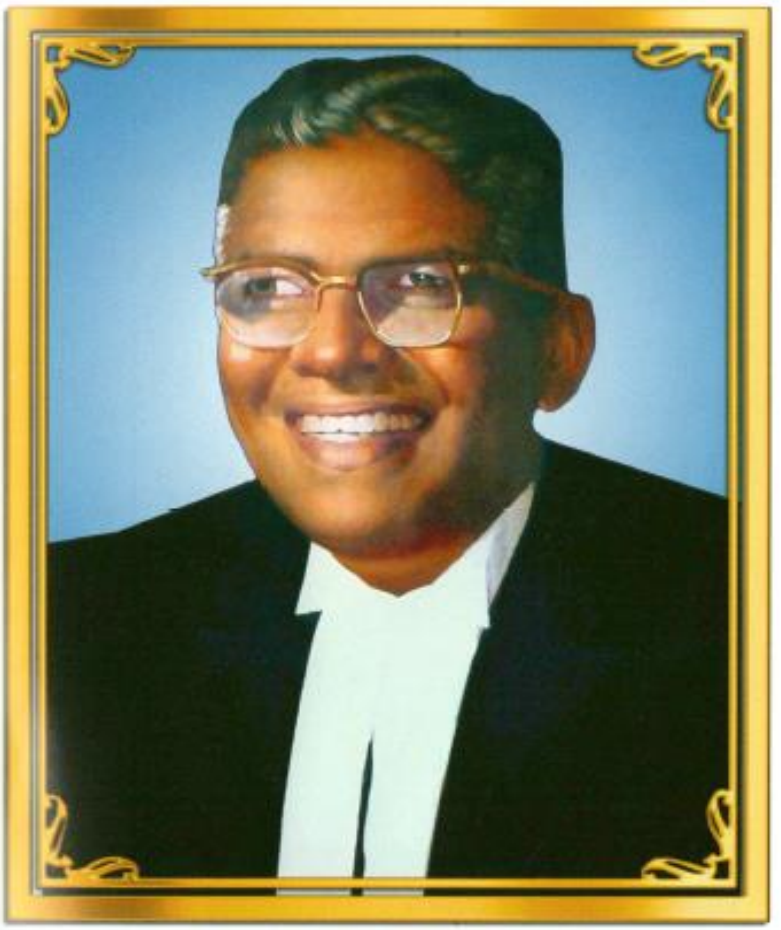
Mission Statement

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

In Memorium

Late Nitte Mahalinga Adyanthaya

Our Founder



Late Justice K. S. Hegde
1909-1990

SRI N. VINAYA HEGDE

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

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

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

HEADS OF DEPARTMENTS

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

15.	Dr. Srinivas Pai P	HoD, Mechanical Engg
16.	Dr. Venugopala PS	HoD, Artificial Intelligence & Data Science
17.	Mr. Bharath G Kumar	Head, Training & Placement Cell

INCHARGE OF INSTITUTION'S RESPONSIBILITIES

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

ENTREPRENEURSHIP DEVELOPMENT CELL

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

DEPARTMENT OF TRAINING & PLACEMENT

1.	Mr. Ankith S Kumar	Counsellor

DEPARTMENT OF MATHEMATICS

1.	Dr. Shashirekha B. Rai	Professor
2.	Dr. Kumudakshi	Asso. Professor/ HoD
3.	Dr. Sharad M. Hegde	Asst. Professor Gd III
4.	Dr. Vasanth K.R	Asst. Professor Gd III
5.	Dr. Ashwini Kumari	Asst. Professor Gd III
6.	Dr. Chaithra K.	Asst. Professor Gd III
7.	Dr. Prashanthi K S	Asst. Professor Gd III
8.	Dr. Girija K P	Asst. Professor Gd III
9.	Dr. Ganesh Kumar K	Asst. Professor Gd III

10.	Mrs. Ambika N.	Asst. Professor Gd I
11.	Mrs. Vinaya Acharya	Asst. Professor Gd I
12.	Mrs. Anitha D. Bayar	Asst. Professor
13.	Mrs. Bhavya K.	Asst. Professor
14.	Mrs. Bhavya. D.	Asst. Professor
15.	Mrs. Sharmila	Asst. Professor
16.	Mrs. Anjana Pai K	Asst. Professor
17.	Mrs. Soumya	Asst. Professor
18.	Mrs. Smitha G. V.	Asst. Professor

DEPARTMENT OF PHYSICS

1.	Dr. Manjunath K. B.	Professor
2.	Dr. Shobha R. Prabhu	Asso. Professor / HoD
3.	Dr. Sathyajith	Asso. Professor
4.	Dr. Raghavendra Bairy	Asso. Professor
5.	Dr. Nagaraja B.S.	Asst. Professor Gd III
6.	Dr. Shyam Prasad . K.	Asst. Professor Gd III
7.	Dr. Saritha Suvarna	Asst. Professor Gd III

DEPARTMENT OF CHEMISTRY

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

DEPARTMENT OF HUMANITIES

1.	Dr. Ramakrishna B.	Professor
2.	Mrs. Rashmi D. Hegde	Asso. Professor
3.	Dr. Vishwanatha	Asso. Professor /HoD
4.	Dr. Jnaneshwar Pai Maroor	Asst. Professor Gd III

5.	Dr. Joy Elvine Martis	Asst. Professor Gd III
6.	Mrs. Shyla D Mendonca	Asst. Professor Gd II
7.	Ms. Sonia Lobo	Asst. Professor Gd I
8.	Ms. Akshatha Kumari J Shetty	Asst. Professor Gd I
9.	Mr. Srinivas Nekkar	Asst. Professor
10.	Mrs. Sudeeksha S. Pai	Asst. Professor
11.	Mrs. Shwetha	Asst. Professor

OFFICE SECTION HEADS

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

SECURITY DEPARTMENT

1.	Mr. Hirianna Suvarna S	Security Supervisor

SPORTS DEPARTMENT

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

HOSTEL WARDENS

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

HOSTEL SUPERINTENDENT / MANAGER

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

REGULATIONS

2023-24

(Applicable for admission batch 2018-19 onwards)

NITTE EDUCATION TRUST | NMAM INSTITUTE OF TECHNOLOGY

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REGULATIONS

COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE PROGRAMMES OF NMAM INSTITUTE OF TECHNOLOGY, NITTE

Karkala, Udupi Dist., Karnataka

1. **INTRODUCTION**

1.1 The general regulations are common to all B.E. (Credit System) Degree Programmes conducted at the NMAMIT, Nitte Campus and shall be called "NMAMIT Regulations".

1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting Instructions of course, conduct of the examination and evaluation and certification of student's performance and all amendments related to the said Degree programme(s).

1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the BE Degree program (of VTU) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. **This set of Regulations, may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time, and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.**

1.4 In order to guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.

1.5 The Academic Council may consider any issues or matters of Concern relating to any or all the academic activities of NMAMIT courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

1.6 The course shall be called **Bachelor of Engineering** course abbreviated as B.E. (Subject of specialization) – Credit System.

1.7 **DURATION OF THE COURSE**

(a) The course shall extend over a period of total duration of 4 years.

(b) Each year shall have the following schedule with **5** ½ days a week.

Suggested Break down of Academic Year into Semesters

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

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

courses registered and also ensure their better monitoring by Faculty Advisors).

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

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

2. DEGREE PROGRAMMES

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

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

Other teaching departments are –

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

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

3. REGISTRATION

3.1 Every student after consulting his Faculty Advisor in parent department shall register approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar.

Students who fail to register on or before the specified date will have to pay a late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the college at the end of each semester, like odd, even, supplementary and it forms the basis for determining the student's performance in that semester.

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

Course Credit Assignment

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

Lecture / Tutorials / Practical:

i) One hour Lecture per week is assigned one Credit.

ii) 2-hour Tutorial session per week is assigned 1.0 Credit.

iii) 2-hour Lab. session per week is assigned 1.0 credit.

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

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

Calculation of Contact Hours / Week – A Typical Example

Typical Course Load per Semester			
No. of Courses	**Credits / Course**	**Total Credits**	**Contact Hours per Week**
2 Lecture Courses	3:0:0	6	6
2 Lec. cum Lab Courses	3:0:1	8	10
2 Lec. cum Tut. Courses	3:1:0	8	10
1 Lec. Tut. cum Lab Courses	1:1:1	3	5
Total	**10:2:2**	**25**	**31**

A student must register, as advised by Faculty Advisor, between a minimum of 16 credits and up to a Maximum of 28 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 (=22) or to be within the limits of minimum (=16) and maximum (=28) 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 Sciences (BSC)	24-30
2.	Engineering Sciences (ESC)	15 -20
3.	Humanities, Social Sciences and Management	7- 10
4.	Professional Courses (PCC) – core	70 - 90
5.	Professional Courses (PEC) – elective	18
6.	Open Elective Courses (OE)	06
7.	Project Work (PROJ) Seminar on Current Topic	16 (VI – 2, VII-2, VIII-12) 01
8.	Internship	03
9.	Mandatory Learning courses	Non-Credit
Note: **Student can register between 16 to 28 credits per semester** **Total Credits to be earned : 175**		

5.2 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components 'a' to 'g', the semester wise distribution among them, as well as the syllabi of

5.3 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.

5.4 **The earned Credit Requirement for the B.E. Degree is 175.**

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.

5.5 **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, Constitution of India, 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.

5.6 **PROJECT**

i) Project work at 8^{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.

5.7 **ELECTIVES**

i) A candidate shall take electives in each semester from groups of electives, commencing from 5^{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 5^{th}, 6^{th}, 7^{th} and 8^{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 (175 credits) within the time limits specified by the university.

iii) The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.

iv) A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the Student's roll list. The fees/charges once paid shall not be refunded.

v) A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

7.2 Permanent Withdrawal

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

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

(a) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues if any.

(b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts.

(c) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

8. EVALUATION SYSTEM

8.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.

8.2 The Letter grades S, A, B, C, D, E, F indicate the level of academic achievement, assessed on a decimal (0-10) scale.

8.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid- semester examinations and one semester end examination. The distribution of weightage among these components may be as follows.

Semester End Examination (SEE) : 50% (50 marks)
Continuous Internal Evaluation (CIE) : 50% (50 marks)

i) Quizzes, Tutorials, Assignments, Seminars, mini projects, tutorials etc. : 10 marks
ii) Mid-semester Examination : 40 marks

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

8.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.

8.5 The course Instructor shall announce in the class and/or display at the Faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

8.6 Passing standards

Evaluation Method	Passing Standard
Sessional (CIE)	Score: ≥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) Grade point scale for absolute grading

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

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

8.8 Earning of Credits

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

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

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

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

- Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller

of Examinations to write Make up Examinations within 2 working days of that particular examination for which he or she is absent, failing which they will not be given permission. This is admissible only for students who have more than 45 CIE marks.

- Grade 'W': To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice
- Grade 'X': To a student having attendance ≥85% and CIE rating (90%), in a course but SEE performance observed to be poor, which could result in a F grade in the course. **(No 'F' grade awarded in this case but student's performance record maintained separately).**

8.10 Grade Card: Each student shall be issued a Grade Card (or Transcript) 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) In the event of a student in the final semester failing in a Laboratory course and/or in CIE of a course, he/she could be given 'I' grade for the course. In such a case the concerned course instructor would have the possibility to grant the student extra time not exceeding 12 weeks for completing the course, with the concurrence of the Department/College. If no such extra time is sought/granted, the concerned student would have to re-register for the

course in a succeeding semester and take steps to fulfill the requirements of the Degree.

b) 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.

c) 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.

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

CGPA is computed as follows:

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

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, so that the CGPA, in particular, can be made use of in rank ordering the students' performance at a College. If two students get the same CGPA, the tie could be resolved by considering the number of times a student has obtained higher SGPA; But, if it is still not resolved, the

number of times a student has obtained higher grades like S,A,B etc. could be taken into account.

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 F 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 175 (135 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
5.75	50 (second class)
6.25	55
6.75	60 (First class)
7.25	65
7.75	70 (Distinction)
8.25	75

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 (175 credits for regular students registered for 4 year degree programmes & 135 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 $\geq$D in all courses from 5thto 8thsemester 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 5thto 8thsemester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD ($\geq$ 90 %) before closure of eighth semester as per the academic calendar.
(iv) Students shall be permitted to drop the registered course work (s) and select alternative course work (s) in case they cannot give proctored examination.

(v) Students have to take courses from the list of MOOCs approved by the University, which can be from NPTEL / SWAYAM / other platforms.

(vi) Students shall select courses in consultation with their Class Advisor, such that the content / syllabus of them are not similar to that of the core courses, professional electives or open electives, which the students may 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

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

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

B. E. SYLLABUS

CIVIL ENGINEERING

VII & VIII SEMESTER

With

Scheme of Teaching

& Examination

DEPARTMENT: CIVIL ENGINEERING

1.	Dr. I. Ramesh Mithanthaya	Ph.D	Prof./ Vice Principal /Dean (Aca)
2.	Dr. A.N. Parameswaran	Ph.D	Professor/ Director (III)
3.	Dr. Arun KumarBhat	Ph.D	Professor/HOD
4.	Dr. Udayakumar G.	Ph.D	Professor
5.	Dr. Srinath Shetty K.	Ph.D	Professor
6.	Dr. Radhakrishnan K.	Ph.D	Professor
7.	Mr.Bhandage A R	M. Tech	Associate Professor
8.	Dr. Bhojaraja B E.	Ph.D	Associate Professor
9.	Dr.Ranjith A	Ph.D	Associate Professor
10.	Dr. Shaik Kabeer Ahmed	Ph.D	Associate Professor
11.	Dr.Shriram P Marathe	Ph.D	Associate Professor
12.	Mr. J.K. Lokesh	M.Tech	Asst. Prof.Gd III
13.	Dr.Pushparaj A Naik	Ph. D	Asst. Prof.Gd III
14.	Dr. Mithun B.M.	Ph.D	Asst. Prof.Gd III
15.	Dr. Saranya P	Ph. D	Asst. Prof. Gd III
16.	Dr.Shanmukha Shetty	Ph. D	Asst. Prof. Gd III
17.	Mr.SundipShenoy R.	M.Tech. (Ph. D)	Asst. Prof.Gd II
18.	Mr. Gururaj Acharya	M.Tech.	Asst. Prof.Gd II
19.	Mr.Rakshith Kumar Shetty	M.Tech.	Asst. Prof.Gd II
20.	Mr.Manjunath M.	M.Tech. (Ph.D)	Asst. Prof.Gd II
21.	Mr. Roshan Rai	M.Tech.	Asst. Prof.Gd II
22.	Mr. Arjun K Punja	M.Tech	Asst. Prof.Gd II
23.	Mr.Thushar S. Shetty	M.Tech. (Ph. D)	Asst. Prof. Gd II
24.	Mr.Prashantha Kumar K.	M.Tech (Ph.D)	Asst. Prof.Gd I
25.	Mr.Prithviraj H.K.	M.Tech. (Ph. D)	Asst. Prof.Gd I
26.	Mr. Pradeep Karanth	M.Tech. (Ph. D)	Asst. Prof.Gd I
27.	Ms.ThanushreeHegde	M.Tech. (Ph. D)	Asst. Prof.Gd I
28.	Ms. Deekshitha M	M.Tech. (Ph. D)	Asst. Prof.Gd I
29.	Mr. Ekanath P.	M. Tech.	Visiting Faculty
30.	Mr. Rajesh D. Maistry	M. Tech.	Visiting Faculty

DEPARTMENT OF CIVIL ENGINEERING

Vision

To uphold the Department as a leader in community development through innovation and excellence in diverse areas of Civil Engineering to meet the global challenges and market demands.

Mission

1. To provide the students a strong theoretical knowledge and practical skills to understand the basic concept and fundamentals of various Civil Engineering subjects.
2. To be competent and skilled enough to take the challenges in Research, Consultancy and Entrepreneurship.
3. To encourage the students in developing professional ethics through discipline and principles.

Programme Educational Objectives (PEOs)

The graduates of the program will be

PEO1	Equipped with fundamentals of civil engineering along with interdisciplinary science, engineering and management concepts.
PEO2	Equipped with advanced and emerging field of civil engineering practices to compete and match with the industrial requirements.
PEO3	Competent enough to conceive the ideas, prepare plan, design, execute, monitor and manage the project with the effective utilization of resources such as men, material, machine and money along with time effectively.
PEO4	Continue to learn and adapt to suit the needs and challenges of real world problems and come up with optimal solutions.

Programme Outcomes (POs)

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences, and engineering sciences.

PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1	Ability to apply the knowledge of Civil Engineering domains, conduct experiments, analyze, interpret data and design the system components.
PSO2	Enrich the knowledge in Structural, Geo technical, Transportation, Environmental Engineering, Water Resources, Infrastructure and Development, Surveying and Geo-informatics by means of innovative practices.
PSO3	Competency to plan, produce detailed drawings, write specification, prepare cost estimates, selection of materials, schedule work plans, execute and value real properties.

DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF TEACHING AND EXAMINATION
VII SEMESTER B.E.

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week			Credits
					Theory Lecture	Tutorial	Practical/ Drawing	
1	PC	20CV701	Hydrology & Irrigation Engineering	Civil Engineering	4	0	0	4
2	PC	20CV702	Quantity Surveying & Contract Management*	Civil Engineering	4	0	0	4
3	PC	20CV703	Design and Detailing of Steel Structural Elements	Civil Engineering	2	0	2	3
4	EC	20CVEXXX	Elective-IV	Civil Engineering	3	0	0	3
5	EC	20CVEXXX	Elective-V	Civil Engineering	3	0	0	3
6	OE	20XXX	Open Elective-I	Civil Engineering	3	0	0	3
7	PC	20CV704	Environmental Engg. Lab	Civil Engineering	0	0	2	1
8	PR	20CV705	Project –I	Civil Engineering	0	0	8	3
9	PC	20CV706	Seminar	Civil Engineering	0	0	2	1
				Total Credits				**25**

Note : PC: Professional Core, EC : Elective Course , OE: Open Elective, PR: Project

DEPARTMENT OF CIVIL ENGINEERING
SCHEME OF TEACHING AND EXAMINATION
VIII SEMESTER B.E.

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week			Credits
					Theory Lecture	Tutorial	Practical/ Drawing	
1	EC	20CVEXXX	Elective VI	Civil Engineering	3	0	0	3
2	OE	20XXX	Open Elective-II	Civil Engineering	3	0	0	3
3	PR	20CV801	Project–II	Civil Engineering	0	0	24	12
4	PC	20CV802	Internship	Civil Engineering	0	0	0	3
				Total Credits				21

Note : PC: Professional Core, BS : Basic Science, EC : Elective Course, PR: Project, OE Open Elective

Elective Groups

(Students can register for 6 electives between 5th to 8th semesters from the list given below preferably from one stream. If there are two electives in a semester then students can select one each from Group I and II)

Group-I		Group-II	
Stream 1. Structural Engineering			
Course Code	**Course Name**	**Course Code**	**Course Name**
20CVE101	Design of Masonry Structures	20CVE201	[22] Earthquake Resistant Structures
20CVE102	[1] Matrix Methods of Structural Analysis	20CVE202	Design of Bridges
20CVE103	[1] Theory of Elasticity	20CVE203	Advanced RCC Design
20CVE104	Design of Pre-stressed concrete Structures	20CVE204	[11] Finite Element Method of Structural Analysis
20CVE105	[2] Structural Dynamics	20CVE205	Numerical Methods in Civil Engg

Note: Suffix 1 refers to the prerequisite course for course with suffix 11

Stream 2. Geotechnical and Transportation Engineering			
Course Code	**Course Name**	**Course Code**	**Course Name**
20CVE301	Ground Improvement Techniques	20CVE401	Pavement Materials and Construction
20CVE302	Traffic Engineering	20CVE402	Pavement Design
20CVE303	Highway Geometric Design	20CVE403	Reinforced Earth Structures
20CVE304	Earth Retaining Structures	20CVE404	Deep Foundations
20CVE305	Road Safety and Management	20CVE405	Environmental Geotechniques

Stream 3. Construction Technology and Management			
Course Code	**Course Name**	**Course Code**	**Course Name**
20CVE501	Alternative Building Materials and Technologies	20CVE601	Design of Special Concretes
20CVE502	Advanced Concrete Technology	20CVE602	Sustainable Construction Materials and Methods
20CVE503	Building Services	20CVE603	Valuation of Real Properties
20CVE504	Construction Planning & Control	20CVE604	Disaster Management and Mitigation
20CVE505	Construction Quality Management	20CVE605	Construction Safety Management
20CVE506	Construction Methods and Equipments	20CVE606	Construction economics and finance
20CVE507	Engineering Project Management	20CVE607	Business Management

Stream 4. Water Resources Engg, Environmental Engg& Geology			
Course Code	**Course Name**	**Course Code**	**Course Name**
20CVE701	Ground Water Hydrology &Exploration	20CVE801	Solid Waste Management
20CVE702	Environmental Impact Assessment for Civil Engineering	20CVE802	Advanced Applied Engineering Geology
20CVE703	Rural Water Supply & Sanitation	20CVE803	Introduction to Geo-informatics
20CVE704	R S & GIS application in Water Resource Engg.	20CVE804	Geo-informatics in Environmental Engineering
20CVE705	Advanced Hydraulics	20CVE805	Groundwater Recharge and conservation

Stream 5. Software Oriented Courses in Civil Engineering			
Course Code	**Course Name**	**Course Code**	**Course Name**
20CVE901	3D BIM - AUTODESK REVIT	20CVE906	Software Advances in Pavement Design
20CVE902	CAD IN CIVIL ENGINEERING	20CVE907	Application of RS&GIS for Water resources management
20CVE903	FUNDAMENTALS OF MACHINE LEARNING	20CVE908	Project Planning using Software's
20CVE904	Python Programming	20CVE909	JAVA PROGRAMMING

HYDROLOGY AND IRRIGATION ENGINEERING			
Course Code	**20CV701**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**4:0:0**	**SEE Marks**	**50**
Total Hours	**50**	**Credits**	**04**

Course Learning Objectives:

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

1. Explain hydrological cycle, water budget equation, **determine** mean rainfall and missing rainfall. l distribution and its measurements.
2. Analyze water losses like infiltration, evaporation and components of runoff.
3. Explain systems and methods of irrigation, reference crop evapotranspiration and irrigation efficiencies.
4. Distinguish canals, canal regulation works, cross drainage works and design irrigation channels using silt theories
5. Analyse stability of gravity dams and explain types and failure of earthen dams.

UNIT – I

INTRODUCTION: Definition, importance of hydrology, global water availability, practical applications of hydrology, concept of catchment and water budget equation.

Rainfall: Forms and types of precipitation, measurement of rain fall - recording and non-recording type of rain gauges, consistency of rainfall data (double mass curve method), computation of mean rainfall, moving average curve, return period - mass curve, rainfall hyetographs, intensity – duration - frequency curves. **10 Hours**

UNIT – II

WATER LOSSES: Introduction, infiltration, factors affecting infiltration capacity, measurement (double ring infiltrometer), Horton's infiltration equation, infiltration indices. Evaporation-process, factors affecting evaporation, evapotranspiration, PET, AET, factors affecting ET, estimation of ET.

RUNOFF: Components - and factors affecting runoff, stream flow measurements- area velocity and slope area method, rainfall - runoff relationship- regression analysis, peak runoff (flood) estimation - rational method**.** **11 Hours**

UNIT – III

IRRIGATION: Benefits and ill effects of irrigation, Water logging, need for drainage, sources of water for irrigation, Systems and Methods of irrigation, Reference crop evapotranspiration - crop coefficients, crop water requirements, irrigation water requirements, irrigation efficiency, frequency of irrigation.

8 Hours

UNIT – IV

CANALS: Types and - alignment of canals, design of irrigation channelsfor alluvial soils (only) using - Lacey's and Kennedy's methods, description of canal drops, canal regulators and cross drainage works. **10 Hours**

UNIT – V

RESERVOIRS: Types, investigation for reservoir sites, storage zones, determination of storage capacity and yield of a reservoir using mass inflow curve.
GRAVITY DAMS: Forces acting, modes of failure, elementary and practical profile, stability analysis, single step design method.
EARTHEN DAMS: Types, modes of failure.

11 Hours

Course Outcomes:

At the end of the course students will be able to

1. **Explain** hydrological cycle, water budget equation and **determine** mean rainfall and missing rainfall.
2. **Determine** water losses, stream flow and **develop** rainfall -runoff relationship applying regression analysis.
3. **Explain** systems and methods of irrigation, reference crop evapotranspiration, crop and irrigation water requirements.
4. **Explain** the alignment of canals, **design** irrigation channels applying Lacey's and Kennedy's theories and **discuss** canal drops, canal regulators and cross drainage works
5. **Find** the storage capacity of reservoirs, **analyze** stability of gravity dams and **explain** the types and failures of earthen dams.

Mapping POs & COs:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO 1	1	3	1				2						2	3	
CO 2	1	3	1	1			2						2	3	
CO 3	1	3	1				2						2	3	1
CO 4	1	2	3				2						2	3	1
CO 5	1	3	3				2						2	3	1

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. K Subramanya , "Engineering Hydrology", Tata McGraw Hill, New Delhi, 4th Edition, 2017.
2. Punmia B.C and PandeLal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 16th edition, 2013

REFERENCE BOOKS:

1. Garg S.K. "Irrigation Engineering and Hydraulic Structures: Water Resources Engineering, Vol. II" Khanna Publications, New Delhi, 5th edition 2016
2. Modi P.N. "Irrigation, Water Resources, and Water Power Engineering", Standard Book House, New Delhi, 10th edition 2019.
3. Michael A.M., "Irrigation Theory and Practices",Vikas Publishing House Pvt Ltd, New Delhi, 2nd edition 2008
4. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi, 2005
5. Raghunath H. M. "Hydrology Principles, Analysis and Design", 3rd edition, New Age International, 2006.

NPTEL ONLINE SOURCE:

https://nptel.ac.in/courses/105/104/105104103/
https://nptel.ac.in/courses/126/105/126105010/

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QUANTITY SURVEYING AND CONTRACT MANAGEMENT			
Course Code	**20CV702**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**4:0:0**	**SEE Marks**	**50**
Total Hours	**50**	**Credits**	**04**

Course Learning Objectives:

This Course will enable students to

1. **Estimate** the quantities of different items of work by using Centre line method and Long wall- Short wall method to know the approximate construction cost of buildings.
2. **Explain** the specifications of Civil construction works.
3. **Find** the quantities and able to **calculate** the rates of items.
4. **Outline** the contract systems from the point of contractor's interest to avoid conflicts between client and contractors.
5. **Assess** contract and tender documents for various construction work.

UNIT – I

ESTIMATES:*Types, units of measurements, abstract, cost of materials and labour.*

BUILDING ESTIMATE: Methods of quantity extraction, cost of materials from Schedule of Rate (SR), preparation of detailed estimate for the load bearing structures using center line method and long wall-short wall method, preparation of detailed estimate of R.C.C structures.

18 Hours

UNIT – II

ESTIMATION OF: Manhole and septic tank.

SPECIFICATION: *Objectives, essentials*, general and detailed specification of common building items. **8 Hours**

UNIT – III

RATE ANALYSIS: Working out quantities and rates for earth work in different types of soils, P.C.C and R.C.C for different mixes, bricks and stone masonry, centering and form work for different RCC structural components *flooring, plastering and painting*. **8 Hours**

UNIT – IV

CONTRACT MANAGEMENT (Pre award):-Tendering Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD /NHAI). *Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture. Contract Forms: (source: PWD / CPWD /NHAI).* **8 Hours**

UNIT – V

CONTRACT MANAGEMENT(Post award): Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, *settlement of account or final payment, claims, Delay's and Compensation, Disputes and its resolution mechanism, Contract management and administration*.

8 Hours

Course Outcomes:

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

1. **Prepare** a detailed estimate for load bearing and RCC structures.
2. **Estimate** the rates for manhole and septic tank and **write** the general and detailed specification of common building items to the clients.
3. **Calculate** the quantities and **determine** the rate of items.
4. **Outline** the tender and contract documents for projects to avoid conflicts between client and contractors.
5. **Explain** the tender and contract terminologies as applied to civil works.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1						1					2	1	3
CO2	1	1								2			1	1	2
CO3	2	1						1					1	1	3
CO4	1					1		1		1			1	1	2
CO5	1					1		1		1			1	1	2

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

TEXTBOOKS:

1. Dutta B.N. (2016) "Estimating & Coasting in Civil Engineering", UBS Publishers' Distributors Ltd, New Delhi.
2. M. Chakraborti, (2010) "Estimating, Costing, specification and valuation in Civil Engineering." Published by author, Calcutta.
3. B.S. Patil, (2015) "Civil Engineering Contracts and Estimates", Universities Press (India) Pvt. Ltd.

REFERENCE BOOKS:

1. Rangwala S. C, (2014) "Estimating & specification", Charotar Publishing House Anand.
2. Birde G.S, (2014) "Text book of Estimating & Costing", Dhanpath Rai and Sons, New Delhi.
3. Martin Brook, (2008), "Estimating and Tendering for construction work", Butter worth-Heinemann Ltd, Oxford.
4. Robert L Peurifoy, Garold D. Oberlender, (2015) " Estimating Construction Costs" , Tata McGraw-Hill Publishers , New Delhi.
5. PWD Data Book, CPWD Schedule of Rates (SoR) and NH SoR – Karnataka FIDIC Contract forms.
6. B.S. Ramaswamy, (2016), "Contracts and their Management", Lexis Nexis Publishers.

NPTEL ONLINE SOURCE: https://nptel.ac.in/courses/105/103/105103093/

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DESIGN AND DETAILING OF STEEL STRUCTURAL ELEMENTS			
Course Code	**20CV703**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**4:0:2**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the behavior of different types of steel structures
2. **Identify** different types of sections used in steel construction
3. **Assess** the strength and stability of components of steel structures
4. Be aware of the Scale Factors, Sections of drawings
5. Draft the detailing of Steel Structural members

PART – A

1. Connections (Drawings to be prepared for given structural details): Bolted and welded-beam-beam, Beam-column, seated- stiffened and un-stiffened.
2. Columns (Drawings to be prepared for given structural details): Splices for columns of same and different sections. Lacing and battens.
3. Column Bases (Drawings to be prepared for given structural details): Slab base and gusseted base. *Limit State Method of design, strength of welds, strength of bolts.*

12 Hours

PART –B

Design and Drawing of i) welded plate girder ii) Roof Truss iii) Gantry girder
Section classification and failure checks.

