ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(Choice Based Credit System)

R20

Civil Engineering

For

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for batches admitted from 2020-2021)

SWARNANDHRA

COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

SEETHARAMAPURAM, NARSAPUR-534 280, W.G.DT., A.P.

ACADEMIC REGULATIONS

1. INTRODUCTION

Swarnandhra College of Engineering & Technology (**Subsequently referred to as SCET**) will be followed the norms of Jawaharlal Nehru Technological University Kakinada and Govt. of Andhra Pradesh.

All Academic Programme rules and regulations are approved by the Academic Council, which is the highest Academic body of the Institute. It is applicable for all Bachelor of Technology (B. Tech) degree programme from academic year 2020-21.

2. ADMISSIONS

2.1 Regular Admission

(Join in first year B. Tech Programme)

Admissions in the Institution are classified into **CATEGORY – A,** through convener, EAMCET and **CATEGORY- B** filled by the college management.

2.2 Lateral Entry Admission

(Join in the Second year/third semester of B. Tech Programme)

Eligibility: Diploma in Engineering / B.Sc Degree with Mathematics as one course.

Based on the rank secured by the candidate at Engineering Common Entrance Test (ECET) conducted by APSCHE, Government of Andhra Pradesh.

2.3 Advance standing Admission

(Transfer from other Colleges/ Re-admission due to dis-continuation)

These may arise in the following cases:

a) When a student seeks transfer from other colleges to SCET and desirous to pursue the study at SCET in an eligible branch of study.
b) When students of SCET get transferred from one regulation to another regulation.

In all such cases, approval is mandatory from the statutory bodies

3. UNDER GRADUATE (UG) PROGRAMMES OFFERED

The College is offering the following programmes:

- Computer Science and Engineering (CSE)
- Electronics and communication Engineering (ECE)
- Electrical and Electronics Engineering (EEE)
- Information Technology (IT)
- Mechanical Engineering (ME)
- Civil Engineering (CE)
- Artificial Intelligence and Machine Learning (AI&ML)
- Robotics (ROBO)

3.1 Structure of the Programme:

i) **Preamble:**

It is emphasized in UGC Guidelines on Choice Based Credit System (CBCS), that the important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters. It is adopted grading system in place of conventional system of marks and percentages.

CBCS provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The students can register any course of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach through open electives.

Key words CBCS, such as Course, credit, credit point, CGPA, SGPA, Grade Point, Letter Grades as given in the UGC guidelines are used the same definitions.

Each Programme consists of:

- Foundation courses in Basic Sciences, Engineering Sciences, Humanities and social science including management courses.
- Professional core Courses to impart broad knowledge.
- Professional Elective Courses from the discipline or interdisciplinary areas / industry related opted by the student based on their interest in specialization.
- Open Elective Courses from the interdisciplinary areas opted by the students based on their interest in specialization.
- Mandatory Courses, Internship, Seminar, Project work.
- Skill Oriented Courses to upskilling the graduates on the skills relevant to the need and demands of the industry.

Each Programme designed to have 35-40 theory courses, 20-25 laboratory courses and 05 Skill Oriented Courses. The categories of courses are indicated in the following table.

A three-week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

TABLE-1 CATEGORY OF COURSES

S.No	Category	Code
1	Humanities and social science including Management courses	HSMC
2	Basic Science courses	BSC
3	Engineering courses science	ESC
4	Professional core Courses	PCC
5	Open Elective Courses	OEC
6	Professional Elective Courses	PEC
7	Internship, seminar, project work	PROJ
8	Skill Oriented Courses	SC
9	Laboratory Courses	LC
10	Mandatory courses	MC

Note: All components prescribed in the curriculum will be conducted and evaluated.

MOOCS: A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

ii) **Contact hours:** Depending on the complexity and volume of the course, the number of contact hours per week will be determined.

iii) **Credits:**

TABLE-2 CREDITS BASED ON CONTACT HOURS

Course type	No. of Contact Hours	No. of Credits
Theory	1	1
Practical	2	1

TABLE-3 CREDITS FOR DIFFERENT COURSES

Course type	Lecture method			Credits
	L	T	P	C
Theory/Elective	2	1	0	3
	3	0	0	3
	2	0	2	3
	2	0	0	2
Laboratory	0	0	2	1
	0	0	3	1.5
	0	0	4	2
Skill Oriented Courses	1	0	2	2

3.2 Curriculum for each Programme:

- All Four year B. Tech Programme of study is formulated based on the guidelines mentioned in 3.1 and recommended by the concerned Board of Studies (BoS) and approved by the Academic Council(AC).
- The same curriculum will be applicable for lateral entry students from 3 rd semester onwards.
- For advance standing admission, the equivalent curriculum will be prepared by BoS and approved by AC.