27 Hours

Course Outcomes:

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

1. **Develop** and **detailing** of Beam-column, Bolted and welded connections.
2. **Develop** and **detailing** of columns connections and column bases.
3. **Design** and **detailing** of girders and truss.

TEXTBOOKS:

1. Krishnamurthy – Structural Design and Drawing (Steel Structures) CBS publishers, New Delhi 1985 (Part -3)
2. Krishna Raju .N " Structural Design and Drawing Reinforced Concrete and Steel" Universities Press, Hyderabad 2009
3. S. S. Bhavikatti "Design and Drawing of Steel Structures", I K International Publishing House Pvt. Ltd. 2013.

REFERENCE BOOKS:

1. N. Subramanian, "Design of Steel Structures", Oxford University Press, 2014
2. S. K. Duggal, "Limit State Design of steel structures", Tata McGraw Hill, 2013.
3. S. S. Bhavikatti, "Design of Steel Structures by Limit State Method as per IS 800: 2007", I.K. International Publishing House Pvt. Ltd., 2013.
4. IS – 800: 2007, Steel tables (to be supplied in examination).
5. Dr. V. L. Shah and Prof. Veena Gore, "Limit State Design of Steel Structures (IS 800: 2007)", Structures Publications, Pune, 2010.
6. Dr. Ram Chandra and Virendra Gehlot, "Limit State Design of Steel Structures", Scientific Publishers (India), 2013.

NPTEL ONLINE SOURCE: http://nptel.ac.in/courses/105106113/

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1					1	1				2	2	3
CO2	1	2	3					1	1				2	2	3
CO3	1	2	3					1	1				2	2	3

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

****SCHEME OF EXAMINATION-SEMESTER END EXAMINATION (SEE) ****:**
1. PART A –Answer any one full question out of two questions. Each carrying 30 marks.
2**. PART B**- Answer any one questions out of two questions. Each carrying 70 marks.
****SCHEME OF EXAMINATION-Continuous Internal Evaluation (CIE)****:**

1. Submission of AutoCAD drawings sheets and class performance-30 Marks.
2. MSE or Task -20 Marks.

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ENVIRONMENTAL ENGINEERING LAB			
Course Code	**20CV704**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:3**	**SEE Marks**	**50**
Total Hours	**26**	**Credits**	**01**

Course Learning Objectives:

This Course will enable students to

1. To learn different methods of water & waste water quality.
2. To conduct experiments to determine the concentrations of water and waste water.
3. To determine the degree and type of treatment.
4. To understand the environmental significance and application in environmental engineering practice.

LISTOFEXPERIMENTS

1. Determination of solids in sewage: Total solids, suspended solids, dissolved solids, volatile Solids, fixed Solids and settable solids.
2. Determination of Electrical conductivity.
3. Determination of Turbidity
4. Determination of Chlorides.
5. Determination of Alkalinity, Acidity and pH.
6. Determination of Calcium, Magnesium and Total Hardness.
7. Determination of Dissolved Oxygen.
8. Determination of BOD.
9. Determination of COD.
10. Determination of Available Chlorine in bleaching powder.
11. Determination of Chlorine Demand and Residual Chlorine.
12. Determination of Optimum dosage of Alumby Jartest.
13. Determination of Iron.
14. Determination of Sulphate.
15. Determination of Nitrates.

Course Outcomes:

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

1.Conductvariousqualitytests on water and waste water

2.Assessthesuitabilityofwaterfordrinking and irrigation purpose.

3.Assessthesuitabilityofwaterforconcretingworks.

4.AssessthesuitabilityofwaterforETPandSTP.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				L						L			L	H	
CO2	L			M				M					L	H	
CO3				M				L					L	H	
CO4				M				L					L	H	

Note: **L: Low M:Medium H:High**

REFERENCEBOOKS:

1. Manual of water and wastewater Analysis–NEERI Publication
2. Standard methods for examination of water and wastewater,(1995),American Public Health Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. Relevant IS codes (latest edition).
4. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science", McGraw-Hill Series in Civil and Environmental Engineering

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PROJECT PHASE I			
Course Code	**20CV705**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:3**	**SEE Marks**	**50**
Total Hours	**26**	**Credits**	**03**

Course Learning Objectives:

Preparing a project - brief proposal including

1. Problem Identification
2. Proposing different solutions for the problem based on literature survey
3. List of possible solutions including alternatives and constraints
4. A statement of system / process specifications proposed to be developed (Block Diagram/Flowchart)
5. Developing a mathematical model for solving the above problem (if any)
6. Finalization of system requirements and specification
7. Consolidated report preparation of the above project as approved by the guide.

Course Outcomes:

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

CO1. Identify a project based on literature survey and evaluate probable issues concerning it.

CO2. Formulate and present a plan for the problem solution with report.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	2	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	-	-	-	3	-	2	2	1	3	2

Note 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SEMINAR			
Course Code	**20CV706**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0:0:3**	**SEE Marks**	**50**
Total Hours	**26**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Assess the quality of topic and interpret results.
2. Present the topic using ICT skills and answer the queries.

Details:

1. Students has to search the topics from available literature or existing civil engineering projects which are recent and innovative in the field of construction. Select at least two or three topics and discuss with the Mentor and finalize one.
2. Prepare a detailed report highlighting the salient features and get it approved by the Mentor.
3. Prepare a power point presentation and present it in front of the Mentors and fellow students. There will be a discussion on the topic and the topic has to be defended by the student.

Course Outcomes:

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

CO1. Identify a research topic based on literature survey and evaluate probable issues concerning it.

CO2. Formulate and present the selected topic with report.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	2	2	3	2	3	2	3	2	3
CO2	2	3	2	3	3	-	-	-	3	-	2	2	1	3	2

Note 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

VIII Semester

PROJECT PHASE II			
Course Code	**20CV801**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P)	**0:0:3**	**SEE Marks**	**100**
Total Hours	**26**	**Credits**	**12**

The project work involves the following:

1. A presentation including the following:
2. Experimental observation, design and development.
3. Consolidated report preparation highlighting the experiment and design.

SCHEME OF EVALUATION: Project demonstration or presentation with Report and Viva voce
Total marks: 100 Marks

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

The evaluation of students is proposed to be done by internal faculty with active involvement of industrial personnel. The evaluation may be based on following criteria:

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

At the end of the project work course students are required to submit a working model (if any) and a report of detailed analysis and findings from their work.

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

CO1. Perform experiments /analysis, testing and develop a model/ product for proposed problem.
CO2. Prepare a technical report in standard format.
CO3. Present and defend the technical work.

Course Articulation Matrix:

Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	2	2	2	2	2	3	2	3	2	3	2
CO 2	3	3	-	3	1	-	-	3	3	3	2	3	3	2
CO3	2	2	3	3	2	2	2	1	2	2	2	2	3	2

1: Low 2: Medium 3: High

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INTERNSHIP			
Course Code	**20CV802**	**CIE Marks**	**100**
Teaching Hours/Week (L:T:P)	**0:0:3**	**SEE Marks**	**100**
Total Hours	**26**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Assess the understanding of field process of construction and interpret theoretical knowledge.
2. Present the topic using ICT skills and answer the queries.

Students have to undergo one month Internship in reputed Construction Company and get practical exposure in Civil Engineering. Students have to submit an internship report containing brief history of the Industry, nature of construction and the competitive advantage of the Industry. Further the report should include the objectives of the Industrial training, assignments completed in the Industry during training, innovative practices followed in the industry and the suggestions to the Industry on the existing unresolved problems. Last few sentences on summarizing what has been learned during the industrial training program, areas of improvement, usefulness of industrial training on future employment prospects, professional and ethical conduct and attainment of the objectives of Industrial training.

Procedure for the Evaluation of U.G Internship

1. Students should submit the reports of the Internship undergone along with the internship certificate to the respective mentor at the beginning of 8th Semester (The Final year project guides are mentors for internship report verification).
2. The Examination of internship will be carried out along with the university project viva-voce examination.
3. There will be 50 marks for CIE & 50 marks for viva-voce conducted during SEE.
4. This viva-voce examination will be conducted along with final year project viva-voce examination.
5. Degree will be awarded only after successful completion of Internship and viva-voce. Grade will be shown as either PP or NP in 8th Semester grade card.

Department Electives
1. Structures group Electives

DESIGN OF MASONRY STRUCTURES			
Course Code	**20CVE101**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Know about 'Masonry', its use, advantages and disadvantages
2. Have clear knowledge of different types of 'Masonry units', types and grades of 'Mortar' as per IS Code, properties of masonry units and mortar.
3. Know the strength of masonry unit and masonry prism, computation of permissible strength of masonry for different types of masonry structures considering factors like 'Effective height',' Effective length', 'Slenderness ratio' and 'Eccentricity ratio'.
4. Design different types of masonry structures selecting suitable masonry units and mortar using IS 1905 (revised in 2002) and SP 20.
5. Know about the use of (i) Reinforced Masonry, (ii) Composite Masonry (iii) Confined Masonry and (iv) 'In filled frames', their advantages and disadvantages.

UNIT – I

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION

Brick, stone and block masonry units – strength, modulus of elasticity, water absorption and uses.
Mortar: classification and properties, selection.
Defects and errors in masonry construction cracks in masonry, types, reasons for cracking, methods of avoiding cracks.
Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

15 Hours

UNIT – II

PERMISSIBLE STRESSES

Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.
Load considerations for masonry: walls carrying axial load, eccentric load with different eccentric ratios—walls with openings and free standing wall.
Design considerations: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action and lintels.

14 Hours

UNIT – III

Design of load bearing masonry walls for building up to 3storeys using IS 1905 and SP20 procedure.
Reinforced masonry and its application, flexural and compression elements of reinforced masonry,

shear walls.
Composite masonry walls, composite wall beam elements, infilled frames.

11 Hours

Course Outcomes:

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

1. **Explain** the types, properties, uses, defects, crack and its remedial measuresin masonry structures)
2. **Analyze** the emerging permissible compressive, tensile and shear stress and factors influencing them for masonry elements.
3. **Explain** permissible stresses and design criteria as per IS: 1905 and SP-20.
4. **Determine** the effective height of walls, columns, effective length, effective thickness of wall and factors affecting them.
5. **Analyze and design** load bearing masonry walls for buildings up to three stories using IS: 1905 and SP-20 and **understand** the concept of reinforced masonry.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1										1	2	
CO2	1	2	1										1	2	
CO3	1	2	3										1	2	
CO4	1	2	3										1	2	
CO5	1	2	3										1	2	2

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

1. Henry A. W., (1990), "Structural masonry", Macmillan Education Ltd.
2. Dayarathnam P., (1987), "Brick and reinforced brick structures", Oxford & IBH Publication.
3. M. L. Gambhir, Building and Construction Materials (2017), Mc Graw Hill education Pvt. Ltd.

REFERENCE BOOKS:

1. Sinha, B.P and Davies, S.R (1997), "Design of Masonry Structures", E & FN spon.
2. IS 1905-1987 (3rd revision), "Code of practice for structural use of unreinforced masonry", BIS, New Delhi.
3. SP 20 (S& T) 1991, "Hand book on Masonry Design and Construction (1st revision)", BIS, New Delhi.
4. R E Klingner 2010 Masonry structural design, McGrawHill Companies, Inc. New York, pp 588.
5. National Building Code of India 2016 Vol.1, Part 6 Section 4 Structural Design – Masonry.

NPTEL SOURCE:

https://nptel.ac.in/courses/105/106/105106197/

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MATRIX METHODS OF STRUCTURAL ANALYSIS			
Course Code	**20CVE102**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students:

- **(a)** To **define** the flexibility and **development** of flexible matrix for defined coordinates for structural system.
- **(b)** To **analyze** the trusses, continuous beams and rigid plane frames by flexibility matrix method.
- **(c)** To **define** the stiffness and **development** of stiffness matrix for the defined coordinates for structural system.
- **(d)** To **analyze** the trusses, continuous beams and rigid plane frames by stiffness matrix method.
- **(e)** To **summarize** the direct stiffness method, local and global coordinates and **analyze** the trusses, continuous beams and rigid frames.

UNIT – I

Introduction to flexibility method, Element flexibility matrix, Principle of contragradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix. Matrix determination of the displacement vector, Determination of member forces. *Analysis of trusses by flexibility method using force transformation matrix.*
Analysis of axially rigid continuous beams and *rigid plane frames with axially rigid members by flexibility method using Force transformation Matrix*.

16 Hours

UNIT – II

Fundamentals of the stiffness method, equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, *Truss analysis by stiffness method using Displacement Transformation Matrix.*Continuous Beam and *rigid frame analysis with axially rigid members by stiffness method using displacement transformation matrix.*

15 Hours

UNIT –III

Introduction to direct stiffness method, local and global co-ordinate system, transformation of variables, transformation of the member displacement matrix, force matrix, stiffness matrix, transformation of the stiffness matrix of the member of a truss, transformation of the stiffness matrix of the member of the rigid frame, overall stiffness matrix, boundary conditions, computation of internal forces.
Analysis of pin jointed truss, rigid plane frames and continuous beams by direct stiffness method.

9 Hours

NOTE:

1. Determination of member forces, displacement and reactions using matrices only
2. Number of indeterminacy shall be ≤ 3 (for paper setting)

Course Outcomes:

At the end of the course, students will be able to

1. **Define** flexibility matrix and **develop** flexibility matrix for assigned coordinates.
2. **Determine** the member forces in trusses, **analyze** continuous beams and rigid plane frames by flexibility matrix method.
3. **Define** stiffness matrix and **develop** stiffness matrix for assigned coordinates.
4. **Determine** the member forces in trusses, **analyze** continuous beams and rigid plane frames by stiffness matrix method
5. **Analyze** the trusses, continuous beams and rigid plane frames by direct stiffness method.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2										1	2	3	
CO2	2	3										1	3	1	2
CO3	1	2										1	2	3	
CO4	2	3										1	3	1	2
CO5	2	3										1	3	1	2

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

1. W. Weaver J.M. Gere, (1986), "Matrix Analysis of framed structures", CBS publishers and Distributors.
2. S Rajshekharan. G Sankara Subramanian, (2010), "Computational Structural Mechanics", PHI.

REFERENCE BOOKS:

1. L. S. Negi and R S Jangid, (1997), "Structural Analysis", Tata Mc Graw-Hill.
2. H C Martin, (1996), "Introduction to Matrix Methods of Structural Analysis", International Text Book Company.
3. R. Vaidyanathan, P.Perumal, (2007), "Comprehensive Structural Analysis– Volume I", Laxmi Publications (P) Limited.
4. S.S.Bhavikatti, (2013), "Matrix Methods of Structural Analysis", I.K. International Publishing House Pvt. Ltd.

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THEORY OF ELASTICITY

Course Code	**20CVE103**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Understand the concept of plane stress and plane strain problems.
2. Develop compatibility equations for strains and strain measurements.
3. Formulate and solve two dimensional problems in case of bending and develop Airy's stress function equations
4. Derive compatibility equations in polar coordinates.
5. Analyze the stress distribution in axisymmetric problems and the effect of circular hole on the stress distribution.

UNIT – I

Introduction to elasticity :*stress and strain relations,* mathematical theory continuum, stress and strain at a point, constitutive laws, generalized Hooke's law, strain-displacement relations, stress tensor, stress transformation, stress invariants, strain tensor, strain invariants, plane stress and plane strain, principal stresses and strains.

Analysis of strain: F*ormation and solutions to differential equations,* measurement of surface strains – strain rosettes, compatibility concept – need and physical significance, compatibility equation in terms of strains.

15 Hours

UNIT – II

Two dimensional problems in Cartesian coordinates: compatibility equations for plane stress and plane strain cases, Airy's stress function – Polynomial stress functions. *Bending theory of beams- assumptions, bending stresses.* Bending of a cantilever beam subjected to end load and UDL, Sim ply supported beam subjected to UDL, Displacements in Cantilever and simply supported Beams.

Two dimensional problems in polar coordinates: Strain-displacement relations – Equations of equilibrium, Compatibility equation, Stress function.

14 Hours

UNIT – III

Axisymmetric Stress Distribution *stress - strain relations for thin and thick cylinders, radial and circumferential stress distribution,* Thick discs and cylinders, Rotating discs.

Circular Hole in a plate- Effect on Stress Distribution subjected to Tension, compression and shear, Stress concentration factor. **11 Hours**

Course Outcomes:

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

1. **Illustrate** mathematical representation of stresses, strains in continuum and **analyze** the beams for plane stress, plane strain conditions
2. **Formulate** compatibility equation in terms of strains and **measure** the strains in strain rosettes.
3. **Develop** the differential equations and **Solve** two dimensional problems in rectangular coordinates
4. **Develop** the differential equations and **solve** two dimensional problems in polar coordinates.
5. **Determine** the stress distribution under axisymmetric loading in cylinders, rotating discs and **analyze** the effect of circular hole in a plate

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

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Timoshenko S.P. and Goodier J.N. “Theory of Elasticity”, International Student’s Edition, Mc Graw Hill Book Co., Inc., New Delhi,2005.
2. Wang P.C., “Applied Elasticity”, 2005.

REFERENCE BOOKS:

1. Valliappan C., (1981), “Continuum Mechanics – Fundamentals”, Oxford & IBH Publishing Co. Ltd, New Delhi.
2. Srinath L.S., (2009), “Advanced Mechanics of Solids”, Tata Mc Graw Hill Publications Co. Ltd., New Delhi.
3. Venkataraman& Patel, “Structural Mechanics with introduction to Elasticity and Plasticity”, Mc Graw Hill Book Inc., New York, 2009.
4. Dr. Sadhu Singh, ‘Theory of Elasticity”, Khanna Publishers, Delhi, 2009.
5. T. G. Seetharam & L. Govindaraju, “Applied Elasticity”, Interline publishing.

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DESIGN OF PRESTRESSED CONCRETE STRUCTURES			
Course Code	**20CVE105**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Summarize** the concept, materials and types of pre-stressing.
2. **Analyse** the section for flexure and losses of pre-stress in concrete under different loading condition.
3. **Explain** deflection and analyse pre-stressed concrete members.
4. **Analyse** the section for flexure, shear in reference with IS code recommendations
5. **Solve** the permissible stress, Pre-stressing force and Eccentricity in a pre-tensioned and post-tensioned section.

UNIT – I

MATERIALS: High strength concrete and steel, stress-Strain characteristics and properties, *Pre-tensioning and Post-tensioning systems, Tensioning methods and End Anchorages*.

Basic principles of pre stressing: Fundamentals, *Load Balancing, Stress Concepts, Centre of Thrust.*

ANALYSISOFSECTIONSFORFLEXURE: *Stresses in concrete* due to pre-stress and loads, Cable Profiles.

LOSSESOF PRE-STRESS: *pre-tensioning and post tensioning*, determination of jacking force**.**

16 Hours

UNIT – II

DEFLECTIONS: Short term and long-term, *Methods of reducing deflection, Deflection limits as per IS: 1343, elastic deflections under transfer loads* and due to different cable profiles, effect of creep, load verses deflection curve.

LIMIT STATE OF COLLAPSE: *Flexural and Shear strength of sections, IS Code recommendations,* shear resistance of sections, shear reinforcement, limit state of serviceability – *control of deflections and cracking.*

16 Hours

UNIT – III

DESIGNOFBEAMS: pre-tensioned and post-tensioned symmetrical and asymmetrical sections. *Permissible stress, prestressing force and eccentricity*.

8 Hours

Course Outcomes:

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

1. **Summarize** the concept, basic materials and types of pre-stressing systems.
2. **Solve** the stresses and losses in the pre-stressed members.
3. **Explain** Short-term and Long-term deflections and **Evaluate** the deflection under given loading condition
4. **Analyse** the section for flexure, shear under limit state of collapse and serviceability for pre-stressed concrete members.
5. **Evaluate** pre-tensioned and post tensioned beam components for permissible stress, Pre-stressing force and Eccentricity.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1												2		
CO2	2		2										2		
CO3		3	2					2					2	2	
CO4		3						2					2	2	
CO5		2	2					2					2	2	

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

TEXTBOOKS:

1. N. Krishna Raju, "Pre-stressed Concrete", 6th edition, Tata McGraw Hill Education (India) Pvt. Ltd, Chennai 2018.
2. Praveen Nagarajan, "Pre-stressed Concrete Design", Pearson Education, 2013

REFERENCE BOOKS:

1. T.Y. Lin and Ned H. Burns, "Design of pre-stressed concrete structures", 3rd edition, John Wiley & Sons, New York, 2015.
2. N.C. Sinha & S.K. Roy, "Fundamental of pre-stressed concrete", 2011, S. Chand Limited.
3. IS: 1343: 2012 "Pre-Stressed Concrete - Code of practice (To be provided in the examination)
4. P. Dayarathnam, "Pre-stressed Concrete",6th edition, Oxford and IBH Publishing Co, 2018.
5. N. Rajgopalan, "Pre-stressed Concrete", Alpha Science International, 2005.

NPTELONLINESOURCE:

https://nptel.ac.in/courses/105/106/105106117/

http://www.nptelvideos.in/2012/11/prestressed-concrete-structures.html

STRUCTURAL DYNAMICS			
Course Code	**20CVE104**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Comprehend** principles of vibration and elementary components of a vibratory system.
2. **Comprehend** the behaviour of engineering structures subjected to dynamic forces.
3. **Analyze** undamped and damped free vibration of a single degree of freedom system
4. **Analyze** undamped and damped forced vibration of a single degree of freedom system
5. **Analyze** MDOF systems.

UNIT – I

Introduction to Structural Dynamics: Laws of motion, D'Alembert's Principle, Stiffness of springs in series and parallel, Mass moment of inertia, Simple harmonic motion, Vibration – Types, Parts of a vibrating system, *Degrees of freedom, Fundamentals of free vibration*.

Free vibration: Undamped and damped (single degree of freedom system), Logarithmic decrement.

15 Hours

UNIT – II

Forced Vibration: Undamped and damped (single degree of freedom system) – Steady state response, Dynamic magnification factor, response to harmonic loading, Rotational and reciprocating unbalance, Force transmissibility, Force transferred to foundation, *Forced vibration and its effect on machine foundation.*

14 Hours

UNIT – III

Multi Degree of Freedom (MDOF) Systems: Response to Free and forced vibration – natural frequencies, *determination of Eigen values and Eigen vectors* – Orthogonality principle, Shear buildings modeled as MDOF systems. Forced undamped and damped vibration of shear buildings – Modal superposition method.

11 Hours

Course Outcomes:

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

1. **Explain** the principles of vibration and elementary components of a vibratory system.
2. **Discuss** the behavior of engineering structures subjected to dynamic forces.
3. **Analyze** undamped and damped free vibration of a single degree of freedom system.
4. **Analyze** undamped and damped forced vibration of a single degree of freedom system.
5. **Analyze** the given MDOF system.

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

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Mukhopadhya M. "Vibrations, Dynamics and Structural Systems" Oxford IBH Publications, 2000
2. Mario Paz. "Structural Dynamics" CBS Publishers, 2004

REFERENCE BOOKS:

1. Clough & Penzien. "Dynamics of Structures" McGraw Hill Publishers 2004
2. Anil K Chopra. "Dynamics of Structures" PHI Publishers 2006
3. S. R. Damodarasamy and S. Kavitha, Basics of Structural Dynamics and Aseismic Design, PHI Learning Private Limited, New Delhi, latest print 2015.

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EARTHQUAKE RESISTANT STRUCTURES			
Course Code	**20CVE201**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives

This Course will enable students

1. To provide the basic knowledge of Earthquake and seismic zoning of India.
2. To study the performance of buildings due to irregularity during Earthquake
3. To apply the knowledge of mathematics, science and engineering to analyze linear structural systems subjected to earthquake forces.
4. To study the detailing of Earthquake resistant RCC buildings and to gain basic knowledge on geotechnical earthquake engineering.
5. To study the code provisions for Earthquake resistant masonry and earthen buildings. And also to apply the knowledge of mathematics, science and engineering to analyze linear structural systems of masonry buildings.

UNIT – I

Introduction:

Engineering Seismology – *Internal structure of earth*, *Geology of Earth*, Definitions, Classification of Earthquakes, Causes of Earthquakes, Seismic waves, Theory of plate tectonics, Elastic rebound theory, Intensity and Magnitude of earthquake, Seismic measuring equipment's.

Seismic Response of Buildings:

Effect of Structural Irregularities on seismic performance of RC buildings. Vertical irregularity and plan configuration problems, Seismo resistant building architecture –lateral load resistant systems, Building characteristics.

15 Hours

UNIT – II

Earthquake Resistant Design Concepts:

Seismic zones of India, Design Philosophy and principle of Earthquakes Resistant Design, Guidelines for Earthquakes Resistant Design. Equivalent static force method-Assumptions, evaluation of Earthquake forces as per IS: 1893-2016. Dynamics analysis procedure- Response spectrum Method. Liquefaction–Causes and remedial measures.

15 Hours

UNIT - III

Seismic Analysis of Masonry Buildings –*Lessons learnt from past earthquakes on the performance of masonry and earthen buildings*. Elastic properties of structural masonry, Failure of masonry building- Causes, failure modes. Steps for improving seismic performance of masonry buildings- Design considerations, provisions of IS: 4326-1993 for design of masonry buildings.

10 Hours

Course Outcomes:

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

1. **Acquire** knowledge on basic concepts of earthquake engineering and seismic zones of India.
2. **Explain** the suitability ofbuilding plan and configuration for an earthquake prone area.
3. **Determine** earthquake forces in a building as per IS 1893:2016 provisions and **analyze** the failure of RC buildings.
4. **Analyze** the structure using dynamic analysis procedureand **acquire** knowledge of geotechnical earthquake engineering.
5. **Analyze** and **design** the masonry buildings subjected to seismic forces.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2			1	1						1	2	
CO2	1	2	3			1	1						1	2	
CO3	1	2	3			1	1						1	2	
CO4	1	2	3			1	1						1	2	
CO5	1	2	3			1	1						1	2	

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Jaikrishna et al., Elements of Earthquake Engineering, South Asia Publishers, New Delhi. 1st edition December 2000, reprinted 2014.
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, PHI, India.2nd edition 2015.
3. Chopra, A.K., Dynamics of Structures, Prentice-Hall of India Pvt. Ltd. New Delhi. 1st edition 2011.
4. S K Duggal, Earthquake Resistant Design of Structures, Oxford University press, 2007.

REFERENCE BOOKS:

1. Clough, R.W. and Penzien J, Dynamics of Structures, McGraw Hill Book Co. New York 3rd edition 2003.
2. S. R. Damodarasamy and S. Kavitha, Basics of Structural Dynamics and Aseismic Design, PHI Learning Private Limited, New Delhi, latest print 2015.
3. Biggs, M., An Introduction to Structural Dynamics, McGraw Hill Book Co. New York, January 1964.
4. PAZ M., Structural Dynamics, CBS Publishers, New Delhi. July 1997.

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DESIGN OF BRIDGES			
Course Code	**20CVE202**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

At the end of the course the students will be able to:
1) Learn the components and classification of bridges.
2) Understand the IRC codal provisions for bridge design.
3) Learn the concepts in analyzing & designing the pipe and slab culverts.
4) Understand the analysis & design of slab and girder of T-beam bridges.
4) Understand the importance of bearings and joints in bridges.

UNIT – I

INTRODUCTION TO BRIDGES: History, components, *classification, selection of site,* linear waterway, scour, afflux.
Foundation: types of foundation (Pile, Raft, Well and Caisson – Brief Description only) cofferdam. Substructure: types of abutment, piers, wing walls– forces acting on them and empirical designs – bank connection and protection works
BRIDGE LOADING STANDARDS: Loads to be considered while designing road bridges as per IRC (Indian Road Congress), impact factors, Indian Railway Bridge loading standards.

16 Hours

UNIT - II

CULVERTS: Computation of water discharge, design of pipe culverts and *slab culverts* for IRC class AA and class-A loading.
T-BEAM BRIDGES: Pigeaud's method for computation of interior slab moments, design of interior slab panel of T-beam bridge for IRC class AA tracked vehicles, courbon's method for computation of moments in girders.

16 Hours

UNIT – III

BEARINGS, JOINTS AND APPURTENANCES
Importance of bearings, bearings for slab bridges, bearings for girder bridges, *expansion bearings, fixed bearings, elastomeric bearings, bearings for skew bridges*, joints and appurtenances.

8 Hours

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

1. **Explain** the components of bridges and **classify** them.
2. **Explain** the IRC codal provisions for road and railway bridge design.
3. **Estimate** the water discharge, **analyse** and **design** the pipe and slab culverts as per IRC 6 : 2016 part II, IS 458 : 2003, IS 456 : 2000 and IRC 21 : 2000.
4. **Analyse** and **Design** the interior slab panels and girders of T Beam bridges as per pigeaud's method and courbon's method respectively using IS 456: 2000 and IRC 6: 2016 part II.
5. **Explain** the importance and types of bearings and joints in bridges.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1											1		1	
CO2	2											1	1	2	
CO3	1	2	3					1				1	3	2	1
CO4	1	2	3					1				1	3	2	1
CO5	1											1	1	2	

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

d) Johnson Victor, *"Essentials of bridge Engineering"*, Sixth edition, Oxford and IBH publications, 2007

e) Krishna Raju, *"Design of Bridges"*, Fourth edition, Oxford and IBH publications, 2009

REFERENCE BOOKS:

1) Jagadish T. R. & Jayaram M.A., "Design Of Bridge Structures", Second Edition, Prentice Hall Of India Private Limited, 2004

2) Ponnuswamy. S.' 'Bridge Engineering', Tata Mcgraw-Hill Publishing Co.' New Delhi, 2008.

3) M. G. Aswani, V. N Vazirani & M. M. Ratwani, 'Design of Concrete Bridges' Second Edition, Khanna Publishers,2013

4) S. P. Bindra, 'Principles and Practice of Bridge Engineering', Ninth Edition, Dhanpat Rai publications,2016

NPTEL ONLINE COURSE LINK:

Nptel.ac.in/courses/105105165.

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ADVANCED RCC DESIGN OF STRUCTURES			
Course Code	**20CVE203**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Analyze** of slabs by yield line approach and **Design** flat slab.
2. **Analyze** and **design** of grid slabs by approximate method.
3. **Design** the continuous beams with moment redistribution
4. **Analyze** and **design** Silos and Bunkers
5. **Understand** the behavior of shells and folded plates.

UNIT – I

Analysis of Slabs: *Boundary conditions and yield line pattern at failure*, Yield line analysis of slabs with equilibrium method and virtual work method.
Design of flat slabs by Direct Design Method (with drops).

15 Hours

UNIT – II

Design of grid floors
Design of continuous beams with redistribution of moments.

15 Hours

UNIT – III

Silos and Bunkers: *Components*, design using Janssen's Theory and IS: 456-2000 Method
Shell and folded plate roofs – *Types,* forms and structural behaviour.

10 Hours

Course Outcomes:

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

1. **Analyze** slabs by yield line approach.
2. **Design** flat slab by direct method.
3. **Analyze** and **design** grid slabs by approximate methods.
4. **Design** the continuous beams with moment redistribution.
5. **Analyze** and **design** silos and bunkers and **explain** the behavior of shells and folded plates.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1									2	2	
CO2	2	2	3	1									2	2	2
CO3	2	2	3	2									2	1	2
CO4	2	2	3	2									2	1	2
CO5	2	2		2							1		2	2	

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Raju N K "Advanced Reinforced Concrete Design", CBS Publisher
2. Dr. B. C. Punmia et.al, "Reinforced Concrete Design",Vol – II, Lakshmi Publications

REFERENCE BOOKS:

1. Jai Krishna and Jain "Plain and Reinforced Concrete Vol. II" Nem Chand Bros. Roorkee
2. Varghese P.C "Advanced Reinforced Concrete Design" Prentice Hall of India – 2007
3. Devadas Menon and Unnikrishnan. P "Reinforced Concrete Structures"
4. Varghese P. C. "Limit State Design of Reinforced Concrete Vol. II" Prentice Hall of India (P) ltd, New Delhi.

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FINITE ELEMENT METHOD OF ANALYSIS			
Course Code	**20CVE204**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Get an idea how strain energy concept can be used for **FEA** method
2. **Analyse** the components by 2D formulation and element discretization.
3. **Demonstrate** numerical evaluation of stiffness to find stresses
4. Study the concepts of Isometric and Jacobian matrix.
5. Finding solutions by numerical Integration.

UNIT – I

Finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions, *Theory of elasticity concepts, Energy principles.*

15 Hours

UNIT - II

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, *Finding solutions for Static Condensation of nodes.*

15 Hours

UNIT – III

Isoparametric concepts: isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, *Finding solutions to Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.*

10 Hours

Course Outcomes:

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

1. **Explain** thebasic concept of energy principles and steps involved in FEA method and **Analyze** 2D formulation for 4 and 8 noded quadrilateral elements.
2. **Determine** static condensation of nodes**.**
3. **Analyze** and **Evaluate** element stiffness and stresses by numerical approach.
4. **Explain** Isoparametric concepts applying Jacobian transformation matrix and Stiffness Matrix.
5. **Analyze** and **Find** solutions for one, two and three dimensional elements by Numerical integration.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3											2	3	
CO2	2	3											2	3	
CO3	2	3											2	3	
CO4	2	3											2	3	
CO5	2	3											2	3	

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

1. Krishnamoorthy C.S., “Finite Element analysis” -Tata McGraw Hill, 2015
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,2014
3. Cook R D et.al., “Concepts and applications of Finite Element analysis ”, John Wiley.2013

REFERENCE BOOKS:

1. Daryl L Logan, “A first course on Finite element Method”, Cengage Learning 2011
2. Bathe K J - “Finite Element Procedures in Engineering analysis”- Prentice Hall .2016

NPTEL ONLINE SOURCE:

- https://nptel.ac.in/courses/112/104/112104193/
- https://nptel.ac.in/courses/112/104/112104116/

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NUMERICAL METHODS IN CIVIL ENGINEERING

Course Code	**20CVE205**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:

1. Understand different numerical techniques to solve civil engineering problems
2. Understand different methods solving simultaneous and transcendental equations
3. Understand various numerical integration techniques for computing slope and deflections of determinate beams
4. Explain numerical methods for solving ordinary differential equations
5. Explain finite difference techniques

UNIT – I

INTRODUCTION, SCOPE AND IMPORTANCE OF THE SUBJECT:

Solution of linear simultaneous equations by the following methods:
(i) Gaussian elimination, (ii) Gauss-Jordan matrix inversion, (iii) Gauss-Siedel, (iv) Factorization. Application of the above methods in solving problems by slope-deflection method applied to beams and frames, problems in construction planning.
Finding the roots of nonlinear algebraic and transcendental equations by (i) Bisection method, (ii) Newton-Raphson method. Application of the above methods to solve problems in structural engineering, hydraulics, geotechnical engineering and environmental engineering.

16 Hours

UNIT – II

NUMERICAL INTEGRATION TECHNIQUES: (i) Trapezoidal rule, (ii) Simpson's one third rule. Application of the above methods for computing the area of BMD for statically determinate beams. Computation of slope and deflection in statically determinate beams by New Marks method.
Solution of ordinary differential equations by (i) Euler's method, (ii) 4^{th} order Runge-Kutta method. Application of the above methods to solve civil engineering problems.

15 Hours

UNIT – III

Finite difference techniques to solve problems in structural mechanics. Analysis of statically determinate and indeterminate beams.

9 Hours

Course Outcomes:

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

1. **Develop** the linear equations in solving problems related to Civil Engineering and **solve** them by different techniques
2. **Determine** the Eigen values and Eigen roots for the given data.
3. **Find** the area of bending moment diagram for different problems on statically determinate structures and computing slope and deflection of statically determinate structures by adopting numerical integration techniques
4. **Formulate** and **solve** differential equations for Computation of slope and deflection
5. **Analyze** the determinate and indeterminate beams using finite difference method

TEXTBOOKS:

1. Chapra S.C. &R. P. Canale, "Numerical Methods for Engineers", McGraw Hill, 2014.
2. N. Krishna Raju & K. U. Muthu, "Numerical Methods in Engineering Problems", MacMillan India Limited, 2005.

REFERENCE BOOKS:

1. Iqbal H. Khan & Q. Hassan, "Numerical Methods for Engineers and Scientists", Galgotia, New Delhi, 2010.
2. Pallab Ghosh, "Numerical Methods using Computer Programs in C", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Schilling, "Numerical methods for Engineers using MATLAB and C", I Edition, Thomson Publications, 2009.
4. S. Rajasekaran, "Numerical Methods in Science and Engineering- A Practical Approach", S. Chand and Company Limited, New Delhi, 2013.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1									1	1	
CO2	3	2		1									1	1	
CO3	3	2		1									1	1	
CO4	3	2		1									1	1	
CO5	3	2		1									1	1	

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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2. Geotechnical and Transportation Group Electives

GROUND IMPROVEMENT TECHNIQUES			
Course Code	**20CVE301**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Know the objectives of soil improvement, classification of ground improvement techniques and to select the best method or technique for the existing condition.
2. Know 'Hydraulic modification', its aim, principle and techniques such as gravity drain, lowering of water table, multistage well point, vacuum dewatering etc.
3. Define chemical modification, its aim, special effects, different methods or techniques.
4. Have a clear knowledge regarding "Grouting", effects of grouting, Chemicals and materials used, types of grouting. Grouting procedure and applications of grouting.
5. Know the concepts and use of recent methods in Soil reinforcement.

UNIT – I

GROUND IMPROVEMENT: Definition, Objectives of soil improvement. Classification of ground improvement techniques. *Factors to be considered in the selection of the best soil improvement* technique.

MECHANICAL MODIFICATION: Type of mechanical modification, compaction, Principle of modification for various types of soils. Effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil, micaceous soil. Effect of compaction on engineering behaviour like Compressibility, Swelling and Shrinkage, Permeability, relative density, liquefaction potential. *Field compaction - static, dynamic, impact and vibratory type*. Specification of compaction. Tolerance of compaction.

15 Hours

UNIT – II

HYDRAULIC MODIFICATION: Definition, aim, principle, techniques, gravity drain, lowering of water table, multistage well point, vacuum dewatering, design of dewatering system including pipe line *effects of dewatering*. Drainage of slopes, preloading, vertical drains, numerical problems on design of vertical drains, sand drains, Prefabricated vertical drainssand drains, Electro osmotictic dewatering.

CHEMICAL MODIFICATION: Definition, aim, special effects, and methods, Techniques - sandwich technique, admixtures, cement stabilization. Hydration - effect of cement stabilization on permeability, Swelling and shrinkage. *Criteria for Lime stabilization, cement stabilization. - Suitability, process, special effects, criteria. Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid*. Fly ash in cement stabilization, Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

14 Hours

UNIT – III

GROUTING: Introduction, Effects of grouting, Chemicals and materials used, Types of grouting, Grouting procedure and Applications of grouting.
MISCELLANEOUS METHODS (only Concepts): Introduction, Soil reinforcement. Thermal methods, *Ground improvement by confinement - Crib walls, Gabions &Mattresses, Anchors, Rock bolts and soil nailingGeo-synthetics in soil modification, Micro piles. Case studies.*

12 Hours

Course Outcomes:

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

1. **Understand** the objectives, necessity and scope of ground improvement techniques
2. **Identify** and Implement the various methods of mechanical modifications in the soil improving techniques.
3. **Explain** the methods involved in ground modification by hydraulic methods.
4. **Identify** and apply the chemical modifications techniques in field conditions.
5. **Explain** techniques related to grouting and other miscellaneous soil reinforcement techniques.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1			1							1	2	2	
CO2	1	2			1		1					1	2	2	
CO3	1	2			2	1	1					1	2	2	
CO4	1	2			2	1	1					1	2	2	
CO5	1	2			2	1	1					1	2	2	

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

TEXTBOOKS:

1. Koerner. R.M. “Construction and Geotechnical Methods in Foundation Engineering”, Prentice Hall, New Jersy, 3rd Edn. 2002.
2. Purushoptham Raj., P. “Ground Improvement Techniques” Tata McGraw Hill, New Delhi, 2005.

REFERENCE BOOKS:

1. Manfred Hausmann., “Engineering Principles of Ground modification”. McGraw-Hill Ryerson, Limited, 1990
2. Colin, J.F.P. (1988) “Earth Reinforcement and Soil Structures”.
3. Ingles, C.G. and Metcalf, J.B. (1956), Soil Stabilization- Principle and Practice.
4. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

INTERNET SOURCES:

- https://nptel.ac.in/courses/105/108/105108075/
- http://www.cdeep.iitb.ac.in/webpage_data/nptel/civil%20engineering/foundation_engineering/course_home36.1.html

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TRAFFIC ENGINEERING			
Course Code	**20CVE302**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. Understand the fundamentals of traffic engineering, scope and its uses in the actual field condition.
2. Understand the significance of various traffic studies as per IRC guidelines.
3. Understand the flow theories and its probabilistic approach in connection with traffic engineering.
4. Acquire the knowledge of traffic signals design and other traffic regulatory methods as per IRC.
5. Impart the basic knowledge on traffic rotary, street lighting, arboriculture and intelligent transport system.

UNIT – I

Introduction to Traffic Engineering: *Scope*, road user and vehicle characteristics- static and dynamic, *reaction time of driver*.

Traffic parameter Studies and Analysis: *Objectives*, method of study- definition, data collection and analysis(traffic volume, spot speed, origin and destination, speed and delay), parking- on street and off street parking, accidents- *causes*, analysis and *measures.*

16 Hours

UNIT – II

Traffic Flow Theories: Green shield theory, Goodness of fit-correlation and regression analysis (linear only), Queuing theory, car following theory, Traffic forecast- simulation technique.

Traffic Regulation and Control: *Controls-Driver, Vehicle and Road*, Traffic Regulations- One Way Streets, *Traffic Signs*, *Road Markings*, Traffic signals- types, design principles (Webster's and IRC Method).

15 Hours

UNIT – III

ROAD INTERSECTIONS AND MANAGEMENT: Road intersection-Importance, classification, Rotary design, *Highway lighting, Road side Arboriculture*, Intelligent Transport system.

9 Hours

Course Outcomes:

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

1. Explain the Scope and characteristics of traffic engineering.
2. Illustrate the importance and methods in Traffic studies.
3. Summarize the Traffic flow theories and explain the importance.
4. Apply the design principles of traffic signals and outline the traffic regulation measures.
5. Design the rotary intersection and explain the importance of highway lighting, arboriculture and ITS.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1				1	1						2	1	
CO2	2	3	2			1	1						3	2	
CO3	3	2				1	1						2	1	
CO4	2	2	3			1	1						2	2	1
CO5	3	2	3			1	1						2	2	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Khanna S.K, C.E.G Justo & Veeraraghavan A. “Highway Engineering”, Nemchand & Bros, Roorkee. (2014) (10th Revised Edition)
2. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2012).

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2. Kadiyali L. R., Lal. N.B, “Principles and Practices in Highway Engineering”, Khanna Publishers, New Delhi. 7th Revised Edition. (2013).
3. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt Ltd, New Delhi. (2011)
4. Relevant IRC codes published by Bureau of Indian Standards, New Delhi.
5. Handbook for Roads and bridges – MORTH, New Delhi.(2009)

NPTEL SOURCES:

- https://nptel.ac.in/courses/105/105/105105107/

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HIGHWAY GEOMETRIC DESIGN			
Course Code	**20CVE303**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. Understand the different road design elements factors as per IRC Standards.
2. Acquire the knowledge in different cross-sectional elements of highway.
3. Understand and calculate the different sight distances, set back distance.
4. Understand the elements and calculate the length of horizontal and vertical alignment.
5. Identify different intersection and design the traffic rotary intersections and drainage systems.

UNIT – I

INTRODUCTION: *Objectives, requirements*, design control factors: topography, design speed, design vehicle, traffic capacity, volume, environment and other factors - IRC specifications, PCU concept for design.

CROSS SECTION ELEMENTS: Pavement surface characteristics –friction, skid resistance, pavement unevenness, light reflecting characteristics, camber: *objectives*, types, methods, pavement width carriageway, kerb, medians, shoulders, foot paths, parking lanes, service roads, cycle tracks, driveways, *guard rails, width of formation, right of way*, design of road humps as per IRC Specification. **16 Hours**

UNIT – II

SIGHT DISTANCES: Factors and problems: stopping and overtaking, at intersections, set back distances at curves.

HORIZONTAL AND VERTICAL ALIGNMENT: Horizontal alignment: *objectives, requirements*, design elements, super elevation, extra widening of pavements at curves, transition curve: types, evaluating length; vertical alignment*: gradient*, design criteria, types, design of summit and valley curves, design standards for hill roads.

15 Hours

UNIT – III

INTERSECTION DESIGN: *Types*, elements, design considerations of at-grade intersection, grade separations and interchanges, rotary and its design only.

HIGHWAY DRAINAGE:*Importance, Requirements of surface and subsurface drainage*, design of cross sections and filter material.

9 Hours

Course Outcomes:

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

1. Explain the road design control factors as per IRC guidelines.
2. Explain the road surface characteristics, road side amenities and illustrate the design aspects of road hump as per IRC guidelines.
3. Determine the sight distances and set back distance at highway curves.
4. Design the horizontal, vertical alignment elements in highway and hill roads.
5. Illustrate the types of intersection, highway drainages and design traffic rotary, highway drainage cross section and filter material.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2										1	1	1
CO2	2	2	2										1	2	1
CO3	3	2	3										2	3	2
CO4	3	2	2										1	2	2
CO5	3	3	3										2	3	3

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Khanna S.K, C.E.G Justo & Veeraraghavan A. “Highway Engineering”, Nemchand & Bros , Roorkee.(2014) (10th Revised Edition)
2. Kadiyali L. R., Lal. N.B, “Principles and Practices in Highway Engineering”, Khanna Publishers, New Delhi. 7th Revised Edition. (2013).

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).
2. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2011).
3. Relevant IRC codes published by Bureau of Indian Standards, New Delhi.
4. Handbook for Roads and bridges – MORTH, New Delhi.(2001)

NPTEL ONLINE SOURCES:

- https://nptel.ac.in/courses/105/105/105105107/

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EARTH RETAINING STRUCTURES			
Course Code	**20CVE304**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Know about types of retaining wall, forces acting on them and possible modes of failure of each type.
2. Understand how to analyze stability of different types of retaining wall, and to study different types of sheet pile walls and how to design them under different soil conditions.
3. Differentiate between cantilever sheet pile wall and anchored sheet pile wall with reference to the design and construction for given field conditions.
4. Study and understand lateral earth pressure distribution on sheeting of braced system in different soil types.
5. Study different components of braced systems, their selection and design them for given soil and depth of excavation. Also, to study the different types of coffer dams and the usefulness under the different situations.

UNIT – I

RETAINING WALLS: Types of retaining wall and forces on each type of wall. Modes of failure of retaining walls - sliding, overturning and bearing. Stability analysis and principles of the design of retaining walls – Gravity retaining walls, *Cantilever retaining walls, counter fort retaining walls (no structural design). Drainage from the backfill.*

BULK HEADS: Cantilever sheet pile walls *Types of sheet pile walls.* Cantilever sheet pile wall in cohesion-less soils. Cantilever sheet pile wall in clay. Design problem in each case.

16 Hours

UNIT – II

BULK HEADS: Anchored Sheet Pile Walls:

Anchored sheet pile with free earth support in cohesion-less and cohesive soil. Bulkheads with fixed earth support method – *Types, locations and design of anchors*.

BRACED CUTS: Introduction. Lateral earth pressure on sheeting, Different types of sheeting and bracing systems. *Design of various components of bracings*.

15 Hours

UNIT – III

COFFER DAMS & CELLULAR COFFER DAMS: Introduction. Introduction – *types of cofferdams* - Design of cellular cofferdams on rock by Tennesse Valley Authority (TVA) method – safety against sliding, slipping, overturning, vertical shear and stability against bursting

Design of cellular coffer dam on soil -safety against sliding, slipping, overturning, vertical shear and stability against bursting**.**

9 Hours

Course Outcomes:

At the end of the course students will be able to

1. **Explain** and **analyze** retaining wall, the force acting on earth type wall and possible mode of failure of each type.
2. **Explain** and **design** cantilever type sheet pile wall.
3. **Explain** anchored sheet pile walls, its advantage over cantilever sheet pile wall.
4. **Analyze** and identify lateral earth pressure distribution on sheeting of braced system for earth trench in different soil types.
5. **Analyze** and **design** coffer dams and cellular cofferdams.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2										2	3	1
CO2	2	2	3										2	3	1
CO3	1	2	3										2	3	1
CO4	1	2	3										2	3	1
CO5	2	2	3										2	3	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Clayton, C.R.I., Woods, R.I., Bond, A.J., Milititsky, J. – Earth Pressure and Earth-retaining structures, CRC Press, Taylor and Francis group, 2013
2. Budhu, M. – Foundations and Earth retaining structures, John Wiley & Sons, Inc., 2008

REFERENCE BOOKS:

3. Bowles, J.E. – Foundation Analysis and Design, 5th Edition, BBS Publisher, 2009.
4. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.
5. Soil Mechanics and Foundation Engineering, Dr. K.R. Arora, (Sixth edition) (2003), Standard Publishers & Distributors.
6. Soil Mechanics and Foundation Engineering, S.K. Garg, (Fifth edition) (2004), Khanna Publishers.
7. Soil Mechanics and Foundation Engineering,: Dr. B.C. Punmia (2005), Laxmi Publications Ltd.,
8. Numericals in Geotechnical Engineering, A.V. Narasimha Rao & Dr. C. Venkataramaiah, University Press.
9. Soil Mechanics and Foundation Engineering, Dr. V.N.S. Murthy (2011), C B S Publishers and Distributers, Bengaluru.
10. Geotechnical Engineering, Dr. C. Venkataramaiah (2006), New Age publications.

NPTEL ONLINE SOURCES:

http://www.cdeep.iitb.ac.in/webpage_data/nptel/civil%20engineering/foundation_engineering/toc-m6.html
http://nptel.ac.in/courses/105106052/9
http://nptel.ac.in/downloads/105101083/

ROAD SAFETY AND MANAGEMENT			
Course Code	**20CVE305**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to
1. Get awareness about the global, national and regional road crash scenario and their impacts
2. Identify the risk factors associated with crash involvement and its severity
3. Demonstrate the traffic management measures to minimize road crash
4. Understand the methods of collection and analysis of crash data
5. Gain the knowledge of the procedure for performing road safety audit.

UNIT – I

INTRODUCTION TO ROAD SAFETY ENGINEERING -

Over view of road safety - *Global road safety scenario and pattern - global trends and projections - national and state road safety level - problems in road safety in developing countries magnitude, socioeconomic and health effects.*

TRAFFIC ELEMENTS -

Characteristics of Road user, Motor vehicle, Roadway- relationship between elements- human factors governing road user behavior- risk factors for traffic accidents- exposure to risk- crash involvement- crash severity- post crash injury outcomes.

17 Hours

UNIT – II

ANALYSIS AND PREVENTION OF ACCIDENTS

Collection of accident data- Statistical methods for analysis of accident data- Speed in relation of safety- Weather and its effects on accidents- *Vulnerable road users safety- parking influence on accidents.*

TRAFFIC MANAGEMENT MEASURES FOR ACCIDENT PREVENTION

Legislation, Enforcement, Education and Propaganda, *Formulating and implementing road safety policy.*

14 Hours

UNIT – III

ROAD SAFETY IMPROVEMENT PROGRAM

Road safety audit (RSA) - Procedure in road safety audit- design standards- audit tasks- stages of road safety audit- key legal aspects. *Road design issues in RSA's – structuring and preparation of audit report.*

9 Hours

Course Outcomes:

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

1. **Identify** the factors contributing to accidents
2. **Collect** the necessary data pertaining to road crashes and **prepare** comprehensive accident crash database.
3. **Perform** the statistical analysis of accident crash data.
4. **Describe** the traffic management measures for accident prevention
5. **Explain** the road safety audit and **prepare** a detailed audit report.

TEXTBOOKS:

1. Kadiyali, L. R., "Traffic Engineering and Transportation Planning", 7th Ed., Khanna publishers, India (2011).
2. David L. Geotsc. Occupational Safety and Health for Technologists, Engineers and Managers. 5th Edition, 2004.

REFERENCE BOOKS:

1. World Health Organization, Road Traffic Injury Prevention Training Manual, 2006.
2. Fuller, R., Santos, J.A. Human Factors for Highway Engineers, Pergamon, 2002.
3. IRC: 103-1988, Guidelines for Pedestrian Facilities, Indian Roads Congress, New Delhi.
4. IRC: SP: 32-1988, Road Safety for Children (5-12 Years old), Indian Roads Congress, New Delhi.
5. IRC: SP: 44-1996, Highway Safety Code, Indian Roads Congress, New Delhi.
6. IRC: SP: 88-2010, Road Safety Audit Manual, Indian Roads Congress, New Delhi.
7. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, “Highway Engineering”, Revised 10th edition, Nem Chand and Bros, 2014.
8. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 3rd Revised Edition. (2015).

Course Articulation Matrix:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	3											2	1	
CO 2	3	1											1	2	2
CO 3	3	2	2										2		
CO 4	3	1												3	
CO 5	2	3												2	

1: Low 2: Medium 3: High

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PAVEMENT MATERIALS AND CONSTRUCTION			
Course Code	**20CVE401**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Know the properties, requirements and uses of soil, aggregates, Bitumen and Tar in the construction of pavement.
2. Understand the preparation, requirements and uses of Bituminous emulsions and cutbacks.
3. Choose suitable aggregate mix and design bituminous mix as per specification.
4. Know the various equipment used in the construction of pavement and their working principle.
5. Understand the different steps involved in preparing sub-grade and tests used to check its quality.
6. Know the specifications, construction methods and quality control checks used for different layers of flexible pavement.
7. Know the specifications, construction methods and quality control checks used for cement concrete pavement.
8. Describe the necessity and use of different types of joints in cement concrete pavements.

UNIT – I

Introduction to Pavements, Types, Comparison, Typical cross-sections, functions and requirements.

SOIL: Requirements, Classifications and tests on subgrade soil.

AGGREGATES: Origin, classification, requirements, properties and tests on road aggregates. Concepts of size and gradation, design gradation. Maximum aggregate size, aggregate blending to meet the specification using method of trials and Rothfutch's method.

BITUMEN AND TAR: Origin, preparation, properties and chemical constituents of Bitumen and Tar, Requirements for pavement construction.

BITUMINOUS EMULSIONS AND CUTBACKS: Types, preparation, characteristics, tests and uses in road construction. Adhesion of bituminous binders to road aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.

BITUMINOUS MIXES: Mechanical properties, dense and open textured mixes, flexibility and brittleness (excluding Hveem stabilometer & Hubbar – field tests). Bituminous mix design by Marshall method and specification using different criteria- voids in mineral aggregate, voids in total mix, density, flow, stability and voids filled with bitumen.

16 Hours

UNIT – II

EQUIPMENT IN HIGHWAY CONSTRUCTION: Different types of equipment for excavation, grading and compaction, their working principle, advantages and limitations. Equipment for the construction of bituminous and cement concrete pavement and stabilized soil road.

SUB GRADE: Earthwork grading, construction of embankments and cuts for roads. Preparation of sub grade, quality control tests.

FLEXIBLE PAVEMENTS: Introduction, Brief discussions on following: Interface treatment-

Prime coat and tack coat, Penetration macadam, Built-up spray Grout, Bituminous Macadam and Dense Bituminous Macadam.

Specifications of materials, construction methods and quality control checks during construction for typical Wet mix Macadam base and Bituminous Concrete surface course as per BIS only. Field quality control tests after the construction of flexible pavement: Specifications of materials, construction method and field control checks for different types of flexible pavement layers.

16 Hours

UNIT – III

CEMENT CONCRETE PAVEMENTS: *Specifications of materials* and method of construction of cement concrete pavements, *Quality control tests.*
Different types of joints used and their construction method.

8 Hours

TEXT BOOKS:

1. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi. Revised Edition. 2012.
2. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
2. Peurifoy R. L., (2003), "Construction Planning, Equipment and Methods", TMH, New-Delhi.
3. F.L.Roberts. Prithvi S. Kandhal., E. Ray Brown, Dah-Yinn Lee, Thomas W. Kennedy, "Hot mix asphalt materials, mixture design, and construction", Second edition, National Asphalt Pavement Association Research and Education Foundation, Lanhman, Maryland, 1996.
4. RRL, DSIR, "Bituminous Materials in Road Construction", HMSO Publication, London.
5. Sharma, S. C., (2005), "Construction Equipment and its Management", Khanna Publishers, New Delhi, 110006.
6. Relevant publications of Bureau of Indian Standards, New Delhi.

Course Outcomes:

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

1. **Explain** the types of pavements, component layers, their functions, their importance, and the various materials used for the construction and to **describe** the properties, requirements, preparation and uses of soil, aggregates, Bitumen, Tar, bituminous emulsions and cutbacks in the construction of pavement.
2. **Select** suitable aggregate mix and to **design** the bituminous mix as per Marshall Method.
3. **Select** the suitable equipments for the construction of pavement based on necessity and **describe** their working principle; and **describe** the different steps involved in preparing sub-grade and tests used to check its quality.
4. **Recite** the specifications, construction methods and quality control checks used for different layers of flexible pavement.
5. **Explain** the specifications, construction methods and quality control checks used for cement concrete pavement and to **construct** the different types of joints in the pavements.

Course Articulation Matrix:

CO	PO 1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	2											2	2	
CO2	2	3	2										2	2	1
CO3	3	1											3	2	2
CO4	3	2	1										2	3	1
CO5	3	2	1										2	3	1

Note: 1: Low 2: Medium 3: High

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PAVEMENT DESIGN			
Course Code	**20CVE402**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives

This Course will enable students to

1. Get a preliminary knowledge on flexible and rigid pavement design for highways and airport pavements.
2. Analyze the stresses and deflections in flexible and rigid pavements.
3. Understand the various methods in designing the structure of a flexible pavement.
4. Describe the functions and requirements of various types of joints in CC pavement.
5. Know to design the various component parts of concrete pavement.

UNIT – I

PAVEMENT DESIGN: Desirable characteristics and requirements of a well-designed Pavement, Difference between highway and air field pavements, Basic concepts and objects of pavement design. *Functions of various components and comparison of flexible and rigid pavements, Factors affecting design and performance of pavements*.

STRESSES AND DEFLECTIONS IN FLEXIBLE PAVEMENTS: Stresses and deflections, Principle-Assumptions-limitations, applications of Boussinesq's single layered theory and Burmister's two layered theories in pavement design and problems. Various factors in traffic design wheel load-Contact pressure-ESWL concept for dual and tandem wheel load assembly (Boyd and Foster method), repeated loads and EWL concept-Problems.

16 Hours

UNIT – II

FLEXIBLE PAVEMENT DESIGN: Methods for highways and airport pavement design, *Introduction to CBR method-Advantages and limitations*, Flexible pavement design as per ***IRC: 37-2001***- design factors and recommendations- design steps and Problems.

McLeod method, Burmister's method and Kansas (triaxial) method- principle, design steps and problems.

STRESSES IN RIGID PAVEMENTS: *Factors to be considered in traffic wheel load during the*

design life of a CC pavement. Basic principle and concepts in analysis of stresses in rigid pavements. Westergaard's analysis- Assumptions, Modified Westergaard's (IRC) equations-Concept of Wheel load stresses-Warping stresses-Frictional stresses-Combined stresses (Using charts /equations)-Problems.

15 Hours

UNIT – III

RIGID PAVEMENT DESIGN:*Types of joints in cement concrete pavements and their functions, joints details for longitudinal joints, contraction joints and expansion joints.*Design of joint spacing as per IRC guidelines.

Design of Dowel bars at load transfer joints, Design of Tie bars at longitudinal joints-design steps and problems as per ***IRC: 58-2002***. Design of low volume concrete roads by IRC equations method; Guidelines for thickness design of CC slab as per *IRC:58-2002*.