4 DURATION OF THE PROGRAMME:

The duration of the B. Tech. Programme is four academic years consisting of eight semesters. Students, who fail to fulfill all the academic requirements for the award of the degree within the prescribed duration as per article 4.1, will forfeit their admission in B. Tech**.**

4.1 Maximum duration of study.

Maximum duration permitted for completion of the B. Tech. Programme of study will be:

Regular Admission: Eight academic years in sequence from the year of admission for a student admitted into first year of any Programme.

Lateral Entry Admission: Six academic years in sequence from the year of admission for a student admitted into second year of any Programme.

Advanced standing Admission: The maximum time for completion of Programme of study, will be twice the period in terms of academic years in sequence, with prescribed curriculum.

TABLE- 4 MAXIMUM DURATION OF STUDY

Admitted year of study	Maximum duration
First year	8 Academic years in sequence
Second year (Lateral entry)	6 Academic years in sequence
Advanced standing	Twice the period in terms of academic years in sequence

4.2 Cancellation of Admission :
In case candidate fails the above conditions for the award of degree, admission stands cancelled.

5 MEDIUM OF INSTRUCTION :
The medium of instruction and examinations are in English.

6 MINIMUM INSTRUCTION DAYS: Each semester will consist of 22 weeks duration with minimum of 110 working days which includes instruction days, internal tests and End examinations.

7 TRANSITORY REGULATIONS (Admitted under advance standing**):**

The following regulations will be followed the operandi. At the time of such admission, based on the Programme pursued (case by case)

- Discontinued or detained candidates are eligible for re-admission in subsequent years in the same semester.
- The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

In case of transferred students from other colleges, credits shall be transferred to SCET as per the academic regulations and course structure of SCET.

8 DISTRIBUTION AND WEIGHTAGE OF MARKS:

Each semester consists of 4/5/6 theory courses and 4/3/2 Laboratory courses. However, in the 8th semester there will be only project work / internship in industry.

(a). **Theory Courses:**

- Each course consists of five units.
- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- The internal evaluation of 30 marks consists of Two Mids for 20 marks and Five class tests for 10 marks.
- Mid Examination: Each mid examination will be conducted for 20 marks with the duration of 75 Minutes. Internal test paper consists of three questions (8M+8M+4M) from two and half units and all are to be answered.
- **Weighted average of two Mids** performance will be considered, weightage of 80% for the best Mid marks and 20% for the second.
- **Class tests for 10 marks calculation**: There will be one class test conducted in each unit. Average of **Best three** will be considered.
- The **end semester** examination will be conducted for 70 marks which covers full syllabus. In end examination pattern, **Part – A** consists of five short questions from all units (Brainstorming/Thought provoking/Case study) for 10 marks. **Part – B** has **5 questions** with internal choice from each unit and valued for 60 marks.
- Internal Marks will be considered for three academic years only if the candidates will not completed the concern course because of less than 12 internal marks. Thereafter the candidate writes external examination for 70 which will be converted to 100 but the candidate must get minimum 40 %.

(b). **Practical Courses:**

- All courses will be evaluated with a maximum of 100 marks.
- Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination.
- End practical examination will be conducted by the internal and external examiner appointed by COE.
- Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

(c). **Design or Engineering Drawing Marks Distribution:** For the courses of design or drawing such as Engineering Graphics, etc., the distribution will be 30 marks for internal evaluation with 10 marks for day-to-day work, and 20 marks from two internal test (80% of first best + 20% of second best). End examination will be conducted for 70 marks.

(d) **Summer Internship:** It can be carried out with a minimum of Six weeks and maximum Eight weeks duration at end of 4^{th} semester and 6^{th} semester. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. It will be evaluated internally by an internal evaluation committee comprising of Head of the Department and two faculty of the department. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits

(e) **Full Internship and Project Work:** The 8th Semester Project Work with full internship will be evaluated for 200 Marks. The project work is evaluated for internal assessment of 60 and external Examination for 140. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

i) Internal Assessment: Internal Assessment will be monitored by Project Review Committee consists of Head of the Department , Supervisor and Senior faculty member on the basis of two seminars and the internal marks will be awarded by Project Supervisor with recommendation of PRC.

ii) External Examination: External Examination will be conducted by Project external examination committee consists of Head of the Department, Supervisor and External examiner appointed by CoE , through presentation / viva - voce by the student.