9 Hours

TEXTBOOKS:

1. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.
2. Kadiyali L. R., Lal. N.B, "Principles and Practices in Highway Engineering", Khanna Publishers, New Delhi, 2014.

REFERENCE BOOKS:

1. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 2006.
2. Khanna, Justo. C.E.G, "Highway Engineering", 8th edition, Nem Chand and Bros, 2001.
3. Yoder E.J. and Witczak, "Principle of pavement design", 2nd edition, John Wiley and Sons, 1975.
4. Yang H. Huang, "Pavement Analysis and Design", Pearson Prentice Hall, 2004
5. Relevant IRC codes for the design.

Course Outcomes:

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

1. **Explain** the fundamental design factors affecting the performance of flexible and rigid pavements.
2. **Analyze** the stresses and deflections in flexible pavement.
3. **Design** the thickness of the highway and airport pavements by different methods.
4. **Compute** the stresses and deflections in cement concrete pavements.
5. **Design** various components of the rigid pavement as per IRC guidelines.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3												1	3	
CO2	2	3	1										2	1	
CO3	3	2											1	2	1
CO4	2	3	1										2	1	
CO5	3	2											1	2	1

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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REINFORCED EARTH STRUCTURES

Course Code	**20CVE403**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course learning objectives:

This Course will enable students to

1. Understand the concepts of reinforced earth structures.
2. Explain the types, engineering properties of "Geo synthetics"
3. Understand the field requirements of Geo synthetics for using them in Separation, filtration, drainage and containment
4. Design earth embankments using the design principles.
5. Checkthe stability of reinforced earth foundations and to explain the concepts of "Soil nailing system".

UNIT – I

REINFORCED EARTH: Historical background, mechanism of reinforced earth, Effect of reinforcement on soil. Application and advantages of reinforced earth.
GEOSYNTHETICS: Types, properties and testing methods.

14 Hours

UNIT– II

COMPONENTS: Soil- properties; Reinforcement, types- geosynthetics and metallic (bars, strips, mats and grids). Facing elements-types and properties.
FUNCTIONSOF GEOSYNTHETICS: Separation, reinforcement, filtration, drainage and containment. Two examples of application in the field (case histories) for each function are to be explained.
REINFORCED EARTH RETAINING WALL: External and internal stability, Design Methods – Coherent gravity and Tie back wedge, design of typical reinforced earth retaining wall (Tieback wedge method only).

16 Hours

UNIT – III

REINFORCED EARTH EMBANKMENT AND FOUNDATION: Improving the stability of a typical earth embankment slope using geotextiles. Reinforced earth foundation – Modes of failure, improvement of bearing capacity by geotextile inclusion.

SOIL NAILING SYSTEM: concept and principles, driven and grouted nail system, advantages and limitations.

9 Hours

Course Outcomes:

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

1. Describe the mechanism and list advantages of reinforced earth.
2. Evaluate physical, mechanical strength, hydraulic, durability and endurance properties for a given geosynthetics.
3. Explain the components of reinforced earth, outline the functions of geotextile and assess the suitability of geosynthetics in filtration, drainage and containment.
4. Design the reinforced earth retaining wall using Tieback wedgemethod for external and internal stability.
5. Analyze and check the stability of reinforced earth embankments, earth foundations and recommend suitable measure to improve bearing capacity.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			1							3	2	
CO2	3	1	1			1							3	2	
CO3	1	1	3			2	1	1					3	2	1
CO4	2	1	3			2	1	1					3	2	1
CO5	1	2	3			2	1	1					3	2	1

1: Low 2: Medium 3: High

TEXTBOOKS:

1. Jones C.J.E.P, (1996), "Earth Reinforcement and Soil Structure", Butterworth's, London.
2. Korner, R.M, (1999), "Design With Geo-synthetics", Prentice -Hall of India, Pvt. Ltd. New Delhi.

REFERENCE BOOKS:

1. Ingold, T.S., (1989), "Reinforced Earth", Thomas, Telford, London.
2. Purushothama Raj, P. (2016), "Ground Improvement Techniques", Laxmi Publication(P) Ltd., Bangalore
3. Venkatappa Rao G., and Suryanarayana Raju, G.V, S.,(1990), "Engineering With Geosynthetics", Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Swamy Saran, (2005), "Reinforced Soil and Its Engineering Applications", I. K. International Publishing House Pvt Ltd,

NPTEL ONLINE SOURCES:

1. http://nptel.ac.in/courses/105106052/9
2. http://nptel.ac.in/downloads/105101083/

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DEEP FOUNDATIONS			
Course Code	**20CVE404**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. To learn more about the introductory aspects of piles, selection of deep foundation systems and associated equipment.
2. Design of axial and lateral geotechnical capacity of driven piles in both individually and as group and Learn the usage of wave equation analysis applied to the design and installation of driven piles including driving problem.
3. To carry out the design of pile and to estimate the efficiency of a Pile Group.
4. To understand the structural mechanic aspects of the design in a laterally loaded pile and to estimate the ultimate resistance of a laterally loaded pile.
5. Study the different types of well foundations and carry out the analysis and design.

UNIT – I

PILE CLASSIFICATION

Function – classification of piles – Factors governing choice of pile foundation – Load transfer principles – *piling equipment and methods* – changes in soil condition during installation of piles – Load transfer mechanism,

Soil properties for static pile capacity, Ultimate static pile point capacity, Skin resistance, Static load capacity using load transfer, *Tension piles, Piles for resisting uplift, Laterally loaded piles,* Numerical problems. *Pile load test and Penetration tests.*

Single pile –Dynamic analysis and load tests: Dynamic analysis, Pile driving, Rational pile formulae, other dynamic pile driving formulae and general considerations, Reliability of dynamic pile driving formulae.

14 Hours

UNIT – II

Pile groups – Efficiency of pile groups- Group capacity in clays– Minimum spacing of piles in a group – Negative skin friction of single piles and pile groups –Settlement of pile groups in clays – Equivalent raft approach – Settlement of pile groups in sands, *under reamed piles*.

14 Hours

UNIT - III

WELL FOUNDATIONS

Components of a well foundation–Procedure for construction and sinking of wells–Thickness of well steining for sinking under self-weight - Grip length- Problems encountered in well sinking– Tilts and Shifts– Causes – Permissible tilts and shifts - Methods to rectify tilts and shifts – Forces acting on a well foundation –Allowable bearing pressure – Lateral stability of well foundations - Terzaghi's analysis.

Drilled Piers & Caissons

Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. *Advantages and disadvantages of floating caissons.*

11 Hours

Course Outcome:

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

1. **Understand** about the introductory aspects of piles and Selection of deep foundation systems and associated equipment.
2. **Analyze and design** individually loaded piles using static and dynamic formulas.
3. **Analyze and design** pile group and estimate the efficiency of a Pile Group.
4. **Understand** and Estimate the settlement of pile group under loading.
5. **Analyze and Design** the types of well foundations.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1											1	3	1
CO2	1	2	3										2	3	
CO3	1	2	3										2	3	1
CO4	1	2	3										2	3	1
CO5	1	2	2										2	3	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
2. Swami Saran" Analysis and Design of Substructures Limit state design", Oxford and IBH Pub. Co.pvt, Ltd. New Delhi 1996.
3. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
4. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

REFERENCE BOOKS:

a. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
b. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
c. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
d. Winterkorn, H.F. and Fang, H.Y, Foundation Engineering Handbook, Von Nostrand Reinhold, 1994.
e. Grigorian, Pile Foundation for Buildings and Structures in collapsible Soil, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1999.
f. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
g. Code of practice for design and construction of pile foundation-IS: 2911 (Part I to IV).
h. Shamsher Prakash and Hari D. Sharma "Pile foundations in engineering practice, wiley (2012).

NPTEL ONLINE SOURCES:

https://nptel.ac.in/courses/105/108/105108069/
https://nptel.ac.in/courses/105/105/105105039/
https://nptel.ac.in/courses/105/106/105106144/

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ENVIRONMENTAL GEOTECHNICS			
Course Code	**20CVE405**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. To acquire knowledge about various branches of environmental geotechniques
2. To familiarize with design of landfill impoundments
3. To study different waste disposal systems suiting for hazardous and non-hazardous wastes
4. To familiarize with non-destructive techniques of site characterization.
5. To study the remediation methods for contaminated soil

UNIT – I

Introduction and Soil-water-environment interaction : Introduction to geo environmental Engineering, Soil-water-environment interaction relating to geotechnical problems, Waste:-source, classification and management of waste, Physical, chemical and geotechnical characterization of municipal solid waste, Impact of waste dump and its remediation.

Origin, nature and distribution of soil - Description of individual particle - Soil fabric and Geotechnical application of waste and disposal: Geotechnical use of different types such as Thermal power plant waste, MSW, mine waste, industrial waste. Waste disposal facilities, Parameters controlling the selection of site for sanitary and industrial landfill. Site

characterization. MoEF guidelines.

16 Hours

UNIT - II

Sources, types and composition of different wastes - Characteristics and classification of hazardous wastes - Generation rates - Potential problems in soils due to contaminants.
Ground water flow - Sources of ground water contamination - Contaminant transport - Pollution of aquifers by mining and liquid wastes - Ground water pollution downstream of landfills - Transport mechanisms.
CPCB rules and regulations on waste handling and management - Criteria for selection of sites for waste disposal - Disposal techniques -Disposal systems for typical wastes.
Ground modification and waste modification techniques in waste management - Ground modification - Mechanical modification, hydraulic modification, chemical modification.

15 Hours

UNIT – III

Liners and covers for waste disposal - rigid and flexible liners - Leachate and gas collection system - Engineered landfills (including basal liner and cover liner systems) – components - design criteria.

Hydrological design for ground water pollution control.

Soil contamination and remediation technology for both ground and aquifers.

9 Hours

Course Outcomes:

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

1. **Understand** the fundamentals, and engineering aspects on soil-water-environment interaction.
2. **Explain** the Origin, distribution, and applications of solid waste management.
3. **Classify and characterize** the hazardous waste and ground water flow of contaminant in soil.
4. **Understand** CPCB rules and regulations on waste and **Examine** ground modification techniques in waste management.
5. **Explain** the importance of liners, covers, hydrological designs and remediation's for soil contaminations.

Mapping of POs &COs:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	2	1	1		2	2	1		2		2	1	2	
CO2	1	2	1	1		2	2	1		2		2	1	2	
CO3	1	2	1	1		2	2	1		2		2	1	2	
CO4	1	2	1	1		2	2	1		2		2	1	2	
CO5	1	2	1	1		2	2	1		2		2	1	2	2

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. Koerner, R.M. (2005). Designing with Geosynthetics. Fifth Edition. Prentice Hall, New Jersey, 2005.
2. Daniel, D.E. (1993). Geotechnical Practice for Waste Disposal. Chapman and Hall, London.
3. K. R. Reddyand H D Sharma, "Geo environmental Engineering: Site Remediation, waste containment, and emerging waste management technologies", John Willey, 2004.

REFERENCE BOOKS:

1. David. E. Daniel, Geotechnical practice for waste disposal – Chapman and Hall – London, 1993.
2. Masashi Kamon, editor – Balkema, Environmental Geotechnics, - Rotterdan 1996 3. Hsai-Yang Fang, 3. 3. Introduction to Environmental Geotechnology,- CRC Press, New York, 2009.
3. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
4. Mitchell J. "Fundamentals of soil behaviour", John Wiley and Sons. Third Edition, 2005.
5. Robert M. Koerner, "Construction and Geotechnical methods in Foundation Engineering", McGraw Hill Book Co., 1996.
6. Abdel M. O. Mohamed and Hogan E. Antia, "Developments in Geotechnical Engineering", Elsevier, 1998.
7. Hari D. Sharma and Krishna R. Reddy, "Geo environmental Engineering – Site Remediation, Waste Containment, Emerging waste management technologies", John Wiley and sons, 2004.
8. Hsai Yang Fang and John Daniel, "Introduction to Environmental Geo technology", CRC press, Taylor and Francis, Second Edition, 2013

NPTEL ONLINE SOURCES:

- https://nptel.ac.in/courses/105/101/105101196/

4. Construction Technology Group Elective

ALTERNATIVE BUILDING MATERIALS & TECHNOLOGIES			
Course Code	**20CVE501**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Learn** the energy consumption in building materials and cost effective technologies in buildings.
2. **Illustrate** the design concept for green building taking into consideration of local climatic condition and building materials.
3. **Summarize** the alternative building materials in the present context from wastes.
4. **Summarize** the alternative building technologies which are followed in present construction.
5. **Outline** alternate roofing systems with respect to local climatic conditions and locally available building material

UNIT – I

INTRODUCTION

Energy in building materials, Environmental issues concerned to building materials, embodied energy calculations. Green design concepts in buildings and its rating, Rainwater harvesting. Environmental friendly and cost effective building technologies, Cost concepts in buildings, Cost saving techniques in planning, design and construction.

Comprehensive understanding, criterion, rating procedure of green building through GRIHA assessment. **16 Hours**

UNIT – II

ALTERNATIVE BUILDING MATERIALS - Fiber reinforced concrete - Matrix materials, metal and synthetic fibers, Properties and applications. Ferrocement components, materials and specifications, properties and construction methods. Masonry blocks using industrial wastes, Raw materials, manufacture, properties, advantages and disadvantages of FaL G blocks and Stabilized mudblock.

Building materials from agro and industrial wastes Types of agro wastes, Types of industrial and mining wastes, properties and applications. **15 Hours**

UNIT – III

ALTERNATIVE BUILDING TECHNOLOGIES

Use of arches in foundation, alternatives for wall construction, composite masonry, confined masonry, cavity walls, rammed earth, applications, Top down construction.

Alternative roofing systems: concepts of filler slabs, composite beam panel roofs. Waffle slab construction. Bridge construction by balanced cantilever, incremental launching methods.
Mivan Construction Techniques, Precast concrete and modular construction methods.

9 Hours

Course Outcomes:

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

1. **Solve** the problems related to Energy of building materials and **make use** of cost effective building technologies.
2. **Make use of** the design concept for green building taking into consideration of local climatic condition and building materials.
3. **Utilize** suitable agro and industrial wastes as a building material.
4. **Select** suitable type of alternative building technologies used in civil engineering construction.
5. **Make use of** the alternative economical roofing system by considering local climatic condition.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														3
CO2	1														2
CO3	2	1											2		2
CO4	2	1											2	2	3
CO5	2												2	2	3

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. K.S Jagadish et al., "Alternative Building Materials and Technologies", New Age International Publishers – 1st edition -2007, Reprint: Aug – 2014
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers 3rd Edition December 2013.

REFERENCE BOOKS:

1. IS: 15912 (first revision 2017) Structural Design Using Bamboo – Code of Practice.
2. James J Marks, "The Alternative Building Source Book", Chelsea Green Publishers, 1st Edition 1998.
3. Clarke Snell et al., "Building Green", Large Book Publishers, 1st edition in 2005, reprinted -2014.
4. Jon Nunan, "The Complete Guide to Alternative Home Building Materials and Methods", Atlantic Publishing Company 30th October – 2009, Re-Print 2010.

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ADVANCED CONCRETE TECHNOLOGY			
Course Code	**20CVE502**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives

This Course will enable students to:

1. Understand the importance of microstructure of cement and concrete, types of admixtures and its properties in fresh and hardened state of concrete.
2. Know the tests and factors affecting the results of hardened concrete.
3. Understand durability requirements.
4. Select a suitable type of concrete based on specific application.
5. Know the design concepts cement concrete by BIS method.

UNIT - I

INTRODUCTION: Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, Transition Zone, transport through cement microstructure. Rheology of concrete.

TESTS ON HARDENED CONCRETE: Elastic Modulus, factors affecting strength and elasticity of concrete, Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition. Determination of hardened concrete original W/C. NDT test concepts - Rebound hammer, Ultrasonic Pulse Velocity (UPV) methods.

16 Hours

UNIT – II

DURABILITY OF CONCRETE -

Effect of fire, aggregates, abrasion and cavitation. Autogenious, drying and plastic cracking in concrete.

Corrosion of steel reinforcement, carbonation, chloride ingress, corrosion of prestressing steel. Sulphate attack and delayed ettringite formation, physical salt attack.

SPECIAL CONCRETES

Concept, materials, properties and applications of Alkali Activated Binders, Graphic concrete pattern for precast concrete surface, Self-healing concrete, Pollution Eating Concrete, Engineered Cementitios Composites, Bio Receptive Concrete to colonize structural concrete, Living 'concrete' to reduce the environmental impact, High quality Graphene concrete, Cement made with CARROT extract.

15 Hours

UNIT – III

MIX DESIGN - Factors affecting mix design, Design of High Strength Concrete mixes with/without mineral admixtures using IS 10262-2019 method.

9 Hours

Course Outcomes:

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

1. **Explain** the microstructure of HCP, mechanism of Water Reducing Agents, Bingham's parameters, elasticity of concrete, **calculate** the effect of chemical composition changes on Bogue's compounds formation and effect of w/c on Volume and porosity.
2. **Explain** the effect of admixtures on fresh and hardened concrete properties, **compare** the effects of test conditions on concrete strength.
3. **Explain** the durability of concrete and **identify** the remedial measures for the durability related issues.
4. **Explain** the concept, materials, properties, applications, manufacturing method and typical mix of special concretes.
5. **Design** High Strength Concrete mix proportioning with/without mineral admixtures, as per IS 10262-2019.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1											1	2	
CO2	2	1					1						1	2	2
CO3	2	1	1			1							1	2	1
CO4	2	1					1						2	2	2
CO5	3	2	3			1	1	2					2	3	2

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

TEXTBOOKS:

1. Neville, A.M., "**Properties of Concrete",** ELBS Edition, Longman Ltd., London. 2015.
2. M.S. Shetty, (2015) "**Concrete Technology Theory and Practice" S. chand and company New Delhi.**
3. P.K. Mehta, P J M Monteiro, (2016) "**Concrete microstructure and properties",** Prentice Hall, New Jersey (Special Student Edition by Indian Concrete Institute, Chennai).

REFERENCE BOOKS:

1. IS 10262-2019 "Concrete mix proportioning guidelines".
2. N. Krishna Raju, "**Concrete Mix Design",** Sehgal Publishers, 2016
3. Gambhir M.L, "**Concrete Manual**", Dhanpat Rai & Sons, New Delhi, 2012

NPTEL:

https://nptel.ac.in/courses/105/106/105106176/

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BUILDING SERVICES			
Course Code	**20CVE503**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students

1. To gain the knowledge of different building services and their types used in buildings.
2. To understand the functional requirements of ventilation and principles of illumination of buildings.
3. To outline the classification of air conditioning based on function and season.
4. To gain knowledge of different thermal properties and insulation materials for buildings.
5. To explain the fire hazards and general safety requirements for buildings.

UNIT – I

Introduction: requirements and necessity of services for buildings. Types.

Ventilation: Definition, Necessity, Functional Requirements, Types- Natural Ventilation and Artificial Ventilation

Illumination of buildings- definition, laws of illumination, principles, artificial lighting, day lighting, flood lighting, Introduction to various types of lamps.

16 Hours

UNIT – II

Air conditioning of buildings- essentials of air-conditioning systems, classification based on function & season, systems, design- AC load calculations, installation and maintenance cost.

Thermal comfort in buildings- factors affecting, heat transfer through buildings, thermal properties of building materials, insulation materials for buildings.

15 Hours

UNIT – III

Fire protection: necessity, fire hazards, characteristics and types of fire-resistant materials, fire load and its calculation, fire resistant construction – walls and columns, floors and roofs, wall openings, escape elements and strong room construction, fire protection equipment. General fire safety requirements.

9 Hours

Course Outcomes:

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

1) **Explain** the different building services and their types used in buildings.
2) **Summarize** the functional requirements of ventilation and principles of illumination of buildings.
3) **Classify** the air conditioning based on function and season.
4) **Explain** thermal properties and insulation materials for buildings.
5) **Explain** the fire hazards, **assess** fire load and **summarize** the general safety requirements for buildings.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											2	2	2	2
CO2	2					2						2	1	2	
CO3	2					2						2	1	2	
CO4	2											2	2	2	
CO5	2		2			2						2	1	2	

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

TEXTBOOKS:

1. Building construction by B.C.Punmia, Laxmi Publications.
2. A Text Book on Building Construction by P.C.Varghese, Prentice Hall of India publications
3. Architectural Lighting by Bran David.

REFERENCE BOOK:

1. IS SP41and SP32-hand book on functional requirements of buildings

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CONSTRUCTION PLANNING AND CONTROL			
Course Code	**20CVE504**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. Illustrate concepts related to management, economics and project feasibility conditions.
2. Outline the principles and concepts involved in management.
3. Illustrate the needs of planning and updating project schedule through project management tools such as CPM, PERT.
4. Identify suitable database to manage and organize information's in project.
5. Solve problems using optimization techniques.

UNIT – I

ENGINEERING ECONOMICS- Basic Concepts of economic analysis, Micro and Macro analysis, project feasibility, benefit cost ratio, interest formula, present worth, future worth, Annual equivalent, Basis for comparison of alternatives, break even analysis. Introduction to management, organization and administration.

Value engineering, time management, labor and Material management.

16 Hours

UNIT – II

CONSTRUCTION PLANNING - Introduction, time estimates, planning methods of projects, Bar and Milestone charts, PERT and CPM network analysis, crashing of networks. Project Information and its accuracy, use of Information, organizing information in databases, Relational and conceptual model of databases, Centralized database management Systems, Programs, Information Transfer and Flow.*Computerized Organization and use of Information.*

15 Hours

UNIT – III

OPTIMIZATION TECHNIQUES: Linear Programming: standard form of linear programming, formulation, solution to LPP by graphical method.
Transportation Problem: Introduction, mathematical formulation, methods for initial basic feasible solution, North West corner method, Vogels Approximation method.
Transportation Problem: least cost method, Row and Column minima method.

9 Hours

Course Outcomes:

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

1. **Make use of** concepts related to management and economics for project feasibility.
2. **Relate** effectively the principles and concepts involved in management of civil works.
3. **Utilize** project management tools to develop plan and schedule.
4. **Identify** and **choose** database systems to manage and organize systems.
5. **Utilize** the linear programming and transportation problems for solutions.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2														3
CO2		1									1				
CO3	2										2		2		3
CO4	2	1									1				
CO5	2										2				3

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

TEXTBOOKS:

1. K. Subramanyam, “Construction Management”, Anuradha Publishers Madras, (2009).
2. L.S. Srinath, “Pert and CPM”. Affiliated East-West Press Pvt. Ltd. New Delhi. (2014).
3. B.C Punmia, “Pert and CPM”, Lakshmi publication (2016).
4. Peurifoy , R.L , “Construction Planning equipments and methods”, 8th edition, Mc Graw Hill Publication (2010).

REFERENCE BOOKS:

1. Mahesh Varma, “Construction planning and management”, Metropolitan Book Co, Delhi.
2. S.D. Sharma, “Operation research”. 4th edition, Pub: Kedarnath Ramnath, Meerut, Delhi (2015).

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CONSTRUCTION QUALITY MANAGEMENT			
Course Code	**20CVE505**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1) Summarize the history and quality elements in engineering management.
2) Explain the Integrated quality management as per International Organisations for Standardization.
3) Utilize the quality control in construction projects.
4) Summarize the process and steps involved in benchmarking process.
5) Outline the quality management system in construction projects.

UNIT – I

Quality –History, definition, inspection, control, assurance, engineering, management, Quality guru's, quality function deployment, *six sigma methodology – leadership principles, six sigma team.*

Integrated Quality Management – quality standards, International Organisations for standardization (ISO), ISO 9000 Quality Management system, ISO Certification, ISO 14000 Environmental Management System, *Occupational Health and safety assessment series.*

16 Hours

UNIT - II

QUALITY CONTROL IN CONSTRUCTION PROJECTS QC in concreting, Brick work, stone masonry, Formwork, Foundations, Piling work, Structural work, Woodwork & Timber, Painting, Electrical system, *Waste recovery and maintenance.*

BENCH MARKING: Sources, Process & Step model for Benchmarking, Types of Benchmarking and Code of Conduct. *Internal & External Benchmarking, Advantages of Benchmarking.*

15 Hours

UNIT – III

QUALITY MANAGEMENT SYSTEM IN CONSTRUCTION PROJECTS: Concept, Approach to Problems, Quality Assurance, Quality Control, *Quality Inspection, Records and Reports, Training*, Total Quality Control, Manual/Check Lists, Guide Lines.

9 Hours

Course Outcomes:

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

1) **Explain** the history, quality elements and **summarize** the six-sigma methodology.
2) **Summarize** the Integrated quality management as per International Organisations for Standardization.
3) **Explain** the quality control carried in the construction projects.
4) **Explain** the process and steps involved in benchmarking process.
5) **Explain** the quality management system in construction projects.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2						2	1		
CO2	2					2		3				2	1		
CO3	2					2						2	2	2	3
CO4	2					2						2	2	2	1
CO5	2					2						2	2	2	1

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

TEXTBOOKS:

1. Total Quality Management for Engineers by Mohammed Zairi, Aditya Books Pvt. Ltd., New Delhi. 1992.
2. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
3. Total Quality Management by B. Janakiraman and R.K. Goapal, Prentice-Hall of India Private Limited, New Delhi.

REFERENCE BOOKS:

1. Quality in the Construction Project by Fox, Arthur J., and Holly A. Cornell, American Society of Civil Engineers, New York, Latest Edition.
2. Total Quality Management by Mohantry R.P. and Lakhe R.R., Jaico Publishing House, Mumbai, 2000.
3. Total Quality Management by Break Joseph and Susan Joseph, Excel Books, New Delhi, 1995.
4. Total Quality in Construction Projects by Hellard R.B.: Achieving profitability with customer satisfaction, Thomas Telford, London, 1993.
5. Quality Management by Manjual, Satish, Raj Publishing House, Jaipur, 1999.

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CONSTRUCTION METHODS AND EQUIPMENT

Course Code	**20CVE506**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Summarize the construction of equipment planning, cost of owning and operating.
2. Explain the types and specifications of compacting equipment's.
3. Outline the fundamentals and preliminary earth work operations.
4. Explain the types, basic parts and operating procedure of earthwork equipment's.
5. Outline the process of foundation grouting.

UNIT – I

Construction planning, types, importance, lack of planning. Equipment management in projects, classification of equipment's, selection of construction equipment's, *cost of owning and operating, economic life of equipment's, cost control of equipment's, depreciation analysis.*
Equipment for Compaction – Introduction, specification and types of compacting equipment's.

16 Hours

UNIT - II

Equipment for Earthwork - Fundamentals of Earth Work Operations, types of Earth Work, Machines for preliminary work.
Tractors – Basic parts and operation, Scrapers – types, construction, operation and applications, Motor Graders – construction, operation and safety, Dragline – types, basic parts and operation. Clamshells – Classification, Hoe – basic parts, operation and application, Bulldozer – Classification, selection of type of bulldozer and out of bulldozer. Power Shovel – *types, basic parts, operation of shovel, selection of type, size of power shovel and factors affecting the output of power shovel, methods of improving the output of power shovel*.

15 Hours

UNIT - III

Foundation grouting – materials, purpose, exploring the need, *rate of grouting, equipment's of cement grouting and effectiveness.*

9 Hours

Course Outcomes:

At the end of the course the student will be able to
1) **Explain** the planning of construction equipment and **solve** for the owning, operating and depreciation cost.
2) **Summarize** the types and specifications of compacting equipment's.
3) **Explain** the fundamentals and preliminary earthwork operations.
4) **Explain** the types, basic parts and operating procedure of earthwork equipment's and **calculate** the output of a power shovel.
5) **Summarize** the process of foundation grouting.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		3				2					2	2	2
CO2	2												1	2	
CO3	2												1	2	
CO4	2	2		3				2					2	2	
CO5	2							1					1	2	

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

TEXTBOOKS:

1. B. Satyanarayana and S. C. Saxena, "Construction, Planning and Equipment's", Standard Publishers New Delhi, 8th edition, 2019.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction. Planning, Equipment and Methods", 9th Edition, McGraw Hill, Singapore, 2019.

REFERENCE BOOKS:

1. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 2017
2. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
3. Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi, 1983.

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DESIGN OF SPECIAL CONCRETES			
Course Code	**20CVE601**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Learn to differentiate and apply the principles of special concretes mix designs.
2. Understand the materials, properties, applications, factors influencing the manufacturing of special concretes.

UNIT - I

SUSTAINABLE CONCRETE MIX DESIGN

Properties and factors to be considered for the use of industrial wastes, recycled wastes as aggregates in concrete, Design of Standard Grade Concrete with/without recycled and industrial waste aggregates,**Fiber Reinforced Concrete** – Properties, Applications, Factors influencing the mix design, Design of mixes.

16 Hours

UNIT – II

LIGHT AND HEAVY WEIGHT CONCRETE: Material, Properties, Applications, Factors affecting the mix design, Design of Mix Proportioning**,** Manufacturing Methods.

15 Hours

UNIT - III

MASS CONCRETE AND HIGH VOLUME FLYASH (HVFA) CONCRETE: Factors affecting the mix design, Mix proportioning.

9 Hours

Course Outcomes:

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

1. **Identify** the Properties, factors influencing for the use of recycled, industrial waste aggregates in concrete and explain the properties, applications and factors influencing high strength and fiber reinforced concrete mixes.
2. **Design** Standard, High Strength and Fiber Reinforced Concrete Mixes.
3. **Identify** material, properties, applications, and explain the factors affecting the mix design, Manufacturing Methods of Light weight and high density concrete mixes.
4. **Design** Light weight and High Density Concrete mixes.
5. **Design** Mix Proportioning of Mass Concrete and High Volume Fly Ash Concrete.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1					2							2	1
CO2	3	2	3	1			3	2				1	3	2	1
CO3	2	1					1							2	1
CO4	3	2	3	1			2	2				1	3	2	1
CO5	3	2	3	1			3	2				1	3	2	1

Note: 1: Slight (Low) 2 Moderate (Medium) 3: Substantial (High)

REFERENCE BOOKS

1. IS: 10262: 2019 - Concrete Mix Proportioning – Guidelines
2. IS 456: 2000- reaffirmed in 2016: Plain and Reinforced Concrete - Code of Practice
3. IS 383 : 2016 ‘Coarse and fine aggregates for concrete’
4. A.R. Santhakumar, “Concrete Technology”-Oxford University Press, New Delhi, 2015.
5. Short A and Kinniburgh. W, “Light Weight Concrete”- Asia Publishing House, 2000
6. Neville A. M, “**Properties of Concrete”,** Pearson Education, Asis, 2012.
7. Aitcin P.C. “High performance concrete”-E and FN, Spon London 1998

NPTEL SOURCES

https://nptel.ac.in/courses/105/106/105106176/

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SUSTAINABLE CONSTRUCTION MATERIALS AND METHODS			
Course Code	**20CVE602**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

1. Understand the 'modern' building materials developed using advanced technologies and testing methods.
2. Apprehend the application of recycled/reconstructed building materials in the construction of green buildings.
3. Know the different precast construction methods used at construction site.
4. Appreciate the cutting edge technologies, methods and strategies of project management for sustainable construction.
5. Comprehend components of embodied energy in building and understand the Rating Systems, its contribution to sustainability based on GRIHA and LEED Rating systems.

UNIT – I

Modern Building Materials: Properties and applications –Self-healing concrete3D graphene, Self-healing concrete, Aerographite, Laminated timber, Modular bamboo, Transparent aluminium, Translucent wood, Light-generating concrete, Microbial cellulose, Spider silk, Aluminium foam, Nanocrystal, Wool brick, Pollution-absorbing brick, Hydroceramics, Biochar, Bioreactors, Invisible solar cells

Modern Construction Formworks: Aluminium formwork, Precast system, Modular formwork, Tunnel formwork, Fiberglass shuttering.

16 Hours

UNIT – II

Modern Building Construction Techniques: 3D Volumetric Construction, Precast Flat Panel Modules, Pre-cast Foundation Technique, Hybrid Concrete Building Technique, Thin Joint Masonry Technique, Insulating Concrete Formwork (ICF) Technique

Sustainable Construction and Management: Identification of cutting edge sustainable construction materials, technologies. Project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

15 Hours

UNIT – III

Components of Embodied Energy: Energy for production, transportation and erection, Estimation methodology, Computation of embodied energy for building.
Green Buildings Rating: Concepts Features of TERI GRIHA rating. LEED rating with respect to building envelope, Economics of sustainability and benefits.

9 Hours

Course Outcomes:

After completion of this course the students will be able to

1. **Explain** the properties and applications of modern building materials.
2. **Describe** the choice, properties and various applications of modern construction formworks.
3. **Describe** advanced construction techniques.
4. **Identify** the cutting edge technologies, methods, strategies of project management
5. **Explain, compute the components of embodied energy** and **evaluate** a building based on GRIHA and LEED rating systems

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2				1	2						1	2	
CO2	1	2				1	2						1	2	
CO3	1	2				1	2						1	2	
CO4	1	2			2	1	2						1	2	
CO5	1	3			2	1	3	2					1	2	

Note: L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

REFERENCE BOOKS:

1. Bureau of Indian Standards – relevant codes.
2. National Building Code of India -2016
3. Product Manufacturers' manuals/specifications
4. CPWD construction manual – 2019
5. Sustainability of Construction Materials, Woodhead Publishing Series in Civil and Structural Engineering Edited by J. Khatib - 2nd edition-2016.
6. Green Building Fundamentals by Mike Montoya, Pearson, 2nd edition, 2010
7. GRIHA MANUAL VOL I "National Rating System for Green Buildings, Green Rating for Integrated Habitat Assessment (GRIHA)", Ministry of New & Renewable Energy Government of India, Teri Press, 2010
8. GREEN BUILDING GUIDE Design Techniques, Construction Practices & Materials for Affordable Housing, Published by Rural Community Assistance Corporation (RCAC), by Craig Nielson, LEED AP, 2019.
9. IGBC Green Building Ratings System Version 3.0 – Abridged Reference Guide September – 2014.
10. Wu Chung, H. Advanced Civil Infrastructure Materials, First Edition, Woodhead Publishing Limited, 2006
11. Ministry of Power, Energy Conservation Building Code 2007, Revised Version, Bureau of Energy Efficiency, 2008,
12. Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1st ed. Nabhi Publication, 2008.
13. TERI-Griha's Green Design practices (www.teriin.org/bcsd/griha/griha.htm)
14. Leadership in Energy and Environmental Design (www.usgbc.org/LEED)
15. Venkatarama Reddy, B. V., and. Jagadish, K., S. "Embodied energy of common andAlternative building materials and technologies". Energy and Buildings., 35, 129-137,2003

VALUATION OF REAL PROPERTIES			
Course Code	**20CVE603**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives

This Course will enable students to:

1. Classify properties and understand forms of value.
2. Determine depreciation using suitable methods.
3. Apply techniques of valuation of land.
4. Understand forms of rent and determine standard rent.
5. Adopt suitable techniques of valuation of lands with buildings.

UNIT - I

Cost, Price and Value, Nature and essential characteristics of value. Forms of value. Valuation and its purpose. Classification of property- Freehold and leasehold. Sinking Fund. Amortization. Depreciation and Obsolescence. Methods of depreciation - Straight Line Method, Constant Percentage Method, Sum of years digit method, Sinking Fund Method and Declining Balance Method.

Qualities of a valuer, Principal types of lease- Building lease, Occupation lease, Sublease, Life lease, Perpetual lease.

16 Hours

UNIT - II

Valuation of Land - Valuation methods: Comparative Method, Abstractive Method, Belting Method, Development Method, Flat Rate Technique and Hypothetical Building Scheme (or Land residual Method.) Rent and forms of rent - Outgoings, Gross income and net income, Year's purchase, rate of interest, Standard rent and its computation, Tenancy Laws on rent.

Factors affecting the value of Land, Regular Shaped Plots, Land Locked Land, Recess Land, Strips of Land, Estimating the future life of buildings.

15 Hours

UNIT – III

Valuation of Land with Buildings: Direct Comparison, Land and building method, Rental Method , Profit Method , Development Method, - Valuation for Capital Gains, -, Valuation for Land Acquisition.

The Real Estate (Regulation and Development) Act 2016, Insolvency and Bankruptcy Code.

9 Hours

Course Outcomes:

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

1. **Identify** forms of value and classify property.
2. **Determine** depreciation rates for properties.
3. **Make use of** suitable method to **valuate** a land.
4. **Determine** standard rent of a property.
5. **Valuate** a property with land and building and **make use of** RERA to appropriate condition.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1														3
CO2	2												2		
CO3	2	2													3
CO4	1												2		
CO5	2	2													3

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

TEXTBOOKS:

1. Namavati, R., (1991), "Theory and Practice of Valuation", Lakhani Book Depot, Mumbai
2. S.C. Rangwala, "Valuation of Real Properties" Charotar Publishing House Pvt ltd, Anand. Ninth edition (2013).
3. Shyamales Dutta, "Valuation of Real Property" Eastern Law House, Kolkata Second edition (2004)

REFERENCE BOOKS:

1. S.C. Rangwala, "Elements of Estimating and Costing", Charotar Publishing House, Anand. (1984),
2. Sabapathy, B.K., (1996), "Practical Valuation", Ezhilarasi Prestige Flats, Tiruchirapalli.

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DISASTER MANAGEMENT AND MITIGATION

Course Code	**20CVE604**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

COURSE LEARNING OBJECTIVES:

1. Describe the basic types of hazards and their potential consequences to India
2. Understand the planning and assessment of Hazard, Risk, Vulnerability and disaster
3. Describe the basic concepts of the emergency management cycle (mitigation, preparedness, response, and recovery)
4. Critically understand the various disaster management acts and policies and approaches in both national and state level scenario.
5. To build skills to respond to disasters in an effective, humane and sustainable manner

UNIT - I

Hazard, Risk, Vulnerability, Disaster and Disaster Management. Types of Disasters: Hazard and vulnerability profile of India.

Relevance of Disaster Risk, Vulnerability & Capacity Assessment in Planning, Concepts of

Hazard Assessment, Vulnerability Assessment, Risk Assessment and Capacity Assessment, Hazard Identification and analysis.

16 Hours

UNIT - II

Four elements of comprehensive disaster management (Preparedness, Response, Recovery and Mitigation), Concept of Mitigation and its importance (Structural and Non Structural mitigation measures, identification of mitigation measures relating to different types of hazards and implementing strategies). Land use Management tools for disaster risk reduction. (Building codes, GDCR, zoning ordinances, land acquisition, transfer of development rights, Recovery and reconstruction plan).

National Disaster Management Act, Various State Disaster Management Acts (Gujarat, Uttar Pradesh, Uttaranchal, Bihar, Karnataka) and State disaster management policies (e.g. Orissa, Gujarat, Uttaranchal, Karnataka, Tamil Nadu, Delhi, Uttar Pradesh). Relevance of Rehabilitation and Resettlement Policy in Recovery and reconstruction phase of disaster management. Coastal zoning regulation for construction and reconstruction phase in the coastal areas.

15 Hours

UNIT – III

Role of Government/Civil Society/International Organizations/Communities and Approaches to Community Based Disaster Risk Management and Planning. (Local coping mechanisms, Importance of Mock Drills and on site volunteer management in Community level disaster preparedness activities).

Projects implemented general description of projects carried out in India following natural disasters. Disaster resistant buildings & measures. Recent developments. Case studies.

9 Hours

COURSE OUTCOME:

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

1. Develop an understanding of the key concepts, definitions a key perspectives of All Hazards, Disasters, Risk and Vulnerability
2. Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
3. Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
4. Understand the various acts and policies related to Indian disaster management
5. Explain the role of public and private partnerships

REFERENCE BOOKS:

1. Emergency Management: A Reference Handbook by Jeffrey B. Bumgarner ABC-Clio, 2008
2. Lessons of Disaster: Policy Change after Catastrophic Events by Thomas A. Birkland Georgetown University Press, 2006
3. The Indian Ocean Tsunami: The Global Response to a Natural Disaster by Pradyumna P. Karan; Shanmugam P. Subbiah University Press of Kentucky, 2011.
4. Chaos Organization and Disaster Management by Alan KrischenbaumMarcel Dekker, 2004.
5. Emergency Relief Operations by Kevin M. Cahill Fordham University Press, 2003
6. A Comprehensive Approach to Emergency Planning By Worsely, Tracy L.; Beckering, Don College and University, Vol. 82, No. 4, January 1, 2007.

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CONSTRUCTION SAFETY MANAGEMENT			
Course Code	**20CVE605**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1) Outline the salient feature of safety programs for construction.
2) Summarize the Indian standards for safety in construction.
3) Summarize the construction accidents and safety measures.
4) Explain the behaviour of fuels during fire accidents.
5) Outline the importance of housekeeping and explain the common hazards.

UNIT – I

Safety Management - Introduction, salient features of safety programs, general safety programs for construction. Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, *safety officers, safety records, safety training*. Safety lacunae in Indian Construction Industry

SAFETY STANDARDS - Indian standards for safety in construction, *BIS standards*, American National Standards**.**

15 Hours

UNIT – II

CONSTRUCTION ACCIDENTS AND SAFETY - Accident- Causes, Effects and Safety measures, Legal requirements, Responsibility of the employers. Reporting occurrence of accidents, Reporting occurrence of hazards, *Action to be taken by the Site-in-charge in case of accidents.*

FIRE PREVENTION AND CONTROL - Understanding fire chemistry, Behaviour of fuels in fire, *Fire causes, Types of extinguishers and use*, Fire prevention planning, Check list for fire prevention. Emergency Escape Means of Escape, Evacuation, Occupant firefighting.

16 Hours

UNIT – III

COMMON HAZARDS - Dust, Impregnated timber, Lead poisoning, Toxic fumes, Noise, *Code of practice for reducing noise, Vibration, Power supply*, Lighting, Maintenance, House-keeping, Materials, Movement, Drowning, Openings, Weight.

9 Hours

Course Out comes:

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

1) **Explain** the salient features of safety programs in construction.
2) **Summarize** the Indian standards for safety in construction.
3) **Outline** the construction accidents and its safety measures.
4) **Explain** the behaviour of fuels and fire chemistry during fire accidents.
5) **Outline** the importance of housekeeping **and** explain the common hazards.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2							2					2		
CO2	2							3					2	2	
CO3	2											2	2	2	
CO4	2											2	2	2	
CO5	2											2	2	2	

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

TEXTBOOK:

1) Construction Safety Management, NICMAR Publications, Hyderabad, October 2003.

REFERENCE BOOKS:

1. Jimmy W. Hinze, construction safety, Prentice hall Inc 1997
2. Richard.J.Coble, Jimmoe and TheoeHampt, Construction Safety and Health Management, Prentice Hall Inc 2001.

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CONSTRUCTION ECONOMICS AND FINANCE			
Course Code	**20CVE606**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1) Define the importance of engineering economics
2) Summarize the scope of engineering economics and elements of cost in economy
3) Outline the role of civil engineering in construction economics and its effects on workers.
4) Summarize the capital structure in financial management
5) Explain the fund flow and cash flow statements to implement in construction accounting.

UNIT – I

INTRODUCTION TO ECONOMICS - Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency
Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis.

16 Hours

UNIT – II

CONSTRUCTION ECONOMICS - Role of Civil Engineering in Industrial Development, Construction development in Housing, transport and other infrastructures, Economics of ecology, environment, energy resources. Construction workers - Urban Problems, Poverty, Unemployment Effects on economics due to migration of construction workers to urban area
Capital Structure - The need for financial management, Types of financing - short term borrowing, long term borrowing, leasing.

15 Hours

UNIT - III

FINANCIAL ANALYSIS - Fund Flow and Cash Flow statements (Simple Problems), Financial Analysis – Meaning and Types, Tools and Techniques, Ratio Analysis, Types of Ratios, Profitability Ratio, Turnover ratio, Financial ratio (Balance sheet ratios) (Simple problems), Liquidity and Profitability.

9 Hours

Course Outcomes:

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

1) **Outline** the importance of engineering economics.
2) **Explain** the scope of engineering economics and **outline** the elements of cost**.**
3) **Explain** the role of civil engineering in construction economics and **identify** its effect on construction workers.
4) **Explain** the capital structure in financial management.
5) **Prepare** fund flow and cash flow statements and **utilize** in construction accounting.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2												2		
CO2	2												2	2	
CO3	2	1				2	2					2	2	2	
CO4	2	1										2	2	2	
CO5	2	2										2	2	2	

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

TEXTBOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2012.
2. Suma Damodaran, "Managerial economics", Oxford University press 2010.
3. I.M. Pandey, "Financial Management" 11th edition, Vikas Publishing house Pvt, Ltd, 2015.

REFERENCE BOOKS:

1. Warneer Z Hirsch, "Urban Economics", Macmillan, New York.
2. Prof. K.S. Nagapathi "Management Accounting", R. Chand & Co., New Delhi.

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BUSINESS MANAGEMENT			
Course Code	**20CVE607**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

1. Understand the Nature and Purpose of Business, Financial Markets and Instruments
2. Apprehend Financial Institutions and Investment Banking
3. Appreciate the models of micro finance and its operational aspects.
4. Comprehend components of microfinance, disaster and insurance fundamentals.
5. Know the basics of role and functions of capital markets

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UNIT – I

Nature and Purpose of Business

Economic activities – Types; Business - Characteristics and Objectives of Business, Structure of Business, Classification of Business activities, Classification of Industries, Business Environment.

Financial Markets and Instruments

Money Market - Capital Market – Primary Market and Secondary Market – derivatives. Market – Debt Market – Corporate Debt and Government Securities - New Financial Instruments.

Financial Institutions

Development Financial Institutions – Banking and Non-Banking Institutions – Mutual Fund Organizations – Insurance Companies

Investment Banking

Financial and economic meaning of Investment – Characteristics and objectives of Investment – Types of Investment – Investment alternatives – Choice and Evaluation.

16 Hours

UNIT – II

Models of Microfinance

Models of Microfinance across the world, Microfinance delivery methodologies, Legal and Regulatory framework, Financial Inclusion, Impact of Microfinance

Microfinance: Operational Aspects

Financial products and services, financial accounting and reporting, Revenue models of Microfinance, Risk management.

Microfinance and Disaster

Recent developments of Microfinance in India, Microfinance and Disaster, Cases on Women SHGs, Linkage Building and Successful Micro Entrepreneurs

Fundamentals of Insurance*: I*ntroduction to Insurance, Principles of Insurance, Insurance contract and provisions.

15 Hours

UNIT - III

Role and Functions of Capital Markets, SEBI

Overview of Capital Market; Stock Exchange; Commonly used Terms; Types of Capital Issues; Financial Products/ Instruments including ASBA, QIP; SEBI; Registration of Stock Brokers, Sub-brokers, Share Transfer Agents, etc. QIBs.

9 Hours

Course Outcomes:

After completion of this course the students will be able to

1. **Explain** the *Nature and Purpose of Business and financial Markets and Instruments*.
2. **Describe** *Financial Institutions and Investment Banking.*
3. **Describe** *Financial Institutions and Investment Banking*.
4. **Identify** models of micro finance and its operational aspects
5. **Explain** role and functions of capital markets

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1			2		1	1		3	1			
CO2		2	1			2		1	1		3	1			
CO3		2	1			2		1	1		3	1			
CO4		2	1			2		1	1		3	1			
CO5		2	1			2		1	1		3	1			

Note: L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

REFERENCE BOOKS:

1. Financial Institutions and Markets: Structure, Growth & Innovation , 6th Edition, 2017, by Bhole, McGraw Hill
2. Financial Institutions and Markets,10th edition,2014, by Jeff Madura , Cengage Learning
3. UNDERSTANDING MICROFINANCE, 2009,By Kogent Solutions Inc. · Wiley India Pvt. Limited
4. Microfinance in India, 2008, K G Karmakar, SAGE Publications
5. Capital Markets of IndiaAn Investor's Guide, 2011, By Alan R. Kanuk · Wiley publisher

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4. Water Resource, Environmental Engineering stream Electives

GROUND WATER HYDROLOGY & EXPLORATION			
Course Code	**20CVE701**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable the students to:

1. **Develop** an understanding on the fundamentals of groundwater hydrology, **appraise** its Significance and **Inspect** the techniques of groundwater exploration, development and management.
2. **Explain** the occurrence and distribution of subsurface water, **list** and **distinguish** the types of aquifers, wells and their characteristic properties.
3. **Explain** aquifer parameters, **analyze** pump test and Darcy' Law governing the steady unidirectional groundwater flow.
4. **Explain** Well hydraulics and **estimate** the aquifer parameters in steady and unsteady state radial flow into unconfined and confined aquifers.

UNIT – I

INTRODUCTION: Vertical distribution of subsurface water and its occurrence. Aquifer and its types, water bearing properties of rocks and their classification.

FUNDAMENTALS OF GROUND WATER FLOW: Aquifer parameters- porosity, permeability, Specific yield, specific retention, hydraulic conductivity, storage coefficient, transmissibility, Pump tests, recuperation tests, interference of wells; Darcy's law, steady unidirectional flow in confined and unconfined aquifers.

16 Hours

UNIT – II

WELL HYDRAULLCS:

Steady state Radial flow in confined and unconfined aquifer, Thiem's equilibrium formulae; Estimation of Discharge and Transmissivity.

Unsteady state Radial flow: Aquifer parameters, General equation derivation- Theis's method,

Cooper-Jacob method, Chow's method, solution of unsteady flow equations.

15 Hours

UNIT - III

GROUNDWATER EXPLORATION, DEVELOPMENT AND MANAGEMENT: Remote sensing and Geophysical methods, Electrical Resistivity methods, types of wells and yield of a well. Methods of construction, tube well design, dug wells, well development, pumps for lifting water - working principles, power requirement. Resource Management, Conjunctive use - necessity, techniques and economics.

9 Hours

Course Outcomes:

At the end of the Course students will be able to

1. **Illustrate** the vertical distribution and occurrence of subsurface water, **List** and **distinguish** the water bearing properties of the rocks, the types of aquifers and their characteristic properties
2. **List** and **explain** aquifer parameters, **analyze** pump test and Darcy' Law in steady state unidirectional groundwater flow.
3. **Explain** equilibrium Well hydraulics and **estimate** the aquifer parameters in steady state radial flow in the unconfined and confined aquifers
4. **Explain** in-equilibrium Well hydraulics and **estimate** the aquifer parameters in unsteady state radial flow in the unconfined and confined aquifers using appropriate methods.
5. **List** and **categorize** types of wells**, inspect** and **explain** advanced techniques of groundwater exploration, development and management using remote sensing, geophysics and GIS.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											1		
CO2	3	2				2							2		
CO3	2	3				2							2		
CO4	2	3				2							2		
CO5	3	2				2	2						2	2	

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

1. Todd, D. K., (2006) "**Groundwater Hydrology**", John Wiley and Sons, Singapore
2. Ramakrishnan, S. (2011) "**Ground Water**", 2nd edition, Scitech publications (India) Pvt. Ltd., Chennai
3. Garg, S. K. (2010) "**Hydrology and Water Resources Engineering**" Khanna Publishers, New Delhi

REFERENCE BOOKS:

1. Karanth, K.R. (1987) "**Groundwater Assessment, development and Management**", Tata McGraw Hill
2. Raghunath, H.M., (2007) "**Groundwate**r", New Age International Publishers, New Delhi
3. Patel, A.S., and Shah, D.L., (2008), "**Water management**" New Age International Publishers, New Delhi
4. Bower H., (1978), **Groundwater Hydrology**, - McGraw Hill. .
5. Walton W.C., (1970), "**Groundwater Resource Evaluation**", Mc Graw Hill Publication, New Delhi.

Online reference:

http://nptel.ac.in/courses/105101010/38#
https://nptel.ac.in/courses/105/103/105103026/
https://nptel.ac.in/courses/105/105/105105042/

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ENVIRONMENTAL IMPACT ASSESSMENT FOR CIVIL ENGINEERING			
Course Code	**20CVE702**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**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.

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, Fault tree analysis, Consequence Analysis.

15 Hours

UNIT – III

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.

9 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

REFERENCE BOOKS:

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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RURAL WATER SUPPLY AND SANITATION			
Course Code	**20CVE703**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:

1. Understand importance of water, drinking water standards, water treatment methods and different types of rural water supply systems.
2. Learn different rural sanitation methods and its importance, rain water harvesting and its uses.
3. Create awareness on communicable diseases and its control measures.
4. Understand different methods of Refuse collection methods and its disposal.
5. Provide the knowledge on Milk sanitation, quality control of milk.

UNIT – I

Rural water supply - Introduction: Need for a protected water supply, investigation and selection of water sources, various techniques for rural water supply, protection of well waters, drinking water quality standards water treatment methods – disinfection, deflouridation, hardness and iron removal, ground water contamination and control

Rural sanitation-Conservancy, public latrine, concept of Eco-sanitation, trenching and composting methods, Two pit latrines, aqua privy, W.C, septic tank, soak pit. Drainage Systems: Storm water and sullage disposal, rain water harvesting and uses.

16 Hours

UNIT – II

Communicable diseases- Terminology, water borne diseases, classifications, methods of communication, general methods of control. Disease vectors: House fly and mosquito – life cycle, diseases, transmission and control measures.

Refuse collection and disposal-Garbage, ash, rubbish, collection methods, transportation, disposal- salvaging, dumping, controlled tipping, incineration, composting, dung disposal-digester, biogas plant.

15 Hours

UNIT – III

Milk sanitation- Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed**.**

9 Hours

Course Outcomes:

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

1. **Identify** problems in rural water supply and monitor, quality and maintenance of rural water supply, **design** low cost water treatment system for rural areas.
2. **Explain** rural sanitation, management of grey, storm water and **recognize** types of waste water treatment systems.
3. **Outline** the safe disposal methods of solid wastes.
4. **Illustrate** types of diseases and preventive measures.
5. **Ensure** quality of milk and preventive **measures** for cattle borne diseases.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2			1	2	1					1	2	2
CO2	2	2				1	2	1					1	2	
CO3	1	2				1	2	1					1	2	
CO4	2	2				1	2	1					1	2	
CO5	1	2				1	2	1					1	2	

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

(a) Joseph A. Salvato (1992), "Environmental Engineering and Sanitation" Wiley publications.

(b) E.W Steel (1979), "Water supply & Sanitary Engineering". McGraw-Hill publications.

(c) Terence J. McGhee, E.W. Steel (1991), "Water Supply and Sewerage". McGraw-Hill publications.

REFERENCE BOOKS:

1. Park and Park (2017) "Preventive & Social Medicine", McGraw-Hill, publications. 24th edition.
2. B.C Punmia & Ashok Jain. (2009) "Environmental Engineering-II", Lakshmi publications.
3. Cairncross, S. and Feachem, R. (2000) Environmental Health Engineering in the Tropics, John Wiley & Sons, 306 p.
4. Dangerfield, B. J. (1983)Water Supply and Sanitation in Developing Countries, The Institution of Water Engineers and Scientists, London, England.
5. McGhee, T. J. (1991) Water Supply and Sewerage, McGraw-Hill, 602 p.
6. Morgan, P. (1990) Rural Water Supplies and Sanitation, Macmillan Education Ltd, 358 p.
7. Qasim S. R., Motley E. M., Zhu G., (2000) Water Works Engineering – Planning, Design and Operation, Prentice-Hall PTR, Upper Saddle River, NJ 07458.
8. Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York.
9. Winbald, U., and Simpson-Hebert, M., Ecological Sanitation, SEI, Stockholm, Sweden.
10. Kadlec R.H. and Wallace S.D., Treatment Wetlands, CRC Press, Boca Raton
11. Wastewater Engineering – Treatment and Reuse, Metcalf and Eddy, Tata McGraw Hill

NPTEL SOURCES
https://nptel.ac.in/courses/105/104/105104102/
http://www.pbdwss.gov.in/dwss/left_menu/major_schemes_projects.html
https://www.classcentral.com/course/water-1364
https://www.classcentral.com/course/sanitation-2230

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REMOTE SENSING & GIS APPLICATIONS IN WATER RESOURCES ENGINEERING			
Course Code	**20CVE704**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

The course will enable the students to:

1. **Explain** the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS& GIS
2. **Explain** the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation.
3. **Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4. **List, Explain and appraise** the significance of GEOMATICS in various Water Resource Engineering practices

UNIT – I

Remote sensing and its principles: Physics of Remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.
Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products
Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.
Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

16 Hours

UNIT – II

Digital Image Processing, Analysis and GIS: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.
Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, Vector and Raster GIS, GIS Hardware and software, GPS & GNSS, georeferencing, digitization, Thematic Maps, Overlay Analysis, Operation of GIS, Co-ordinate

systems and map projections, Map scale, data display and cartography.

15 Hours

UNIT – III

RS & GIS Applications in Civil Engineering: Watershed characteristics, Soil moisture analysis, Water quality assessment and monitoring, flood mapping and monitoring, Village resource mapping, Smart City Development, Groundwater inventory, coastal environmental studies.

9 Hours

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. **Define** and **explain** the principles of Remote Sensing, and **list** various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2. **Explain** Photogrammetry, its basic principles, elements of photo interpretation and Visual& Digital Image interpretation techniques.
3. **Explain** different stages involved in Digital Image Processing, various image enhancement techniques, **list** and **classify** the digital image formats and the extracted information for various purposes.
4. **Explain** and **Appraise** GPS, GNSS & GIS - their components, data structures, process and operation, Map and its projections, components, preparation and Overlays.
5. **List** the applications and **explain** the significance of geospatial technology or GEOMATICS (Photogrammetry, RS, GPS, GNSS& GIS) in various fields of Water Resource Engineering practices.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2	2	
CO2	2	2				2	1						2	2	
CO3	2	2				2	1						2	2	
CO4	2	2				2	1						2	2	
CO5	2	2				2	1						2	2	

1/L: Slight (Low) 2/M: Moderate (Medium) 3/H: Substantial (High)

TEXTBOOKS:

1. Anji Reddy, M. (2012) **Text Book of Remote Sensing and Geographical Information Systems**, Fourth Edition, BS Publication, Hyderabad
2. Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi
3. Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) **Remote sensing and Image Interpretations**, 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1. Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2. Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3. Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4. Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi
5. Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6. Kumar, S. (2008) ***Basics of Remote sensing and GIS,*** Laxmi Publications (P) Ltd., Delhi
7. Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004), ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8. Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation,*** 3rd edn. WH Freeman and Company, New York, 494p.

NPTEL SOURCES

- https://www.youtube.com/user/edusat2004
- https://eclass.iirs.gov.in/login

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ADVANCED HYDRAULICS			
Course Code	**20CVE705**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Illustrate** Chezy's and Manning's formulae and **determine** most economical channel section.
2. **Explain** specific energy and **compute** critical flow in non-prismatic channels
3. Derive dynamic equations of gradually varied flow and compute draw down and back water curves
4. **Make use** of hydraulic jump as energy dissipater
5. **Explain** pipe network analysis and **analyse** pressure distribution system.

UNIT – I

Open Channel Flow:

Kinds of open channel flow, channel geometry, types and regimes of flow Velocity distribution in open channel, Uniform Flow – features of uniform flow, Manning's and Chezy's formula- rigid and mobile boundary channels, determination of roughness coefficients

Determination of normal depth and velocity, most economical sections, non-erodible channels, Flow in a channel section with composite roughness, flow in close conduit with open channel flow, wide open channel, specific energy, critical flow and its computation in non-prismatic channels.

16 Hours

UNIT - II

Varied Flow:
Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, classification of flow profile, draw down and back water curves(M1 and M2 type) profile determination, graphical integration, direct step and standard step method, numerical methods.
Hydraulic Jumps: momentum in open channel flow, specific force, derivation of conjugate depths, types, basic characteristics, length and location, jump as energy dissipation, control of jump, surges.

15 Hours

UNIT – III

PIPE NETWORK:
Water distribution, network analysis, analysis of pressure distribution system- equivalent pipe and Hardy cross method, software application.

9 Hours

Course Outcomes:

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

1. **Determine** most economical channel sections for rigid and mobile boundary channels applying Chezy's and Manning's formulae and **compute** critical flow in non-prismatic channels
2. **Explain** and **compute** specific energy in non-prismatic channels
3. Develop dynamic equations of gradually varied flow, **classify** the flow profiles and **compute** length of draw down and back water curves
4. **Develop** conjugate depth relationship and **make use of** hydraulic jump as energy dissipater.
5. **Analyse** pressure distribution system in pipe network

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3											1	2	
CO2	1	3											1	2	
CO3	1	3											1	2	
CO4	1	3	1	1									1	3	
CO5	1	3	2		2								1	3	

Note: 1: Low 2: Medium 3: High

TEXTBOOKS:

1. Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics, Standard Book House, 22nd edition, 2019.
2. Rangaraju K G, "Flow through open channel", McGraw Hill Publications, 2nd edition 2001.