9. Community Service Project (Experiential Learning through Community Engagement):

Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development. Community Service Project is meant to link the community with the college for mutual benefit. Community Service Project is an integral part of the curriculum with 4 Credits and evaluated internally for 100 marks.

Objectives:

- To sensitize the students to the living conditions of the people who are around them,

- ❖ To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- ❖ To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- ❖ To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- ❖ To help students to initiate developmental activities in the community in coordination with public and government authorities.
- ❖ To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project:

1. Every student should put in a minimum of 180 hours for the Community Service Project during the summer/ Semester vacation.
2. Each class/section should be assigned with a mentor
3. Specific Departments could concentrate on their major areas of concern.
4. A log book has to be maintained by each of the student, where the activities undertaken / involved to be recorded.
5. The log book has to be countersigned by the concerned mentor/faculty incharge.
6. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
7. The final evaluation to be reflected in the grade memo of the student.
8. The Community Service Project should be different from the regular programmes of NSS / NCC / Green Corps / Red Ribbon Club, etc.
9. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
10. The Project Log-, Project Implementation, Project report and Presentation shall carry 20%, 30%, 25% and 25% weightage respectively. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

TABLE- 5 MARKS ALLOCATION

Course type	Marks Allocation			
	Internal		End Semester	Total
	Internal test	Class Test/ Day to day work		
Theory course	20	10	70	100
Laboratory course	15	15	70	100
Design or Drawing course	20	10	70	100
Skill Oriented Courses	15	15	70	100
Summer Internship	50		-	50
Community Service Project	100		-	100
Project Work	60		140	200

(f) **Mandatory Courses**:

These courses are compulsory with zero credits. Only internal examination will be conducted and student has to secure minimum 40% of the marks in the evaluation for passing the course. The minimum attendance requirement is 75 %.

(g) **Open Electives:** Students are to choose Open Elective – I during 5th Semester, Open Elective– II during 6th Semester and Open Elective – III and IV during 7th Semester from the list of Open Electives given in the Course Structure. However, students cannot opt for an Open Elective Subject offered by their own (parent) Department, if it is already listed under any category of the courses offered by the parent Department in any Semester.

(h) **Skill Oriented Courses:**

i) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering.

ii) For these courses, one theory and two practical hours may be allotted as approved by the concerned BOS.

iii) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries/Professional bodies/APSSDC or any other accredited bodies as approved by the concerned BoS.

iv) Every year the concerned BoS review the skill oriented courses based on industrial demand which are offered by the eligible external agencies and college.

v) Marks distribution will be 30 marks for internal evaluation and 70 marks for the end semester examination. End examination will be conducted by the internal and external examiner appointed by COE. Internal evaluation will be a continuous assessment during the semester for 30 marks with 15 marks for day-to-day work, including record valuation and 15 marks for internal test.

vi) If a student chooses a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies, in lieu of the skill advanced course offered by the Department, the credits shall be awarded depends on the Course Completion Certificate.

vii) College academic committee evaluates the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

viii) Therearefive(05)skill-oriented coursesshallbeofferedduring IIIto VIIsemesters.

ix) Out of the five skill courses two shall be skill-oriented courses from the same domainand shall be completed in second year. Of the remaining 3 skill courses, one shall benecessarily be a soft skill course and the remaining 2 shall be skill-advanced courseseither from the same domain or Job oriented skill courses, which can be of interdisciplinary nature.

10. ATTENDANCE REQUIREMENTS

(i) A student will be eligible to appear for end semester examinations, if he/she acquired a minimum of 75% of attendance in aggregate of all the courses.

(ii) Condonation of shortage of attendance in aggregate up to 10% on medical grounds (Above 65% and below 75%) in any semester may be granted by the College Academic Committee.

(iii) Shortage of Attendance below 65% in aggregate shall not be condoned.

(iv) Students with less than 65% of attendance in any semester are not eligible to take up their end examination of that particular semester and their registration for previous semesters examinations shall be allowed.

(v) Attendance may also be condoned for those who participate in Inter Collegiate/university sports, co- and extracurricular activities provided their attendance is in the minimum prescribed range for the purpose (>65%) and recommended by the concerned authority. He/ She shall pay the prescribed Condonation fee.

(vi) Prescribed Condonation fee shall be payable by the student to appear for the end examination.

(vii) A Student will not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester as applicable. They may seek re-admission for that semester as and when offered consecutively.

(viii) A student will be condoned only four times for regular student and three times for lateral entry students during entire course of study.

(ix) For induction programme attendance shall be maintained as per AICTE norms.

TABLE-7 ATTENDANCE REQUIREMENT

Attendance Percentage	Condonation fee	Appear End Exams
Above 75 %	Nil	Eligible
65 % -75%	Yes (on medical grounds)	Eligible
Below 65 %	Nil	Not Eligible (Seek re-admission to that semester when offered)

11. MINIMUM ACADEMIC REQUIREMENTS:

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in **S.No.9.**

(i) A student will be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical or design or drawing subject or project if he/she secures not less than a minimum of 35% of marks exclusively in the end semester examinations in each of the courses, for which the candidate had appeared. However, the candidate should have secured a minimum of 40% marks in both external and internal components put together to declare eligible for pass..

(ii) A student will be promoted from first semester to second semester, second semester to third and third to fourth semester, if he/she satisfies the minimum attendance requirement.

(iii) A student will be promoted from 4^{th} to 5^{th} Semester (2^{nd} year to 3^{rd} year), if he/she fulfills the academic requirements of 40% of the credits up to either 3^{rd} or 4^{th} Semester from all the examinations (Regular and supplementary) whether or not the candidate takes the examinations.

(iv) A student will be promoted from 6^{th} to 7^{th} Semester (3^{rd} year to 4^{th} year), only if he/she fulfills the academic requirements of 40% of the credits up to either 5^{th} or6^{th} Semester from, all the examinations (regular and supply) whether or not the candidate takes the examinations.

(v) When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

TABLE-8 PROMOTION IN TO NEXT HIGHER CLASS

Promotion		Promotion Criteria
From	To	
1ST Semester	2nd Semester	Minimum Attendance requirement
2nd Semester	3rd Semester	
3rd Semester	4th Semester	
4th Semester	5th Semester	Minimum Attendance requirement & 40% of credits up to either 3rd or 4th semester from all exams
5th Semester	6th Semester	Minimum Attendance requirement
6th Semester	7th Semester	Minimum Attendance requirement & 40% of credits up to either 5th or 6th semester from all exams
7th Semester	8th Semester	Minimum Attendance requirement

12. GAP YEAR CONCEPT

Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year study, after the 4th Semester with the due recommendations of the GAP committee and approved by the principal. This may be extended to two years at the most which period is not counted for the maximum time for graduation.

13. AWARD OF B.TECH DEGREE:

A student shall be eligible for award of the B.Tech. Degree if he/she fulfills all the following conditions:

(i) Pursue the programme of study for a stipulated period of four years and not more than eight years.

(ii) Register for 160 credits and secure the same.

(iii) Registered and successfully completed all the components prescribed in the programme of study in which he/she is admitted.

(iv) All mandatory courses must be completed with satisfactory.

(vi) Obtained CGPA greater than or equal to 5.0 (minimum requirements for pass).

(vii) A student shall be eligible for the award of B.Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

(viii) All students shall register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during first two years. Grade shall be awarded asSatisfactoryorUnsatisfactoryinthemarksheetonthebasisofparticipation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