REFERENCE BOOKS:

1. A. K. Jain., "Fluid Mechanics", Khanna Publishers, New Delhi. 8th edition, 1995.
2. V. T. Chow: "Open-channel hydraulics." McGraw Hill Publications ,2009
3. K. Subramanya "Flow in open channels" Mc Graw Hill India, 4th edition 2015.
4. Santhosh Kumar Garg., Water Supply Engineering, Khanna Publishers, New Delhi, 33 Edition,2010

NPTEL ONLINE SOURCE:

http://nptel.ac.in/courses/105103021

http://nptel.ac.in/courses/105105201

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SOLID WASTE MANAGEMENT			
Course Code	**20CVE801**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Impart the knowledge of present methods of solid waste management system and to analyze the drawbacks.
2. Understand various waste management statutory rules for the present system.
3. Analyze different elements of solid waste management and design and develop recycling options for biodegradable waste by composting.
4. Identify incineration technologies and waste to energy incineration methods
5. Identify hazardous waste, e-waste, plastic waste and bio medical waste and their management systems.

UNIT – I

Introduction: *Scope and importance of solid waste management*, definition and functional elements of solid waste management,
Sources: Sources and types of solid waste, composition of municipal solid waste, generation rate and conventional solid waste disposal methods.
Collection and transportation of municipal solid waste: services, systems and economics, Municipal Solid waste (Management and Handling) 2016 rules.
Composting: *Aerobic and anaerobic process, Vermicomposting.*
Sanitary land filling: definition, site selection, methods, stages, leachate movement and control, advantages and disadvantages.

16 Hours

UNIT – II

Incineration, Air emission control and Energy Recovery:
Types of incinerators, air pollution control process sources – air pollutants and their effect on health and environment. Air pollution control strategy – particulate and gaseous pollution control devices, types of waste to energy technologies.
Hazardous waste management: Definition, identification, classification of hazardous waste, onsite storage, collection, transfer and transport, processing, disposal, hazardous waste management rules 2016(India).
E-waste management: Definition, categories, impacts on human health and environment, recycling and recovery an integrated approach, e-waste generation and management status in India, E-waste management rules 2016(India).

15 Hours

UNIT – III

Biomedical waste management: Classification, collection, transportation, disposal and treatment of biomedical waste, biomedical waste management rules 2016(India).
Plastic waste management: Sources, types, uses, impact of plastics on marine life, effect on wildlife, human health and environment. *Practices- use of plastic waste in roads, greener alternatives.* Plastic waste management rules 2016(India).
Construction and demolition waste management: origin, components, proper management, recycling, construction and demolition waste management rules.
Government initiatives for solid waste management: Swachh Bharat Mission, Smart City.

9 Hours

Course Outcomes:
After going through this course the student will be able to:

1. **Explain** the basic engineering principles of solid waste management, **identify** improper practices and **summarize** the environmental implications.
2. **Outline** the need for economics in collection and transportation of solid waste and **select** the collection and disposal systems.
3. **Explain** the process of incineration, energy recovery and **illustrate** the environmental impacts of incineration.
4. **Plan** the transportation protocol for hazardous wastes, e-waste and choose the treatment and disposal methods.
5. **Develop** an idea on conventional handling and treatment options for biomedical, plastic, construction and demolition waste and **discuss** government initiatives for waste management.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2				2	3	2					1	3	
CO2	1	1	2			2	3	2					1	3	
CO3	2	1				2	3	2					1	3	
CO4	2	1				2	3	2					1	3	
CO5	1	1				2	3	2					1	3	

Note: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

TEXTBOOKS:

1. George. C. Tchobanoglous, "Integrated Solid Waste Management" – McGraw hill publication. International edition 1993, ISBN 978-0070632370
2. Bhide A D and Sunderashan B B, "Solid Waste Management in developing countries", Indian National Scientific Documentation Centre, 1983

REFERENCE BOOKS:

1. R.E. Hester, Roy M Harrison, "Electronic waste management", Cambridge, UK, RSC Publication, 2009, ISBN 9780854041121
2. Municipal Solid waste (Management & Handling Rules) , Ministry of Environment & Forest Notification, New Delhi, 25th Sept 2000 and amendments on 2013.
3. The Plastic Manufacture, Sale and usage Rules2009. Ministry of Environment and Forest Notification, New Delhi, amendment on February 4, 2011
4. Biomedical waste management (Management & Handling Rules) 20th July 1998. Ministry of Environment & Forest Notification, New Delhi, amendment on February 26,2013.
5. Ashok K. Rathoure "Zero Waste: Management Practices for Environmental Sustainability "ISBN: 9780367180393, 2019
6. swachhbharaturban.gov.in; http://swachhbharatmission.gov.in/sbmcms/index.htm
7. http://smartcities.gov.in/content/

NPTEL ONLINE SOURCE:

https://nptel.ac.in/courses/120/108/120108005/
https://nptel.ac.in/courses/105/105/105105160/
https://nptel.ac.in/courses/105/106/105106056/

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ADVANCED APPLIED ENGINEERING GEOLOGY			
Course Code	**20CVE802**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

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

1. **Develop an understanding** and **appraise** the significance of Earth Sciences in Civil Engineering practices.
2. **Identify** and **differentiate** the suitable Materials of construction **evaluating** its Engineering properties
3. **Appraise and appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management.
4. **Identify, Appreciate, Analyse, Interpret, Evaluate** and **Solve** the geological problems coming under Civil Engineering practices

UNIT – I

Geology and Engineering: Earth Science and its disciplines in Engineering practices, Geological Engineering, significance of geology in the Civil Engineering projects, Maps and Map Reading
Earth Resources and Applied Geology: Geology of dams, reservoirs, tunnels, highways and bridge site engineering. Engineering Properties of Rocks: Crushing strength, Transverse strength, porosity, density, abrasive resistance, frost and fire resistance, Qualities of good Building stones, Road Metals, Railway Ballasts & Concrete aggregates. Rocks as M.O.C. – foundation, decorative stones, flooring & roofing with examples.

15 Hours

UNIT – II

Geohydrology and Watershed Management: Concept of watershed and its development, rainwater harvesting & artificial recharging, water quality and water pollution
Environmental Geology & Medical Geology: Earth and Health, Impact of Geology on environmental health hazards, Environmental Geology of landslides, mining, developmental projects, etc., its applications in Engineering disciplines and civil engineering projects viz: tunnelling, dams and reservoirs, etc., Impact of Weathering and Erosion in the Civil Engineering projects and structures.

16 Hours

UNIT – III

Exploration Geology and Geophysics: for foundation and groundwater; geological, geophysical and hydrological investigations, electrical resistivity and seismic methods, Remote Sensing, GIS, GNSS and their application in the field of exploration and civil engineering.

9 Hours

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. **Identify, Explain** and **Appraise** the significance of Earth Sciences in Civil Engineering practices.
2. **Identify** and **differentiate** the suitable materials of construction **evaluating** its Engineering properties
3. **Identify** and **appraise** artificial recharging, water quality, watershed development and management.
4. **Appraise and appreciate** the advanced applications of Earth Sciences in the field of resource exploration, natural calamities, health and environmental management.
5. **Identify, Appreciate** and **Evaluate** the engineering geological problems coming under Civil Engineering practices and **examine** the **solutions** for them

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2							2	2	
CO2	2	2				2	2						2	2	
CO3	2	2				2	2						2	2	
CO4	2	2				2	2						2	2	
CO5	2	2				2	2						2	2	

Note: 1/L: Slight (Low) 2/ M: Moderate (Medium) 3/H: Substantial (High)

TEXTBOOKS:

- Legget, Robert F & Hatheway, Allen W., (1988) ***Geology and Engineering*** 3rd ed., Mc. Graw Hill Book company, Singapore
- Valdiya, K.S. (2005) ***Environmental Geology*** John Wiley & sons, New Delhi
- Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad

REFERENCE BOOKS:

1. Krynine, Dimitri. P & Judd, William. R (1998) ***Principles of Engineering Geology and Geotechnics***, Tata McGraw Hill Publ. Co., New Delhi
2. Keller, Edward A., (1985) ***Environmental Geology*** 4th Ed., CBS Publishers & Distributors, Delhi
3. Johnson, Robert. B & De Graff V. Jerome (1989), ***"Principles of Engineering Geology and Geotechnics",*** McGraw Hill Book co. London

NPTEL SOURCES:

- https://swayam.gov.in./nd1_noc20_ce33/preview
- https://nptel.ac.in/courses/105/105/105105106

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INTRODUCTION TO GEOINFORMATICS			
Course Code	**20CVE803**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

The course will enable the students to:

1. **Explain** the basic principles of Geoinformatics comprising Remote sensing, Photogrammetry, GPS, GNSS& GIS
2. **Explain** the stages and techniques of photogrammetry, aerial photo interpretation, visual & digital image processing, enhancement and interpretation.
3. **Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and overlays
4. **Explain** the GIS functionality and **Appraise** the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS & GIS) in real world applications.

UNIT – I

Remote sensing and its Principles: Physics of remote sensing, EM spectrum, Blackbody concept, atmospheric windows, spectral response of common earth features.
Platforms & Sensors: Ground based, Air borne and Space borne platforms, Active and Passive Sensors, Photographic sensors, scanners, radiometers, RADAR and thermal infrared, hyper spectral remote sensing, Indian satellites and sensors: capabilities, data products
Photogrammetry: Basic principles of Aerial photography and Photogrammetry, Flight procedures, Aerial Photo Interpretation and Analysis techniques.
Satellite Image Interpretation and Analysis techniques: Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC).

16 Hours

UNIT – II

Digital Image Processing and Analysis: Digital image formats, pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures.
Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, vector and raster GIS, GIS Hardware and software, georeferencing, digitization, thematic maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography.

15 Hours

UNIT – III

Geoinformatics and Virtual GIS: Modern Surveying and Geoinformatics, GPS &GNSS, **GIS Functionality**: Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction, Virtual GIS and Real world applications.

9 Hours

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. **Define** and **explain** the principles of Remote Sensing and **list** various types of platforms, sensors & resolutions in RS with a special reference to Indian satellites and data products.
2. **Explain** Photogrammetry, its basic principles, elements of photo interpretation, Visual & Digital Image interpretation techniques
3. **Explain**different stages involved in Digital Image Processing, various image enhancement techniques, **list and classify** the digital image formats and the extracted information for various purposes.
4. **Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, preparation and Overlays.
5. **Explain** the GIS functionality and **appraise** the significance of GEOINFORMATICS (Photogrammetry, RS, GPS, GNSS& GIS) and Virtual GIS in real world applications.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2							2	2	
CO2	2	2				2	1						2	2	
CO3	2	2				2	1						2	2	
CO4	2	2				2	1						2	2	
CO5	2	2				2	1						2	2	

1/L: Slight (Low) 2/ M: Moderate (Medium) 3/H: Substantial (High)

TEXTBOOKS:

1. Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad
2. Bhatta, Basudeva (2011) ***Remote Sensing and GIS***, 2nd edition, Oxford University Press, N. Delhi
3. Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) ***Remote sensing and Image Interpretations,*** 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS:

1. Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2. Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3. Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4. Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi
5. Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6. Kumar, S. (2008) ***Basics of Remote sensing and GIS,*** Laxmi Publications (P) Ltd., Delhi
7. Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004), ***Geographic Information Systems and Science,*** John Wiley & Sons Ltd., ESRI Press
8. Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation,*** 3rd edn. WH Freeman and Company, New York, 494p.

NPTEL SOURCES:

- https://www.youtube.com/user/edusat2004
- https://eclass.iirs.gov.in/login

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GEOINFORMATICS IN ENVIRONMENTAL ENGINEERING			
Course Code	**20CVE804**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

The course will enable the students to:

1. **Explain** the fundamentals of **geoinformatics**
2. **Explain** platforms, visual & digital image processing, enhancement and interpretation.
3. **Explain** and **Appraise** GIS - its components, data structures, process and operation, Map and its projections, components, and its applications.
4. **Explain** and **Remote sensing**, data sets, process and operation, and its applications.
5. **Explain** the RS & GIS applications in environmental engineering.

UNIT – I

Fundamentals of Remote Sensing: Definition, Physics of remote Sensing, EM Radiation and its interactions with atmosphere,Spectral reflectance of earth features, Resolution: Spatial, Spectral, Temporal and Radiometric.

Platforms, Sensors and Image Processing: Platforms, Active and Passive sensors, various satellites in orbit and their sensors, Data products, Image Processing- Visual and digital image, Interpretation, Ground truth verification, Image analysis, Image enhancement, Rectification, Classification: types, accuracy assessment.

16 Hours

UNIT – II

Introduction to GIS: GIS Components- Hardware, Software, Data ware, User. Data input, manipulation and outputs, data analysis, overlay analysis, buffer analysis, interpolation and extrapolation.

Application of Remote Sensing and GIS : Applications of remotely sensed data for identifying solid waste disposal, forest fire mapping, EIA studies , Optimal routing of solid waste using GIS – Case study, Environmental siting of industries.

15 Hours

UNIT - III

Re-modeling of water distribution system using GIS.

Environmental degradation assessment using geoinformatics.

9 Hours

Course Outcomes:

At the end of the course, upon successful completion, each student will be able to:

1. **Explain** the principles of remote sensing, and **list** types of platforms, sensors and resolutions in RS with a special reference to Indian satellite data products.
2. **Explain** platforms and sensors and **discuss** digital image processing and enhancement techniques.
3. **Explain** GIS components, data structures, process, operation, output and **discuss** their applications.
4. **Evaluate** the applications of Geoinformatics in environmental engineering.
5. **Remodel** the case studies related to water distribution system and **assess** the environmental degradation using Geoinformatics.

Mapping of POs & COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2	2	
CO2	2	2					1						2	2	
CO3	2	2					1						2	2	
CO4	2	2					1						2	2	
CO5	2	2					1						2	2	

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

TEXTBOOKS:

1. Anji Reddy, M. (2012) **Text Book of Remote Sensing and Geographical Information Systems**, Fourth Edition, BS Publication, Hyderabad
2. Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi
3. Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) **Remote sensing and Image Interpretations**, 7th edition, John Wiley and sons, New Delhi

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1. Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.
2. Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi
3. Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***
4. Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi
5. Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6. Kumar, S. (2008) ***Basics of Remote sensing and GIS*** Laxmi Publications (P) Ltd., Delhi
7. Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004), ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8. Sabins, F.L. (1997) ***Remote Sensing: Principles and Interpretation***3rd edn. WH Freeman and Company, New York, 494p.

NPTEL SOURCES

https://www.youtube.com/user/edusat2004
https://eclass.iirs.gov.in/login

GROUNDWATER RECHARGE AND CONSERVATION			
Course Code	**20CVE805**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable the students to:

1. **Develop** an understanding of the basics of groundwater geology, theconcepts of rainwater harvesting, water conservation and groundwater recharging with their significance and help them to **Identify** and **explain** the proper water management techniques.
2. **List, categorize** and **explain** aquifer parameters, types of wells, well inventories, **Inspect** the significance of water quality and geology in groundwater recharging.
3. **List, appraise** and **explain** various traditional and artificial water harvesting & groundwater recharging techniques**, examine** site specific selection procedures, their benefits and problems,
4. **Examine** different water conservation & water quality management techniques, **assess** their suitability and cost effectiveness**.**
5. **Identify, appraise** and **explain** the application of Geoinformatics in water harvesting, conservation, artificial recharging and management of water resources

UNIT - I

INTRODUCTION: Water for life, rainwater harvesting and groundwater recharge: concepts, basics of groundwater geology and water conservation techniques, importance.

WELLS AND WELL INVENTORIES: Definition, types, aquifer parameters, well inventories, ground water quality, groundwater pollution, significance of geology in recharging.

15 Hours

UNIT - II

GROUNDWATER RECHARGING: Objectives, recharge, water balance, traditional, artificial, induced methods, hydro fracturing, roof top harvesting, site selection for groundwater recharging, quality of recharging water, coastal aquifers and recharging, benefits and problems.

WATER CONSERVATION AND MANAGEMENT: Water conservation for commercial and industrial facilities, water quality management, management of freshwater and wastewater, recycling and reuse of water, water conservation, need of ensuring quality and cost-effectiveness of water harvesting.

17 Hours

UNIT - III

RS & GIS application in groundwater conservation, harvesting, artificial recharging and management of water resources.

7 Hours

Course Outcomes:

At the end of the Course students will be able to

1. **Explain** the basics of groundwater geology, concepts of rainwater harvesting, water conservation and groundwater recharging with their significance
2. **List, categorize** and **explain** aquifer parameters, types of wells, well inventories, **Inspect** the significance of water quality and geology in groundwater recharging.
3. **List, appraise and explain** various traditional and artificial water harvesting and groundwater recharging techniques, site specific selection procedures, their benefits and problems,
4. **Examine** different water conservation & water quality management techniques, **assess** their suitability and cost effectiveness**.**
6. **Identify, appraise** and **explain** the application of Geoinformatics in water harvesting, conservation, artificial recharging and management of water resources

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2	2						2		
CO2	2	2				2	2						2		
CO3	2	2				2	2						2		
CO4	2	2				2	2						2		
CO5	2	2				2	2						2	2	

Note: 1/L: Low 2/ M: Medium 3/H: High

TEXTBOOKS:

1. Patel, A.S., and Shah, D.L., (2008), "*Water Management"* New Age International Publishers, New Delhi
2. Karanth, K.R., (1987), "*Groundwater Assessment Development and Management"*, Tata McGraw Hill Publishing co. Ltd., New Delhi

REFERENCE BOOKS

1. Todd, D.K., (1980), "*Groundwater Hydrology"*, 2nd ed. John Wiley and Sons, New York
2. Karnataka State Pollution Control Board, (2007). "*Proceedings of International Workshop of Integrated Water Resources management"*
3. Sharma, P.B.S. (2008) *Groundwater Development and Management*
4. Mohan, Seneviratne (2008). "*A practical Approach to water conservation for commercial and Industrial facilities",* Elsevier Publications.
5. Lillesand Thomas N., and Kiefer, R.W: (2003). "*Remote sensing and image interpretations"*, 6th edition, John Wiley and Sons, New Delhi
6. Bhatta, Basudeva (2011) **Remote Sensing and GIS**, 2nd edition, Oxford University Press, New Delhi

NPTEL SOURCES:

https://www.youtube.com/user/edusat2004
https://eclass.iirs.gov.in/login

5. Software based Elective group

3D BIM - AUTODESK REVIT			
Course Code	**20CVE901**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

During the course students will be enable

1. To know the interface of the Revit world and create the model, views, structural items.
2. To add stairs, ramps, railings, floors and roofs in the model
3. To create the ceilings, interiors, dimensioning, annotating and working with revit edit tools.
4. To show the detailing of the model, creating specific views, area plans.
5. To complete the project by using Autodesk Revit tool

UNIT – I

The Autodesk Revit World - The Revit Interface, the Project Browser, File Types and Families.
Creating a model - Placing Walls, Using Reference Planes, Editing Wall Joins, Placing Doors and Windows.
Creating views –Creating levels, creating and modifying building sections, adding wall section, creating detail sections, creating callouts, creating and modifying a camera view, creating an elevation.
Structural items – Adding structural grids, structural columns, structural framing, foundation systems, structural footings.
Stairs, Ramps, and Railings – Creating stairs by using rise/run function, winding staircase, custom railing system, custom stairs, adding ramps.
Floors – Placing floor slab, building a floor by layers, splitting floor materials, pitching a floor to a floor drain, creating shaft openings.
Roofs – Placing roofs by footprint, creating a sloping roof, creating roof by extrusion, adding a roof dormer.

16 Hours

UNIT – II

Ceilings and interiors – creating ceilings, ceiling openings and soffits, interior design, alternate floor materials
Working with the Revit tools – Basic edit, Array, mirror, align, split element.
Dimensioning and Annotating – Selecting and applying dimensioning, placing text and annotation.
Detailing – Working with line weights, drafting on top of the detail, adding notes, creating blank drafting views.

Creating specific views and match lines – Duplicating views, creating dependent views, adding match lines.
Creating sheets and printing, creating rooms and area plans.

15 Hours

UNIT - III

Project based learning

Create a building model of dimension 50' x 80'. Should include the following features; Plan, Elevation, Section details, Electrical layout, plumbing layout, landscaping, 3D views.

9 Hours

Course Outcomes:

At the end of the course the students should be able to

1. To ***illustrate*** the interface of the Revit world and create the ***model***, views, structural items. (L3)
2. ***Model*** stairs, ramps, railings, floors and roofs. (L3)
3. ***Create*** the ceilings, interiors, dimensioning, annotating and working with revit edit tools. (L3)
4. ***Model,*** show the detailing of the ***plan*** by creating specific views and represent the area plans. (L3)
5. ***Create*** the project by using Autodesk Revit tool (L6)

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2		2				2	2		2	2	2	
CO2	2	2			2				2	2		2	2	2	
CO3	2	2			2				2	2		2	2	2	
CO4	2	2			2			2	2	2		2	2	2	2
CO5	2	2	2		2			2	2	2		2	2	2	2

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

REFERENCE BOOKS:

1. Eric Wing, "Autodesk Revit 2017 for Architecture No experience required", Autodesk authorized publisher.
2. "Autodesk® Revit®2015 Getting Started Guide", Autodesk authorized publisher.
3. "Revit shortcuts guide", Autodesk authorized publisher.

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CAD IN CIVIL ENGINEERING			
Course Code	**20CVE902**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. **Understand** the analysis by software tool.
2. **Identify** different types of methods of analysis using software's
3. **Assess** the geotechnical problems using industry best software's
4. **Analyse** the strength of various types of structural members as per the codal provisions.
5. **Design** the various civil Engineering structures using software's

UNIT – I

STRUCTURES: Structural Analysis of 2D and 3D Trusses, Structural Analysis of Continuous Beams using for different types of loadings and support conditions.
Structural Analysis of 2D and 3D Rigid and Braced Frames for different types of loadings, support conditions, section orientations and stiffness variation between columns and beams.

16 Hours

UNIT – II

GEOTECHNICAL: Analyzing and design of retaining walls using CAD software. **15 Hours**

UNIT - III

DESIGN: Creating design sheets using Microsoft Excel. **9 Hours**

Course Outcomes:

At the end of the course the students should be able to

1. Explain the types analysis, structural analysis methods and procedure (L2)
2. Create 2D and 3D Models for analysis with various end conditions. (L3)
3. Plan a column orientation for different types of buildings (L5)
4. Analyse Retaining wall and 3D frames. (L3)
5. Design the analysed structures using MS Excel. (L6)

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				3	2			2	2	2	2	2	2	
CO2	2	1			3	2			2	2	2	2	2	2	
CO3	2	2	2		3	2			2	2	2	2	2	2	2
CO4	2		2		3	2			2	2	2	2	2	2	
CO5	2	2	2		3	2			2	2	2	2	2	2	2

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

REFERENCE BOOKS:

1. Punmia B. C., Ashok Kumar Jain, Arun Kumar Jain, "Strength of Materials and Theory of Structures", Volume I & Volume II, Laxmi Publications (P) Ltd., 2019.
2. Ramamrutham S., "Theory of Structures", Dhanpat Rai & Sons, New Delhi, 2018.
3. N. Krishnaraju and R. N. Pranesh, Reinforced Concrete Design (IS456:2000)-Principles and Practice, New Age International Publishers, New Delhi, 2006.
4. Dr. Ramchandra and Virendra Gehlot, Limit State Design of Concrete Structures (As per IS: 456-2000), Scientific Publishers (India), Jodhpur, 2010.
5. Punmia B.C.(2017) "Soil Mechanics and Foundations", Laxmi Publishing Co
6. IS: 456-2000 (to be supplied in the examination), SP16.

Scheme of Evaluation

CIE

A project report should include Analysis of beams with different end conditions, Analysis of 2D and 3D portal frames.

a. Analysis of beams and frames.
b. Design sheets for buildings and retaining wall

SEE

- Analysis or Beams and frames software : 10 Marks
- Analysis of Retaining walls : 10 Marks
- Design sheet for beams and columns : 10 Marks
- Design Sheet for retaining wall : 10 Marks

c. Viva voce : 10 Marks

- Total : 50 Marks

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FUNDAMENTALS OF MACHINE LEARNING			
Course Code	**20CVE903**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to:
1. Understand the need and basics of machine learning.
2. Learn ANN and Decision Tree model.
3. Explore the various learning algorithms using Supervised Learning.
4. Understand the important aspects of Analytical Learning and difference between Analytical and Inductive Learning Algorithms.
5. Analyse the techniques related to reinforcement learning.

UNIT – I

Introduction: Well posed learning problems, designing a Learning system, Perspectives and Issues in Machine Learning.
Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version Space and Candidate Elimination Algorithm, Inductive Bias.

Decision tree: Representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm. Hypothesis Space Search, Inductive Bias, Issues in Decision Tree Learning.
Artificial Neural Networks: Introduction, Neural Network Representations, Appropriate problems, Perceptrons, Back propagation algorithm.

16 Hours

UNIT – II

Instance Based Learning: k-nearest neighbour learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.
Bayesian Learning: Bayes theorem, Bayes theorem and concept Learning, Maximum Likelihood, Minimum Description Length, Bayes Optimal Classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Networks, EM Algorithm.
Analytical Learning: PROLOG-EBG, Explanation Based Learning.
Combining Inductive and Analytical Learning: Inductive–Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Alter the Search Objective, Augment Search Operators.

15 Hours

UNIT – III

Reinforcement Learning:
Learning Task, Q Learning, Non Deterministic Rewards and Actions, Temporal Difference Learning.

9 Hours

Course Outcomes:

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

1. Acquire the fundamental concept and importance of machine learning.
2. Demonstrate the application of Decision Tree and ANN and Genetic algorithm for real world problems.
3. Design and implement algorithms for supervised learning system.
4. Design and implement algorithms for Analytical and Inductive Learning.
5. Develop machine learning algorithm and reinforcement techniques for real world problems.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				3	2			2	2	2	2	2	2	
CO2	2	1			3	2			2	2	2	2	2	2	
CO3	2	2	2		3	2			2	2	2	2	2	2	2
CO4	2		2		3	2			2	2	2	2	2	2	
CO5	2	2	2		3	2			2	2	2	2	2	2	2

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

TEXTBOOK:

1. T. M. Mitchell, “Machine Learning”, McGraw Hill, 2017.

REFERENCE BOOKS:

1. EthemAlpaydin, “Introduction to Machine Learning”, Second Edition, The MIT Press, 2004.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
3. R. O. Duda, P. E. Hart and D. G. Stork, “Pattern Classification”, Wiley Publications, 2001.
4. T. Hastie, R. Tibshirani, J. Friedman. “The Elements of Statistical Learning”, 2nd edition, 2008.
5. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
6. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
7. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
8. S. Russel and P. Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Prentice Hall, 2009.

E-Books / Online Resources:

1. https://in.mathworks.com/
2. https://www.kdnuggets.com/
3. https://blog.cambridgespark.

MOOC:

1. https://www.udemy.com/topic/
2. https://www.mooc-list.com/
3. https://peltarion.com (Build and deploy AI with deep learning platform)

PYTHON PROGRAMMING			
Course Code	**20CVE904**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

This Course will enable students to

1. Explain the elementary programming constructs and file operations and use it in Python programming.
2. Describe the concepts like strings, conversion of strings to numbers, lists, tuples, and dictionaries and use these in the python programming.
3. Illustrate the object oriented programming concepts in Python.
4. Construct a Graphical User Interface (GUI) and write a multi-threaded and a Client/Server program in Python.
5. Perform the database connection and Common Gateway Interface (CGI) programming in Python and Visualization with Matplotlib.

UNIT – I

Introduction to python, the concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program.
Understanding error messages; Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short circuit evaluation.
Strings and text files; manipulating files and directories, text files: reading/writing text and numbers from/to a file.
Indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists.
Dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

15 Hours

UNIT - II

Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects inheritance, polymorphism, operator overloading (_eq_,_str_, etc); abstract classes; exception handling, try block.

Graphical user interfaces; event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

16 Hours

UNIT – III

Visualization with Matplotlib - General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density
Creating simple web clients, introduction to CGI, CGI module, building CGI applications, python web application frameworks.

9 Hours

Course Outcomes:

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

1. Explain the basic program constructs and file operations in Python and express it.
2. Design the Python programs using the concepts like strings, conversion of strings to numbers, lists, tuples and dictionaries.
3. Implement the functions and object oriented programming concepts in python.
4. Create a Graphical User Interface, multiple threads and Client/Server programs in python.
5. Implement a database connection and CGI programs in python.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			3				1			3	2	2	
CO2	3	3			3				1			3	2	2	
CO3	3	3			3				2			3	2	2	2
CO4	3	3			3				3			3	2	2	
CO5	3	3			3				2			3	2	2	2

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

TEXTBOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, 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. Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, ISBN: 978-0-13-274718-9, 2013.

REFERENCE BOOKS:

1. Chun, J Wesley, Core Python Programming, 2nd Edition, Pearson, 2007 Reprint 2010.
2. Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers & Distributors Pvt. Ltd., ISBN : 978-93-5110-140-6
3. Learning Python, Fifth Edition, Mark Lutz.
4. Programming Python (English) 4th Edition Mark Lutz.
5. Testing Python, David Sale, Wiley India (P) Ltd., ISBN: 978-81-265-5277-1.

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SOFTWARE ADVANCES IN PAVEMENT DESIGN			
Course Code	**20CVE906**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

During the course students will be enable to

1. Understand the flexible pavement design technique using IRC: 37-2018 recommendations.
2. Understand the fundamentals of flexible pavement analysis using KENLAYER application of KENPAVE software.
3. Comprehend the rigid pavement design technique using IRC: 58-2015 recommendations.
4. Understand the fundamentals of rigid pavement analysis using KENSLAB application of KENPAVE software.
5. Carry-out the design of bituminous overlay design using IRC: 81 and IRC: 115 guidelines.

UNIT – I

Flexible Pavement Design using IRC 37-2018 guidelines - Introduction, Fundamental concepts in flexible pavement design as per IRC 37-2018, Steps in design of pavement, Pavement design examples for (i) Pavement section with bituminous layer(s), granular base and GSB; with bituminous layer(s), granular crack relief layer, CTB, and CTSB; (ii) Pavement Section with bituminous layer(s), SAMI crack relief layer, CTB, and CTSB showing; (iii) Pavement Section with bituminous layer(s), emulsion/foam bitumen stabilised RAP/virgin aggregate layer and CTSB; (iv) Pavement Section with bituminous layer(s), granular crack relief layer, CTB, and GSB; bituminous layer(s), granular base (WMM) and CTSB. Perpetual Pavement designs. Introduction to the use of **IIT Pave software** and design examples.

Application of KENPAVE in Flexible Pavement Design – Introduction to KENLAYER package of KENPAVE software, basic concepts, Analysis of pavement using KENLAYER package, design steps and problems.

16 Hours

UNIT – II

Rigid Pavement Design using IRC 58-2015 guidelines – Introduction, Fundamental concepts in rigid pavement design as per IRC 58-2015, Salient Features, Typical cross sections, Damage analysis, Steps in design of pavement, Design of various Components of rigid pavements as per IRC, Illustrative examples for rigid pavement design:(i) Concrete Pavement with tied concrete shoulders, (ii) Concrete Pavement with no concrete shoulders, (iii) Concrete Pavement with widened outer lanes, (iii) Concrete Pavement bonded to DLC layer. Introduction to the use of **IRC-58 2015 excel sheet** and design examples.

Application of KENPAVE in Rigid Pavement Design – Introduction to KENSLAB package of KENPAVE software, basic concepts, Analysis of pavement using KENSLAB package, design

steps and problems.

15 Hours

UNIT – III

Overlay Design and applications

Bituminous overlay design using IRC 81 - 1997: Introduction to BBD studies, Steps in BBD overlay design, development of excel sheets and solving the problems on overlay design.

Bituminous overlay design using IRC 115-2014: Introduction to FWD test, corrections and back calculations. Steps in FWD overlay design, Use of KGP BACK package and IIT-PAVE package for overlay design using FWD datasets. Example problems.Comparison of BBD and FWD method of overlay design.

9 Hours

Course Outcomes:

At the end of the course the students should be able to

1. **Design** the structure of flexible pavement using IRC: 37-2018 recommendations.
2. **Analyze** the flexible pavement using KENLAYER application of KENPAVE software.
3. **Design** the structure and components of rigid pavement using IRC: 58-2015 recommendations.
4. **Analyze** the rigid pavement using KENSLAB application of KENPAVE software.
5. **Design** flexible pavement overlay using IRC: 81 and IRC: 115 guidelines.

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			1				2	2		1	2	2	1
CO2	3	3			1				2	2		1	2	2	1
CO3	3	3			1				2	2		1	2	2	1
CO4	3	3			1				2	2		1	2	2	1
CO5	3	3			1				2	2		1	2	2	1

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

REFERENCE BOOKS:

1. **IRC: 37-2018**: Guidelines for the Design of Flexible Pavements, (4th revision), Indian Roads Congress, New Delhi.
2. **IRC: 58-2015**: Guidelines for the design of Plane Jointed Rigid Pavements for Highways, (3rd revision), Indian Roads Congress, New Delhi.
3. **IRC: 81-1997**: Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique, (1st revision), Indian Roads Congress, New Delhi.
4. **IRC: 115-2014**, Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique, Indian Roads Congress, New Delhi.
5. Yang H. Huang, "Pavement Analysis and Design", Pearson Prentice Hall, 2004
6. Khanna. S. K, Justo. C.E.G, Veeraragavan. A, "Highway Engineering", Revised 10th edition, Nem Chand and Bros, 2014.

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APPLICATION OF RS&GIS FOR WATER RESOURCES MANAGEMENT

Course Code	**20CVE907**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

UNIT - I

Remote Sensing – Introduction, what is Remote Sensing? Remote vs. *In Situ* Sensing, Passive and Active Remote Sensing, Sensor Types, Platforms, , Remote Sensing, Electromagnetic Spectrum (EMS), Electromagnetic Wave, EMR Energy, Energy Interactions in the Atmosphere, EM/Atmospheric Interactions: Scattering, Absorption, Atmospheric Windows, Spectral Characteristics, Sensor Selection, Spectral Reflectance Curves, specular versus diffuse reflection, Typical Spectral Reflectance curves for Vegetation, Soil and Water, Healthy Vs Stressed Vegetation, Atmospheric Influences on Spectral Response Patterns , Spatial and Temporal Effects, Advantages of Remote Sensing, Remote Sensing Images, Natural Colour Photography, False Colour composite, Remote Sensing Applications.

Aerial photography and Photogrammetry

Origin, Types of aerial photograph, Photogrammetry, Parallax, Filters, Orthophotography, Characteristics and its uses, Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution, Hyperspectral Remote Sensing, Signal-to-Noise Ratio (SNR), Storage Formats, Digital Images, Elements of digital image processing system, Comparison of Scanner Systems, Scale of an Image, Satellites & Orbits, examples Hyperspectral Imaging and its importance, DIP, Geometric Corrections, Radiometric Correction, Image Enhancement steps, Effects of Filtering, Information Extraction, Land cover analysis - Vegetation Indices, Image Classification, Objective of Image Classification, Supervised and Unsupervised Image Classification. **15 Hours**

UNIT - II

GIS -What is a GIS? Spatial and non-spatial data, GIS Process, Raster, Vector Formats, Cartographic instruments, Basic properties of geographic features, Database Implementation, Role of DBMS,

MAPS –Introduction, Features, scale, classification, types, numbering of maps, Map projections, types, coordinate system.

GPS Introduction, How GPS Works? Principle, Segments, Trilateration, Navigation System Worldwide, Types of GPS Survey, Errors in GPS, Differential GPS, IRNSS, Applications of GPS.

Hands on sessions

1. Introduction to QGIS, Importing vector and raster data, attribute table, metadata, feature selection, data export.
2. QGIS Plugins, downloading and installing, importance, open street map
3. Georeferencing an Image downloading map, importing, plugin, transformation setting
4. Creating Vector Features-point, lines and polygon, feature editing, adding attributes.
5. Vector Functions and querying, dissolve, join tables, split and merge vector, extraction, overlay, buffer and spatial query.
6. Data Acquisition and raster functions, DEM, terrain analysis –slope, aspect, hill shade and contour, raster calculator, interpolation, clipping
7. Map composition styling and labelling in QGIS, map elements, Map composition.
8. Bhuvan geoportal and Google earth, utilities, data preparation, importing data to QGIS
9. Introduction to Web GIS and Geoserver –Data sharing, geospatial web services, advantages, publishing vector file. creating workspace, editing new data source.
10. Geoserver – Raster and SLD Integration publishing raster file creating SLD file, applying styles.

15 Hours

UNIT - III

11. Project work
12. Project work
13. Project work
14. Project work
15. Project work presentation and submission.

9 HourS

TEXTBOOKS:

1. Lillesand T.M., and R.W. Kiefer, “Remote sensing and Image interpretation”, 4th edition, John Wiley & Sons – 2012.
2. Gonzal, R.C., Wood, R.E., Digital Image processing, Pearson International Publication,2010.
3. Manoj K. Arora, R.C. Badjatia, “Geomatics Engineering”, Nemichand & Bros. Roorkee – 2011.
4. Burrough, P.A., Principles of Geographical Information System for Land Resource

Assessment, Oxford University Press, 2010.

REFERENCE BOOKS:

1. Mather P.M., "Computer processing of remotely sensed images: an introduction", Wiley. – 1988.
2. Jensen J.R., "Introductory digital image processing: A remote sensing perspective", 2nd Edition, Prentice Hall – 1996.
3. Richards J A., X. Jia, "Remote sensing digital image analysis: an introduction", 3rd Edition, Springer - 1999.
4. Peter A. Burrough & Rachel A. McDonnel "Principles of geographic information systems"-(1998), Oxford University press, Great Britain.
5. Chang, "Geographical Information Systems", McGraw Hill Book Co., 2007.

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PROJECT PLANNING USING SOFTWARES			
Course Code	**20CVE908**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

Course Learning Objectives:

During the course students will be enable

1. To study the types of projects, organization structure and project life cycles
2. To study the creation of project file and input data using M S Project.
3. To study the techniques of network analysis, prepare WBS and estimate resources, duration.
4. To schedule a project, assign resources and track status of project.
5. To prepare the progress report and perform earned value analysis of the project.

UNIT – I

Project definition, Time bound project, Cost bound project, Performance (quality) bound project, Safety bound project. Project sequence, Organization structure, Bar chart, Mile stone chart, Project life cycles.

Working in MS Project: Creating a Simple Project, Setting up a Project File, Identifying the activities.

15 Hours

UNIT – II

Network Analysis - Activity and event, Floats; Precedence diagrams, Activity definition, Work break down structures (WBS), Estimation – Resources, duration. Project management plan, Progress reporting, Cost control, Earned value analysis.

Working in MS Project: Building a Schedule, building a Team for Project, Assigning Resources to Tasks, Setting up a Project Budget, Tracking Status, Managing Change.

Evaluating and Correcting Project Performance, Reporting on Projects, closing a Project, Working on More Than One Project, Exchanging Data between Programs, Linking and Embedding.

16 Hours

UNIT - III

Working in Primavera: Overview of Primavera, Creating Simple Project, Scheduling, Assigning Resources.

9 Hours

Course Outcomes:

At the end of the course the students should be able to

1. **Explain** the types of projects, organization structure and project life cycles. (L2)
2. **Create** a project file and input the data using M S Project. (L3)
3. **Plan** a project using the techniques of network analysis; **Organise** WBS and **Estimate** resources, duration. (L5)
4. **Develop** the schedule of a project, assign resources and track status of project. (L3)
5. **Compile** the progress report and **analyse** earned value of the project. (L6)

Mapping of POs &COs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				3	2			2	2	2	2	2	2	
CO2	2	1			3	2			2	2	2	2	2	2	
CO3	2	2	2		3	2			2	2	2	2	2	2	2
CO4	2		2		3	2			2	2	2	2	2	2	
CO5	2	2	2		3	2			2	2	2	2	2	2	2

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

REFERENCE BOOKS:

1. Project Planning and Control Fourth Edition (2003) Eur Ing Albert Lester, CEng, FICE, FIMechE, FIStructE, FAPM, Elsevier Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP
2. Practice standard for work breakdown structures, Project Management Institute, Newtown square, Pennsylvania USA, 2001.
3. Thomas E Uher, Programming and scheduling techniques, UNSW press book, 2003.
4. Paul Eastwood Harris, Planning and Control using Microsoft® PROJECT 2013 and 2016, East wood Harris Pty Ltd, 2016.
5. Bonnie Biafore, Microsoft Project 2013 The missing manual, O'Reilly Media, Inc., first edition 2013.

Scheme of Evaluation

CIE

A project report should include Schedule, WBS, Resource Estimation, Duration Estimation and budget for the following projects

d. Residential project
e. Multi-storeyed project

SEE

- Scheduling a Project in software : 10 Marks
- Preparation of WBS : 10 Marks
- Assigning of resources and cost : 10 Marks
- Reporting on project : 10 Marks
- Viva voce : 10 Marks
- **Total : 50 Marks**

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JAVA PROGRAMMING			
Course Code	**20CVE909**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**1:0:4**	**SEE Marks**	**50**
Total Hours	**40**	**Credits**	**03**

UNIT – I

Introducing Classes – Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this keyword, Method overloading, Using objects as parameters, Argument passing, Returning objects, Access control, static, final, Using command line arguments, variable length arguments.
Inheritance – Inheritance Basics, Using super, creates a Multilevel Hierarchy, When constructors are called? Method Overriding, Using abstract classes, Using final with Inheritance.
Packages and Interfaces – Packages, Access protection, Importing Packages, Interfaces.
Exception Handling – Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try statements, throw, throws, finally.

16 Hours

UNIT – II

Multithreaded Programming – The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication.
Event Handling -Two Event Handling Mechanisms, the Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model.
Working with Windows, Graphics and Text - Overview, AWT Classes, Window Fundamentals, Working with Frame Windows, Creating a Frame Window in an Applet, Creating a Windowed

Program, Displaying Information within a Window, Working with Graphics, Working with color, Setting the Paint Mode, Working with Fonts, Managing Text Output Using Font Metrics.

15 Hours

UNIT - III

Introducing Swings – component and container, Event handling, Painting. Exploring Swings, Swings UI components.

Input/Output – I/O Basics, Reading Console Input, Writing Console Output, The Print Writer Class.

File Handling - Serial Access Files, File Methods, Redirection, Command Line Parameters, Random Access Files.

Java Database Connectivity (JDBC) - The Vendor Variation Problem, SQL and Versions of JDBC, Creating an ODBC Data Source, Simple Database Access, Modifying the Database Contents, Transactions, Meta Data.

9 Hours

TEXTBOOKS:

1. The Complete Reference Java by Herbert Schildt, Seventh Edition, 2007, Tata McGraw-Hill.
2. An Introduction to Network Programming with Java by Jan Graba, 2007, Springer Publications.
3. Programming with World Wide Web by Robert W.Sebesta, Fourth Edition, Pearson Education.

REFERENCE BOOKS:

1. The Complete Reference J2EE by Jim Keogh, 2002, Tata McGraw-Hill.
2. Java – How to Program? by H. M. Deitel, 2004, Prentice Hall.

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OPEN ELECTIVE - I (VII Semester) - 2023-2024

Sl. No.	Code	Name
1.	20MA8X02	Linear Algebra (for all except CS, IS, EC, CCE & AIML)
2.	20HU8X03	Intellectual property rights (for all)
3.	20CV8X07	Environment Impact Assessment (for all except Civil)
4.	20ME8X08	Industrial Pollution Control (for all except Mechanical)
5.	20HU8X24	Professional and Cognitive Communique (for all)
6.	20ME8X28	Operations Management and Entrepreneurship (for all except Mechanical)
7.	20IS8X38	Introduction to Python Programming (for all except CS & IS)
8.	20BT8X40	Bio Fuel Engineering (for all except BT)
9.	20BT8X42	Solid Waste Management (for all except BT & Civil)
10.	20EC8X59	PCB Design (For all except E&C)
11.	20ME8X63	Innovation & Entrepreneurship (for all)
12.	20HU8X68	Introduction to Yoga (The classes will be conducted from 7.00 a.m. to 8.00 a.m. Those who are willing to come at 7.00 a.m. should only register)
13.	20HU8X70	Overview of Indian Culture and Arts (for all)
14.	20HU8X71	Principles to Physical Education (The classes will be conducted from 5.30 p.m. to 6.30 p.m. Those who are willing to come at 5.30 p.m. should only register)
15.	20HU8X72	Introduction to Japanese language (Students with no backlogs, CGPA should be above 7.0 & who opt to get placed in Japanese companies in Japan/India are eligible to register)
16.	20HU8X74	Introduction to German Language (for all)
17.	20ME8X75	Sustainable Development Goals (for all)
18.	20IS8X76	Web Technologies (for all except CS & IS)
19.	20CS8X77	Programming in Java (for all except EC,CS & IS)
20.	20CS8X78	Data Structures & Algorithms (for all except EC,CS & IS)
21.	20EE8X79	Electric Vehicle Technology (for all except EE)
22.	20HU8X81	National Cadet Corps: Organization, Functions & Capabilities (for only NCC Cadet Students)
23.	20EC8X82	Fundamentals of Image Processing – a practical approach (Only for CV, ME & BT)
24.	20HU8X86	Introduction to Yakshagana (for all - who are familiar with kannada Language)
25.	20ME8X88	Marketing Management (for all except Mechanical)

OPEN ELECTIVE - II (VIII Semester)

Sl. No	Code	Name
1.	20MA8X01	Graph Theory (for all except CS & IS)
2.	20HU8X03	Intellectual property rights *(for all except for those who have taken the subject in the VII semester)*
3.	20BT8X05	Nanotechnology (for all except BT)
4.	20CV8X07	Environment Impact Assessment *(for all except Civil & except for those who have taken the subject in the VII semester)*
5.	20ME8X08	Industrial Pollution Control *(for all except Mechanical & except for those who have taken the subject in the VII semester)*
6.	20EE8X10	Non-Conventional Energy Systems *(for all except EE, Mech. & except for those who have taken the subject in the VII semester)*
7.	20CS8X15	Essentials of Information Technology (for all except CS & IS)
8.	20EC8X18	Consumer Electronics (for all except EC)
9.	20ME8X28	Operations Management and Entrepreneurship *(for all except Mechanical & except for those who have taken the subject in the VII semester)*
10.	20ME8X33	Human Resource Management (for all except Mechanical)
11.	20HU8X37	Linguistics and Language Technology (for all)
12.	20MA8X43	Number Theory (for all)
13.	20ME8X65	Automotive Engineering (For all except Mechanical)
14.	20CV8X67	Disaster Management (For all except Civil)
15.	20HU8X68	Introduction to Yoga *(for all except for those who have taken the subject in the VII semester)*
16.	20HU8X71	Principles to Physical Education *(for all except for those who have taken the subject in the VII semester)*
17.	20HU8X72	Introduction to Japanese language *(for all except for those who have taken the subject in the VII semester)*
18.	20HU8X74	Introduction to German Language (for all *except for those who have taken the subject in the VII semester)*
19.	20ME8X75	Sustainable Development Goals (for all *except for those who have taken the subject in the VII semester)*
20.	20CS8X80	Internet of Things (for all except EC,CS & IS)
21.	20IS8X83	Software Engineering Practices (for all except CS & IS)
22.	20IS8X84	Introduction to Cyber Security (for all except CS & IS)
23.	20EC8X85	Space Technology & Applications (for all except E&C)
24.	20HU8X86	Introduction to Yakshagana (for all - who are familiar with kannada language)

GRAPH THEORY			
Course Code	**20MA8X01**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

1. Explain subgraphs, bipartite graphs, isomorphic graphs etc. Apply the concept of trees and its properties
2. Distinguish between Hamilton and Eulerian graph. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.
3. Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.
4. Find the shortest path between two vertices in a graph. Find minimal spanning tree.

UNIT – I

Introduction to graphs **11 Hours**

Graphs and Graph Models, digraphs, Konigsberg bridge problem. Special Types of Graphs: Subgraphs-spanning and induced subgraphs, Isomorphism of graphs. Some Special Simple Graphs, complete graph, Bipartite Graphs.
Connectivity: point and line connectivity
Trees and its properties.

Eulerand Hamilton graphs **4 Hours**

Eulerian and Hamiltonian graphs and their applications.

UNIT – II

Planar graphs: Euler's polyhedron formula, outer planar graphs, applications **9 Hours**

Colorability: Chromatic number, five color theorem, chromatic polynomial, Applications of graph coloring.

Representation of graphs: **6 Hours**

adjacency matrix, incidence matrix, circuit matrix, cut set matrix. Path matrix

UNIT – III

Network Flows: Max -flow and Min-cut Theorem(statement), problems. **04 Hours**

Shortest paths in weighted graphs:
Dijkstra's algorithm to find shortest paths.

Spanning trees: **05 Hours**

Algorithms to find a spanning tree, minimal spanning tree-Kruskal's & Prim's algorithm.

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

1.	Distinguish between bipartite and complete bipartite graphs, identify whether two graphs are isomorphic, find subgraphs of a graph etc.
2.	Distinguish between Eulerian and Hamiltonian graphs.
3.	Identify whether a graph is planar and to find the chromatic polynomial of a graph.
4.	Representing graphs in Matrices.
5.	Apply algorithmic methods to find the shortest path between two given vertices. Use a suitable algorithm to find a minimal spanning tree.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3										
CO2	2	1										
CO3	2	3										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

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

TEXTBOOKS:

1.	F. Harary, "Graph theory", Narosa Publishing House, 1988.
2.	Narsing Deo, "Graph Theory with applications to Engg. and Comp. Sciences", PHI,1974.
3.	"DiscreteMathematicsanditsapplications",KennethH.Rosen,TataMcGrawHill,VEdition-2003.

REFERENCE BOOKS:

1.	D.B.West, "Introduction to Graph Theory", PHI,2001.
2.	Chartrand and Zhang, "First Course in Graph Theory", 2012

E Books / MOOCs/ NPTEL

1.	http://diestel-***graph-theory***.com.
2.	https://nptel.ac.in/courses/111106102

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LINEAR ALGEBRA

Course Code	**20MA8X02**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable the students to

1. Understand the concepts of vectors, bases.
2. Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3. Find the canonical forms and appraise its importance in various fields.
4. Make use of Gram-Schmidt process to produce an orthonormal basis.
5. Learn the concepts of singular value decomposition and PCA.

UNIT - I

Vector spaces

Vector spaces, subspaces, bases and dimensions, coordinate vecotrs, null spaces and column spaces of the matrices.

Linear Transformations

15 Hours

UNIT - II

Canonical Forms

Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.

Inner Product Spaces

Inner products; inner product spaces, orthogonal sets and projections, Gram-Schmidt process, QR-factorization, Least-squares problems.

15 Hours

UNIT - III

Symmetric Matrices and Quadratic Forms:

Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.

09 Hours

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

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	**Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.**

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓ Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2										
CO2	2	2										
CO3	3	1										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Mode of Teaching and Learning:
Class room teaching. Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:	
1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:	
	There will be **8** questions of **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**.

TEXTBOOKS:	
1.	**Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2004.**
2.	David C.Lay, "Linear Algebra and its Applications",3rd edition, Pearson Education (Asia) Pte. Ltd, 2005.
REFERENCE BOOKS:	
1.	M. Artin , Algebra Prentice Hall of India.2004.
2.	Gilbert Strang, "Linear Algebra and its Applications", 4th edition, Thomson Learning Asia, 2003.
3.	Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications", Pearson Education (Asia) Pte.Ltd 7th edition ,2003.
4.	Sheldon Axler, "Linear Algebra Done Right", Springer International Publication, Third Edition,2015.

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INTELLECTUAL PROPERTY RIGHTS

Course Code	20HU8X03	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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NANOTECHNOLOGY			
Course Code	**20BT8X05**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

***Prerequisites*:** Chemistry, Physics
***Corequisites*:** Nil

Course Learning Objectives:
The objective of this course is
- To learn fundamental concepts of nanoscience and nanotechnology
- To appreciate the application of nanoscience to various fields of engineering.

UNIT - I

INTRODUCTION
Introduction to nanoscience, A Brief History of the Super Small, Definition of nanotechnology, Bottom-Up versus Top-Down; Discussions on nanofabrication, Nanolithography(Dip pen, photo, X-ray, Electron beam, nanosphere lithography), Structure-property relationships in materials, Fabrication of Hard Materials.

NANOMATERIAL AND NANO TOOLS
Zero dimensional: Nano particle, 1-D: Nano wires, nano rods, 2-D: Thin films, Special nanomaterials: Buckyballs (Fullerenes), Nanotubes, nanowire, Dendrimers, Nanoshells, magnetic nanoparticle, Quantum Dot (Nanocrystals), self-assembled monolayers, Scanning probe microscopy (Scanning tunneling microscopy, Atomic force microscopy). Characterization of nanomaterials: Physical, chemical and structural. Applications of nanomaterial

15 Hours

UNIT – II

MICROFLUIDICS
Microflows (Laminar flow), Hagen-Pouiselle equation, micromixing, microvalves & micropumps, Need for the microfluidics, Fabrication of Soft Materials, application of microfluidics.Microfluidics and their applications to lab on chip.

MEMS
Introduction and Overview, Design of MEMS, Sensors, Material aspect of MEMS, Electromagnetic Transducers, Mechanical Transducers, Chemical Transducers, Optical Transducers – Applications of optical and chemical transducers. Recent Developments in MEMS and Nanochips. Application of MEMS.

15 Hours

UNIT - III

APPLICATIONS
Sporting goods equipment, Apparel industry, Cosmetics, Appliances, Automobile/vehicle industry, Paint and Other water resistance coatings, Removing windshield fog, Medical bandages, Organic light-emitting displays, Medical applications, Food and Agriculture. Nanotechnology for data storage. Risk assessment, management, ethical aspects.

9 Hours

Course Outcomes:
At the end of this course student will be able to
1. Understand the terminologies of nanotechnology, nanofabrication and structure-property relationship of materials.
2. Learn and understand synthesis of nanomaterials, structures and their methods of characterization.
3. Understand the concepts of microfluidics and its applications
4. Apply nanotechnology concepts in the field of MEMS
5. Apply nanotechnology concepts in various engineering discipline and assess the risk involved in nanotechnology products

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L						L		L			L
CO2	L						L		L			L
CO3	L						L		L			L
CO4	L						L		L			L
CO5	L						L		L			L

TEXTBOOKS:

1. Lindsay, S.M. *Introduction to Nanoscience*, Oxford University Press, 2009.
2. Robert Kelsall and Hamley, I. (Ed.). *Nanoscale Science and Technology*, Wiley, 2005.
3. Bharat Bhushan (Ed.), *Springer Handbook of Nanotechnology*, 3rd Ed., Springer, 2010.

REFERENCE BOOKS:

1. Booker, R. and Earl Boysen (Eds), *Nanotechnology*, Wiley Dreamtech, 2005.
2. Murthy, D.V.S. *Transducers and instrumentation*, Prentice Hall of India, 2010.
3. Schmidt, G. *Nanotechnology Assessment and perspectives*, Springer, 2006.
4. Ratner M. and Ratner, D. *Nanotechnology – A gentle Introduction to the Next Big Idea*, Pearson Education, 2005.
5. Silberzan, J.B.P. *Microfluidics for Biotechnology*, ARTECH house, 2010.
6. Cao, G. *Nanostructure and nanomaterial*, World scientific, 2011.

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ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	**20CV8X07**	**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	**20ME8X08**	**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 : 20ME8X08/ Industrial Pollution Control														
Course Outcomes (CO)	**Program Outcomes (PO)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-20ME8X08.1	2								1	1		1		
C-20ME8X08.2	2								1	1		1		
C-20ME8X08.3	2								1	1		1		
C-20ME8X08.4	2								1	1		1		
C-20ME8X08.5	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	**20EE8X10**	**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
20EE8X10.1	2	3				1	2	1				
20EE8X10.2	2	3				1	2	1				
20EE8X10.3	2	3				1	2	1				
20EE8X10.4	2	3				1	2	1				
20EE8X10.5	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	**20CS8X15**	**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	**20EC8X18**	**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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PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Course Code	**20HU8X24**	**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 Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

UNIT - I

Common sense and Emotional Intelligence Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking; Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence	15
Etiquettes & Workplace Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace	

UNIT - II

Social Networking Sites and its Impacts Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour	15
Gender and Body Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA	

UNIT - III

Writing Types of Writing, Note Taking Methods, Plagiarism **Reading** Styles of Reading, Types of Reading,Scanning, Skimming	9

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

1.	Problematize Commonsense & Apply Critical thinking skills
2.	Comprehend etiquettes and manners in different situations
3.	Be gender sensitive in both offline and online behavior
4.	Exhibit better comprehension of the social implications of human body
5.	Understand the importance of reading and writing skills

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
CO1		3							3	3		3		
CO2		2						3	2	3		2		
CO3		3							2	2		3		
CO4		3							2	2		3		
CO5		2							3	3		2		

1: Low 2: Medium 3: High

REFERENCE MATERIALS:

1.	Geetha.V. Gender. Kolkatta: Web Impressions, 2009.
2.	Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2013): 91-112.
3.	Barry, Peter. Beginning Theory. New Delhi: Viva Books, 2010.
4.	Berger, John. Ways of Seeing. London: Penguin Books, 1977.
5.	Cranny-Francis, Anny, et al. Gender Studies: Terms and Debates. New York: Palgrave Macmillan, 2003.
6.	Gauntlett, David. Media, Gender and Identity: An Introduction. London: Routledge, 2008
7.	Pilcher, Jane, and Imelda Whelehan. 50 Key Concepts in Gender Studies. London: Sage, 2004. Print.
8.	Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.
9.	Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2004): 199-215.Web.

E-RESOURCES:

1.	http://www.cyberpsychology.eu/view.php?cisloclanku=2009061501/ >.
2.	http://www.surveillance-and-society.org/articles2(2)/webcams.pdf
3.	http://eprints.rclis.org/19790/>.

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OPERATIONS MANAGEMENT & ENTREPRENEURSHIP

Course code	**20ME8X28**	**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: 18ME8X28/ Operations Management & Entrepreneurship															
Course Outcomes (CO)	**Program Outcomes (PO)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C-20ME8X28.1	3	1	0					1	1	1	1				
C-20ME8X28.2	1	2	0						1	1	3				
C-20ME8X28.3	2	2	0				1	0	1	1	3				
C-20ME8X28.4	3	1	0			1	0	1	1		2				
C-20ME8X28.5	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	**20ME8X33**	**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 : 20ME8X33 / 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-20ME8X33.1	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.2	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.3	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.4	3	-	-	-	-	1	-	-	1	1	-	1	-	-
C-20ME8X33.5	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	**20HU8X37**	**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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INTRODUCTION TO PYTHON PROGRAMMING			
Course Code	**20IS8X38**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Prerequisites:
Student must have fundamental knowledge of procedure-oriented programming.

Course Learning Objectives (CLOs):
At the end of the course student should be able to:

- Construct Python programs using data types and looping.
- Design object-oriented Python programs using classes and objects.
- Design useful stand-alone and CGI applications in Python.

UNIT - I

INTRODUCTION: Introduction to python, Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages. Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation.
STRING MANIPULATIONS: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers
LISTS, TUPLES, AND DICTIONARIES: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

15 Hours

UNIT – II

FUNCTIONS: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions

CLASSES AND OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block

15 Hours

UNIT – III

FILE HANDLING: Manipulating files and directories, Reading from Text Files, Writing to Text Files, Reading from Binary Files, Writing to Binary Files, Seeking Within Files, Creating and Reading a formatted file (csv or tab-separated).

GRAPHICAL USER INTERFACES: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X38.1	Demonstrate the basics of Python programming like data types and looping	L2
C8X38.2	Apply the basic data structures in solving the problems	L3
C8X38.3	Experiment with usage of functions in a given problem	L3
C8X38.4	Develop Objects by creating classes and apply object-oriented features	L3
C8X38.5	Develop applications in Python using File Programming &User Interface	L3

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1	L2
CO2	1,2,3	1.4.1,1.3.1,2.3.1,3.1.1,3.2.2	L3
CO3	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X38.1	1	2	1											
C8X38.2	1	2	1										2	2
C8X38.3	1	2	2										2	3
C8X38.4	1	2	2										2	3
C8X38.5	1	2	2										2	3

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

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

ADDITIONAL RESOURCES:

1. Think Python. PDF is free.

SEE Question Paper Pattern:

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

BIOFUEL ENGINEERING			
Course Code	**20BT8X40**	**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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SOLID WASTE MANAGEMENT			
Course Code	**20BT8X42**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

***Prerequisites*:** Nil
***Co-requisites*:** Nil

Course Learning Objectives:

The objective of this course is

1. To learn types of solid wastes, collection, treatment and disposal methods.
2. To understand various processing techniques and regulations of treatment and disposal.

UNIT – I

INTRODUCTION TO SOLID WASTES AND ITS SEGREGATION & TRANSPORTATION

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.

Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.

Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

15 Hours

UNIT – II

PROCESSING TECHNIQUES, RECOVERY OF RESOURCES AND WASTE DISPOSAL

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.

Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.

Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

16 Hours

UNIT – III

SOLID WASTE MANAGEMENT RULES AND PLANNING ISSUES

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2011.

Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

8 Hours

Course Outcomes:

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

1. Identify the sources, classification and characteristics of solid wastes
2. Develop insight into the collection, transfer, and transport of solid waste.
3. Apply waste processing techniques and recovery of resources from the waste.
4. Select the alternatives of solid waste disposals and its impacts.
5. Acquire knowledge about solid and hazardous waste management legislative rules.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L								L			
CO2	L	L				L	L		L			
CO3		M							L			
CO4		M				L	L		L			
CO5	L								L			L

REFERENCE BOOKS:

1. Tchobanaglous, G., Theisen, H. and Vigil, S. A. *Integrated Solid Waste Management*, McGraw – Hill. 1993.
2. Tchobanoglous, G., Thiesen, H., Ellasen, *Solid Waste Engineering Principles and Management*, McGraw – Hill, 1997.
3. Landrefh, R. E. And Rebers, P. A. Lewis, *Municipal Solid Wastes-Problems & Solutions*, 1997.
4. Bhide, A. D. and Sundaresan, B. B. *Solid Waste Management in Developing Countries*, Indian National Scientific Documentation Centre. New Delhi, 2000.

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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NUMBER THEORY			
Course Code	**20MA8X43**	**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 the divisibility of integers ,study of prime numbers and basic properties of congruences.
2.	Study Fermat's little theorem and understand Euler's function.
3.	Study the existence of primitive roots and quadratic residues.
4.	Study the cryptographic applications in number theory.

UNIT - I

Divisibility and the theory of congruences

Division algorithm, Euclid's algorithm for the greatest common divisor. Linear Diophantine equations. Prime numbers, fundamental theorem of arithmetic. Basic properties of congruences, Linear congruences and Chinese reminder theorem.

15 Hours

UNIT - II

Fermat's theorem, Wilson's theorem, Euler's Phi function, Euler's theorem.

Primitive roots and Quadratic congruences 16 **Hours**

Order of an integer modulo n, primitive roots for primes, Euler's criterion, Legendre symbol and its properties

UNIT - III

Cryptography

Introduction to public key cryptography, RSA cryptosystem, an application of primitive roots to cryptography

8 Hours

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

1.	Use divisibility and Greatest common divisor in Euclidean algorithm. Solve Diophantine equations. Identify prime factorization of an integers.
2.	Understand the properties of congruences. Use Chinese reminder theorem to find solution of system of linear congruences
3.	Use Fermat's Little Theorem and Wilson's Theorem. Use of Euler's Phi function.
4.	Identify primitive roots of an integers. Apply Euler's criterion and Legendre symbols.
5.	Code and decode numbers in the RSA cryptosystem.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / **↓Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	3										
CO2	2	3										
CO3	2	3										
CO4	2	3										
CO5	2	3										

1: Low 2: Medium 3: High

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1.	Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2.	The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:	
	There will be **8** questions of **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**.

TEXTBOOKS:	
1.	D. Burton; Elementary Number Theory, McGraw-Hill, 2005
2.	Niven, H.S. Zuckerman & H.L. Montgomery, Introduction to the Theory of Numbers, Wiley,2000.
REFERENCE BOOKS:	
1.	H. Davenport, The Higher Arithmetic, Cambridge University Press, 2008.
2.	G.A. Jones & J.M. Jones, Elementary Number Theory, Springer UTM, 2007.
3.	Thomas Koshy, Elementary Number Theory with Applications, 2nd edition, Elsevier, 2007
4.	Fundamentals of Number Theory by William J. LeVeque
E Books / MOOCs/ NPTEL	
1.	http://refkol.ro/matek/mathbooks/ro.math.wikia.com%2520wiki%2520Fisiere pdf incarcate/ Elementary-Number-Theory.pdf
2.	https://nptel.ac.in/courses/111104138
3.	https://nptel.ac.in/courses/111103020

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PCB DESIGN			
Course Code	**20EC8X59**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Pre-requisites:

Basic electrical and electronics engineering.

Course Learning Objectives:

1. To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2. To expose students to complete PCB Design & manufacturing process

List of Experiments

- Introduction to PCB design tool: building a schematic circuit and layout
- Exploring the PCB design tool by creating new components, using existing components and footprint, simulation features, Active & Passive Components
- Drawing a PCB layout in a single layer with constraints such as board area, track width, packages, via etc
- Creating a double layer PCB for a given schematic circuit
- Creating and using different component package types
- Fabrication of single and double layer PCB on a copper clad board using hatching/engraving technique.
- Handling PCB prototype machine using Mach3 CNC tool for the PCB prototype.

Detailed Course Plan

Lab 1

Introduction to PCB design tool : building a schematic circuit.

Lab 2

Creating Library & Components, using existing components and footprint, simulation features, Active & Passive Components.

Lab 3

Designing a single layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 4
Designing a double layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 5
Simulating digital and analog circuits for given test cases.

Lab 6
Handling programmable microcontroller circuit in the simulation environment of schematic editor .

Lab 7
Defining a footprint for a component in the PCB layout.

Lab 8
Fabrication of single layer PCB using PCB prototype machine – Generating bit filein Copper Cam tool.

Lab 9
Fabrication of single layer PCB using PCB prototype machine – Setting up Mach3 CNC tool.

Lab 10
Fabrication of double layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 11
Fabrication of double layer PCB using PCB prototype machine -Setting up Mach3 CNC tool.

Lab 12
Component placement and soldering.

Lab 13
Desoldering and testing.

Scheme of SEE Examination
It is a 3-Hour exam at the end of the semester where the student is to demonstrate the PCB designing process.

Sl.No	Activity	Max. Marks
1	Creating schematic for a given circuit diagram	15
2	PCB Layout design	20
3	Setting up fabrication	15
Total		**50**

Course Outcomes:
At the end of the course the student will be able to
1. Draw schematic circuit and create PCB layout for single or multilayer PCB
2. Fabricate single and double-layer PCB using Mach3Mill operated CNC machine.

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INNOVATION AND ENTREPRENEURSHIP			
Course Code	**20ME8X63**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Prerequisites:
The student must have learnt basics of Engineering concepts, applications and business as a whole.

Course Learning Objectives: This Course will enable students to,

1	Understand Technological Innovation
2	Understand Innovation management and the difference between Invention and Innovation.
3	Appreciate the importance of Innovation as management process and Innovation management techniques.
4	Define Innovation system and Understand the importance of Technology management and Transfer.
5	Identify Technological Entrepreneurship and its types and Understand the Institutional support provided for Entrepreneurs

UNIT – I	
INTRODUCTION TO TECHNOLOGICAL INNOVATION	**14 Hours**
Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.	
INTRODUCTION TO INNOVATION MANAGEMENT	
Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation.	
INNOVATION AND COMPETITIVENESS	
Case Study – Barriers for Innovation and Competitiveness.	
UNIT – II	
INNOVATION AS A MANAGEMENT PROCESS	**14 Hours**
Activities to enhance companies capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	
INNOVATION SYSTEMS	
The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National.	
TECHNOLOGY MANAGEMENT AND TRANSFER	
Technology Transfer - Impacts of MNCs in technology transfer -	
UNIT – III	
INTRODUCTION TO TECHNOLOGICAL ENTREPRENEURSHIP	**11 Hours**
Types of Entrepreneurship: Mixed Entrepreneurship, Pure Entrepreneurship, Social Entrepreneurship, Collaborative Entrepreneurship, Internal Entrepreneurship, External Entrepreneurship - Sustainable Entrepreneurship -	
INSTITUTIONAL SUPPORT	
Business Incubator (Bi) - Determination of the Five Incubator Services - Incubation Centres in India – Atal Incubation Centre – Startup India - NSIC, KIADB, KSFC.	

Course Outcomes (CO):	
At the end of the course the student will be able to,	
CO 1	Describe technological innovation and its key features for business.
CO 2	Describe innovation management and difference between invention and innovation.
CO 3	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
CO 4	Explain innovation system, technology management and transfer.
CO 5	Explain technological entrepreneurship and institutional support.
TEXTBOOK:	
1	Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., "Innovation and Entrepreneurship Theory, Policy and Practice", Springer, 2015.
REFERENCE BOOKS:	
1	Dick Whittington, "Digital Innovation and Entrepreneurship", Cambridge University Press, 2018.

Course Articulation Matrix:

Course Code / Name : 20ME8X63/ INNOVATION AND ENTREPRENEURSHIP														
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C-20ME8X63.1	3	2				1	1		1			1	3	1
C-20ME8X63.2	3	2				1	1		1			1	3	1
C-20ME8X63.3	2	2				1	1		1			1	3	1
C-20ME8X63.4	2	2				1	1		1			1	3	1
C-20ME8X63.5	3	2				1	1		1			1	3	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **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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AUTOMOTIVE ENGINEERING			
Course Code	**20ME8X65**	**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: 20ME8X65 / Automotive Engineering														
Course Outcomes (CO)	**Program Outcomes (PO)**												**PSO**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-20ME8X65.1	3	1	-	-	-	1	-	-	3	1	-	1	3	3
C-20ME8X65.2	3	1	-	-	-	1	-	-	3	1	-	1	1	3
C-20ME8X65.3	3	1	1	-	-	1	-	-	3	1	-	1	3	3
C-20ME8X65.4	2	3	1	-	-	1	-	-	3	1	-	1	2	3
C-20ME8X65.5	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	**20CV8X67**	**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

9 Hours

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:	**20HU8X68**	**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	**20HU8X70**	**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:

1. A. K. Uppal, “Physical Education and Health”
2. M. L. Kamlesh, “Fundamental Elements of physical Education”,
3. Swami Ramdev, “Yog its philosophy and practice”, Divya Prakashan
4. V. K. Sharma, “Health and Physical Education”

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INTRODUCTION TO JAPANESE LANGUAGE

Course Code	**20HU8X72**	**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

INTRODUCTION TO GERMAN LANGUAGE

Course Code	**20HU8X74**	**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: Mechanical

Course Objectives:

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

UNIT - I	
Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischenKarte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vierJahreszeiten, die Jahre Mir gehtes gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings), Wieschreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles: the □ der/die/das; a/an □ ein/eine Die vierFälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv(Not in level A-1) Deklination des bestimmtenArtikels der/die/das Deklination des unbestimmtenArtikelsein/eine (Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified) Deklination von Substantiven (Declension of nouns) (Singular and Plural) (German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects). Nominativ und Akkusativ(nominative and accusative cases) The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive. (Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs) Negation „kein/e/er "(negation with „kein/e/er ") (Singular und Plural) The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k" at the beginning of the declined form of ein/eine/ein. Peter siehteinHaus. □ Negation □ Peter siehtkeinHaus. (Peter sees a house. □ negation □ Peter does not see a house.) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	13
UNIT - II	
Dativ (the dative) (You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask "(To) whom?") Der Plural (the plural) There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular. Das Personalpronomen (the personal pronoun) The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced. Die Formen des Personal pronomenimNominativ (The nominative forms of the personal pronoun): Präpositionen (prepositions) German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But there are also prepositions which can be followed by both. In this case, the question "Where(to)?" (□ accusative) or "Where?" (□ dative) determines the case of the object. PräpositionenmitAkkusativ und Dativ (Prepositions with accusative and dative) 1. PräpositionenmitAkkusativ (prepositions with accusative) 2. PräpositionenmitDativ (prepositions with dative) 3. PräpositionenmitAkkusativoderDativ (prepositions with accusative or dative)	13

(With examples, writing and hearing exercises, and German to English Glossary as applicable)	

UNIT - III

Konjugation von VerbenimPräsens (Conjugation of verbs in present tense) Verbs are conjugated by attaching certain endings, depending on the person and number of the subject. Trennbare und untrennbareVerben (separable and inseparable verbs) Verbs with prefixes are dinstinguished between separable and inseparable verbs. The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be-kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen 1. TrennbareVerben (separable verbs) 2. UntrennbareVerben (inseparable verbs) Konjugation von VerbenimPerfekt (Conjugation of verbs in present perfect) The present perfect (Perfekt) describes something which happened in the past and is especially used in spoken German. It is formed with the present tense form of „haben“ or „sein“ and the past participle of the main verb. 1. Die Bildung des Partizips (the formation of the past participle) 2. Die Bildung des Perfektsmit „haben“ und „sein“ (the formation of the present perfect with „haben“ and „sein“) Modalverben (modal verbs) A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. While the main verb remains in the infinitive, the modal verb is conjugated. In German, there are 7 modal verbs: können (can/be able), dürfen (may/be allowed), wollen (want), müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like) 1. Konjugation der Modalverben (Conjugation of the modal verbs) 2. Stellung des ModalverbsimSatz (Position of the modal verb within a sentence) (With examples, writing and hearing exercises, and German to English Glossary as applicable)	13

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

1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ / ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓ 1	PSO↓ 2
HU1502-1.1						3			2	1		1		
HU1502-1.2						3			2	1		1		
HU1502-1.3						3			2	1		1		
HU1502-1.4						3			2	1		1		
HU1502-1.5						3			2	1		1		

1: Low 2: Medium 3: High

TEXTBOOKS:

1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, UnterrichtswerkfuerErwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989
2.	Paul Coggle and HeinerSchenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden& Stoughton Educational, UK, 2001
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2011

REFERENCE MATERIALS:

1.	Deutsche SprachlehrefürAusländer.
2.	ThemenAktuell (Text and workbook).
3.	Deutsch alsFremdsprache 1A.
4.	Tangram Aktuell 1A/1B (Text and workbook).
5.	Wherever required the Videos/Audios are also played in the class room sessions

E-RESOURCES:

1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. MilindBrahme | IIT Madras
2.	https://www.traingerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online

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SUSTAINABLE DEVELOPMENT GOALS

Course code	**20ME8X75**	**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 : 20ME/ 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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WEB TECHNOLOGIES			
Course Code	**20IS8X76**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives (CLOs):

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

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Illustrate the Database connectivity using PHP
- Examine JavaScript frameworks such as jQuery

UNIT - I

Introduction to HTML- Html tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

15 Hours

UNIT - II

Client side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

15 Hours

UNIT – III

PHP Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X52.1	Adapt HTML and CSS syntax and semantics to build web pages	L2
C8X52.2	Construct and visually format tables and forms using HTML and CSS	L3
C8X52.3	Experiment with the usage of Event handling and Form validation using Java script	L3
C8X52.4	Understand the principles of object oriented development using PHP and Database concepts	L2
C8X52.5	Inspect JavaScript frameworks like jQuery whichfacilitates developer to focus on core features.	L2

Table: Mapping of COs to PIs, POs and BTL			
Course Outcomes (COs)	**Program Outcomes (POs) Addressed**	**Performance Indicators (PI)**	**Bloom's Taxonomy Level (BTL)**
CO1	1,3	1.3.1,1.4.1,3.2.1,	L2
CO2	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L3
CO3	1,3	1.4.1,3.2.1,3.2.2,3.4.3	L3
CO4	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L2
CO5	1,3	1.4.1,3.2.1,3.2.2	L2

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X52.1	1	2		2								1	2	
C8X52.2	1			2								1	2	
C8X52.3	1	2		2	3							1	2	
C8X52.4	1	2		2	3							1	2	
C8X52.5	1			2	3							1	2	

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

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

E RESOURCES:

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

SEE Question Paper Pattern:

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

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PROGRAMMING IN JAVA			
Course Code	**20CS8X77**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable students to:

1. Learn fundamental features of object oriented language and JAVA programming constructs.
2. Develop and run simple Java programs using OOPS concepts of java
3. Create multi-threaded programs and event driven Graphical User Interface (GUI) programming using swing package.

UNIT – I

Introduction to Java: Java's magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Classes, Inheritance: Classes fundamentals; Declaring objects; Call by value and Call by Reference, array of objects, Constructors, this keyword, and usage of static keyword.
Inheritance: inheritance basics, using super, creating multi-level hierarchy, method Overriding, abstract classes, final classes.

15 Hours

UNIT – II

Exception handling, packages and interfaces: Exception handling in Java, use of try, catch blocks, multiple catch blocks, finally block, use of throw and throws clauses, creating custom exceptions. Packages, Access Protection, Importing Packages, Interfaces. IO Streams for file handling.

Multi-Threaded Programming:
What are threads? How to make the classes threadable; Extending threads; Implementing runnable interface; creating multiple threads, join and is Alive methods of Thread class, Thread Synchronization; achieving thread synchronization among multiple threads. Thread priorities, methods to get and set thread priority

15 Hours

UNIT – III

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model;

Swings:
The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField; The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.

09 Hours

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

1. Apply the object-oriented concepts to solve real world problems using JAVA programming features
2. Illustrate the basic constructs and object orients features of the Java language
3. Design a multi-threaded program using Java with exception handling
4. Develop Java programs that includes packages and interfaces and preform file operations in Java
5. Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings

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

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

Graduate Attributes (GA)
This course will map the following GA as per NBA:

1. Design/Development of Solutions
2. Problem Analysis
3. Modern tool usage

TEXTBOOK:

1.Herbert Scheldt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2-11, 22-24, 29,30)

REFERENCE BOOKS:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2008, ISBN:9788131720806
2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with Java, Tata McGraw Hill education private limited.
3. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

E-Books / Online Resources:

1. Online course material by Oracle :
   http://docs.oracle.com/javase/tutorial/index.html
2. https://www.udemy.com/courses/search/?q=java&price=price-free&view=grid

MOOC:

1. Oracle: *www.oracle.com/events/global/en/java.../java-a-beginners-guide-1720064.pdf*
2. NPTEL:*www.nptelvideos.com/java/java_video_lectures_tutorials.php*

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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DATA STRUCTURES AND ALGORITHMS			
Course Code	**20CS8X78**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning Objectives:

This course will enable students to:

1. **Outline** the concepts of data structures, its types, structures and pointers.
2. **Understand** linear data structures, namely, stack, queue, singly linked list and doubly linked list.
3. **Analyze** nonlineardata structures, namely, binary tree and graphs.
4. **Analyze** the non-recursive and recursive algorithms and to represent Efficiency of these algorithms in terms of the standard Asymptotic notations.
5. **Explain** the various algorithm design techniques and apply them to solve various real world problems.

UNIT – I

INTRODUCTION:

Data Structure, Classification (Primitive and non-primitive), data structure operations.

POINTERS:

Definition and Concepts, Accessing variables through pointers, Arrays and pointers. Structures, pointers to structures.

LINEAR DATA STRUCTURES – STACKS:

Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks using C functions (Push(), Pop(), IsStackFull(), IsStackEmpty()).

LINEAR DATA STRUCTURES – QUEUES:

Introduction and Definition Representation of Queue: Array and Structure representation of queue, Operations on Ordinary Queue using C functions (Insert(), Remove(), IsQueueFul(), IsQueueEmpty())

15 Hours

UNIT – II

LINEAR DATA STRUCTURES - SINGLY LINKED LISTS:

Dynamic Memory allocation functions. Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List using C functions (Insert node at front, Remove a node from front, display singly linked list).

LINEAR DATA STRUCTURES - DOUBLY LINKED LISTS:

Doubly Linked List: Representation. (Operations not included).

NONLINEAR DATA STRUCTURES – BINARY TREES:

Binary Trees: Properties, Linked representation of Binary Tree, Binary Tree Traversals, Introduction to Binary Search Tree.

INTRODUCTION TO ALGORITHMS:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving, understanding and representing graphs using adjacency matrix and linked list.

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms.

15 Hours

UNIT – III

DECREASE & CONQUER:

Concept of Decrease and Conquer, Graph traversal algorithms - Depth First Search, Breadth First Search.

DYNAMIC PROGRAMMING:

Concept of Dynamic Programming, Computing a Binomial Coefficient.

GREEDY METHOD:

Concept of Greedy technique, Prims algorithm.

BACKTRACKING:

Concept of Backtracking technique, N-Queens problem.

9 Hours

Course Outcomes:

1. **Acquire** the fundamental knowledge of various types of data structures and pointers using that knowledge, analyze and design the programs using pointers
2. **Apply** the fundamental programming knowledge of data structures to analyze and design linear data structures, namely, stack, queue, singly linked list and doubly linked list and use them for solving problems.
3. **Implement** and apply the concept of binary trees and graph data structures and also understand their traversals.
4. **Analyze** non-recursive or recursive algorithm and to represent in terms of standard Asymptotic notations.
5. **Apply** Divide and Conquer, Decrease and Conquer, Dynamic programming, Greedy, and Backtracking algorithm design techniques to solve real time problems.

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

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

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

TEXTBOOKS:

1. Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2006.
2. Anany Levitin, “Introduction to the Design & Analysis of Algorithms”, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd edition, Universities Press, 2014.
2. Seymour Lipschutz, "Data Structures, Schaum's Outlines", Revised 1st edition, McGraw Hill, 2014.
3. Thomas H. Cormen, Charles E.Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, PHI, 2006.

MOOCs:

1. Introduction to Data Structures by edx , URL: https://www.edx.org/course/
2. Advance Data Structures by MIT OCW , URL: https://www.mooclab.club/
3. Data Structure by Harvard Extension School, URL: http://www.extension.harvard.
4. http://nptel.ac.in/courses/106101060/

SEE SCHEME:

There will be **8** questions of **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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ELECTRIC VEHICLE TECHNOLOGY			
Course Code	**20EE8X79**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Eligible Students: For all engineering stream except E&E Engineering

Course Learning Objectives:

1. To Understand the fundamental laws and vehicle mechanics.
2. To Understand working of Electric Vehicles and recent trends.
3. Ability to analyze different power converter topology used for electric vehicle application.
4. Ability to develop the electric propulsion unit and its control for application of electric vehicles.

UNIT – I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **14 Hours**

UNIT – II

Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super capacitors.

Electric Propulsion:

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. **16 Hours**

UNIT – III

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

9 Hours

Course Outcomes:

At the end of the course student will be able to

1. Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
2. Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3. Model batteries, Fuel cells, PEMFC and super capacitors.
4. Analyze DC and AC drive topologies used for electric vehicle application.
5. Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes & PSO												
Program Outcomes→ ↓ **Course Outcomes**	1	2	3	4	5	6	7	8	9	10	11	12
20EE8X .1	2	3										
20EE 8X .2	1	2	3									
20EE 8X .3	1	2	3									
20EE 8X .4	1	2	3									
20EE 8X .5	1	2	2									

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**.

TEXTBOOKS:

1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2003
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2005

REFERENCE BOOKS:

1. Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2013.
2. Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, OXFORD University, 2001
3. Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2001

E-Books / MOOC:

1. Introduction to Mechanics | Coursera
2. NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
3. Electric Vehicles - Part 1 - Course (nptel.ac.in)
4. Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
5. NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
6. Electric Cars: Technology | My MOOC (my-mooc.com)

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INTERNET OF THINGS – (IoT)			
Course Code	**20CS8X80**	**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.**

NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES

Course Code	**20HU8X81**	**Course Type**	**OEC**
Teaching Hours/Week (L:T:P:S)	**3:0:0:0**	**Credits**	**03**
Total Teaching Hours	**39+0+0**	**CIE + SEE Marks**	**50+50**

Teaching Department: Chemistry

Course Learning Objectives:

1.	To create evolved youth, who will be equipped to contribute in the development of the nation.
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of a smart soldier and to inculcate the sense of authority by commanding the troop under him/her.
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.
4.	To understand and develop life skills, soft skills and to improve the emotional quotient of the student.
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values

UNIT – I

NCC: Aims, Objectives and Organization NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.	7
Personality Development Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.	7

UNIT – II

Naval Communication and Seamanship Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work. Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.	8
Disaster management and environmental awareness Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities. Dos and Don'ts, Fire services and Firefighting, Environmental Awareness and Conservation.	8

UNIT – III

Naval Orientation Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy. Border and Coastal areas: Security Challenges & role of cadets in Border management	9

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

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	**PSO↓**	
↓ Course Outcomes													1	2
HU1505-1.1						3	3	1						
HU1505-1.2						3	3							
HU1505-1.3									1					

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1. Cadets Handbook, R.K. Guptha, Ramesh Publishing House, New Delhi.

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FUNDAMENTALS OF IMAGE PROCESSING – A PRACTICAL APPROACH			
Course Code	**20EC8X82**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**2:0:1**	**SEE Marks**	**50**
Total Hours	**26:0:26**	**Credits**	**03**

Course Learning Objectives:

This course will enable the students to

1. Understand basic operations on images.
2. Understand the concepts of colour models.
3. Explain image enhancement techniques.
4. Perform morphological operations on images.
5. Perform thresholding operation for image segmentation.

Software Tool Required: MATLAB

Image Fundamentals: Description of Image and Basic operations: Image Brightening, Darkening, Addition, Subtraction, Multiplication and logic operations,Binary and Gray scale images, Color Fundamentals.

Image Enhancement Techniques: Concept & Importance of Histogram, Basic gray level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening filters.

Morphological Operations and Thresholding: Introduction, Erosion and Dilation, Opening and Closing, Thresholding, segmentation methods.

26 Hours

List of Experiments:

1. Introduction to MATLAB.
2. Reading and analyzing images.
3. Image Conversions.
4. Basic operations on images.
5. Basic Arithmetic operations on images- Addition, Subtraction and Multiplication.

6. Exploring Image manipulation operations.
7. Histogram processing.
8. Demonstration of Effects of Filters on images-Smoothing.
9. Demonstration of Effects of Filters on images-Sharpening.
10. Exploring different color models.
11. Demonstration of Morphological Operations.
12. Demonstration of thresholding operations.
13. Exploring image segmentation methods.

Scheme of SEE
Laboratory based evaluation

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

1. Demonstrate the understanding of basic operations on images
2. Apply image enhancement methods
3. Perform segmentation operation

Mapping of PO's/ PSO's & CO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO2	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO3	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-

3 – High **2 – Medium** **1 - Low**

TEXTBOOKS:

1. R. C. Gonzalez and R. E Woods, "**Digital Image Processing**", Pearson education (Asia)/Prentice Hall of India, 3rd Edition, 2009.
2. R. C. Gonzalez and R. E Woods, "**Digital Image Processing Using MATLAB**", Pearson education (Asia)/Prentice Hall of India, 2nd Edition, 2011.
3. 1.S. Jayaraman, S Esskairajan "**Digital Image Processing**", illustrated, Tata McGraw-Hill Education,2011.

NPTEL/ MOOC Link:

1. https://nptel.ac.in/courses/117105135/
2. https://nptel.ac.in/courses/117105079

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SOFTWARE ENGINEERING PRACTICES			
Course Code	**20IS8X83**	**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	**20IS8X84**	**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	**20EC8X85**	**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,launchingintoouter 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

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INTRODUCTION TO YAKSHAGANA			
Course Code	**20HU8X86**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**39**	**Credits**	**03**

Course Learning objectives:

The course will enable the students to:

1. Gain basic understanding of Thenku Thittu Yakshagana.
2. Perform basic movements.
3. Understand speech/dialogue, rhythm, Entry and improvisation skills.

UNIT – I

Introduction: Meaning and features, Origin and development, Difference between Thenkuthittu
and Badaguthittu yakshagana. A brief introduction to Thenkuthittu Yakshagana.
Thalas-Aadi thala, yeka thala, Kore thala and Asta Thala with biditha and mukthya- Practice.
Dhingina – Practice…….

14 Hours

UNIT – II

Thalas- Rupaka Thala, Trivide Thala, Jampe thala etc. with biditha and mukthaya.

Dhigina – Practice
Rangasthala Pravesha steps and Eripada ettugade steps.
Revision of all Thalas. ……

14 Hours

UNIT – III

Yakshagana Prasanga Practice- Abhinaya and presentation……..

11 Hours

Performance: The final part of the course is the performance. A Prasanga will be chosen and taught
to the participants and they will perform the same in front of a live audience.

REFERENCE BOOKS:

1. Arthayana: Yakshagana Talamaddale Arthagarike: Ondu Vishleshane: Dr.Ramananda Banari.
2. Yaksha Naatyanjali Thenkuthittu- Sampadaka: Sathish Madivala, Karkala.
3. Yakshagna Shikshana Patya Pustka- Prathamika vibhaga (Karnatka Patya pusthaka sangha-
   Bengaluru)
4. Koralara: YakshaganaVimarsha Sankalana: Dr.M. Prabhakara Joshi
5. Vaagartha Gawrava: (Dr. Joshi Abhinandana Guchaha): Ga. Na. Bhat

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MARKETING MANAGEMENT			
Course Code	**20ME8X88**	**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
CO 2	Interpret the buying behaviour of customers and role of marketing segments
CO3	Explain the role of product pricing and marketing research in the competitive global business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve thegoals of marketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House,New Delhi, 1999

REFERENCE BOOKS:

1. Philip Kolter, " Marketing Management: Analysis, Planning, Implementation and Control ", 1998.
2. Green Paul.E. and Donald Tull, " Research for Marketing Decisions ", 1975.
3. Ramaswamy.V.S. and S.Namakumari, " Marketing Environment: Planning, Implementation and Control the Indian Context ", 1990
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing Strategies.

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