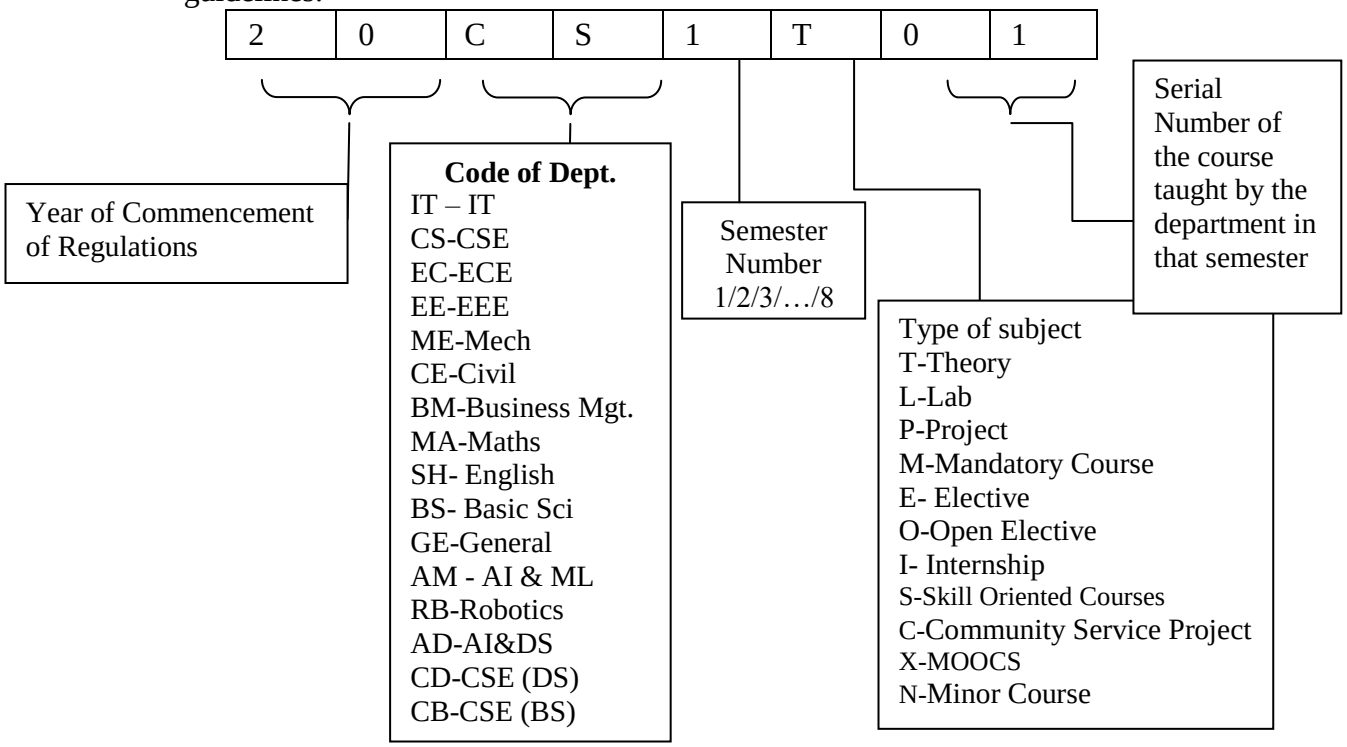
(ix) Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

14. AWARD OF B. TECH. (HONOR)/B. TECH. (MINOR):

B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. Registering for Honors/Minor is optional.(Refer Sl.No 23& 24)

15. COURSE CODE & COURSE NUMBERING SCHEME:

The subject codes will be given by the department teaching the subject. Each subject code contains 8 characters. The 8 characters for each subject will be filled as per the following guidelines.



16. GRADING SYSTEM:

16.1 Award of Grade:

(i) Semester Grade Point Average (SGPA):

a) The Semester Grade Point Average (SGPA) will be calculated according to the formula

$$SGPA\ (Si)=\frac{\sum C_i G_i}{\sum C_i}$$

Where C_i = number of credits for the subject i

G_i = grade points obtained by the student in the subject.

b) To arrive at Cumulative Grade Point Average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time.

$$CGPA = \frac{\sum C_i S_i}{\sum C_i}$$

where 'S_i' is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester

i. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
ii. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.
iii. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters A+, A, B, C, D, E and F.
iv. Equivalent Percentage = (CGPA – 0.75) x 10

(ii) After a student satisfies the requirements prescribed for the award of B.Tech Programme he/she shall be placed in one of the following four grades. The award of the degree is based on CGPA on a grade point scale of 10 and given in Table 9.

Table -9

CGPA	Award of Division
≥7.75	First Class with Distinction (Without any supplementary appearance)
≥ 6.75 <7.75	First Class
≥ 5.75 <6.75	Second Class
≥ 5.00<5.75	Pass Class

16.2 Award of Grade in Each Semester:

(i) Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester for each subject. The letter grades and the corresponding grade points are as given in the Table 10.

Table -10

Percentage of Marks Scored	Letter Grade	Level	Grade Points
>=90	A+	Outstanding	10
80 - 89	A	Excellent	9
70-79	B	Very Good	8
60-69	C	Good	7
50-59	D	Fair	6
40-49	E	Satisfactory	5
<40	F	Fail	0
	Ab	Absent	0

(ii) A student earns a minimum of 5 grade points in a subject is declared to have successfully completed the subject, and is deemed to have earned the credits assigned to that subject. However, it should be noted that a pass in any subject/Internship/project/ shall be governed by the rules mentioned in **S.No. 13**.

(iii) Grade Sheet: A grade sheet (memorandum) will be issued to each student indicating his/her performance in all courses taken in that semester and also indicating the grades.

(iv) Transcripts: After successful completion of the programme of study, a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued up to any point of study to the student on request and by paying stipulated fee in force.

(v) Candidates shall be permitted to apply for revaluation within the stipulated period with payment of prescribed fee.

(vi) The Academic Council has to approve and recommend to the JNTUK, Kakinada for the award of a degree to any student.

17. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 121 credits from 3rd Semester to 8th Semester of Program (regular) for the award of the degree.

ii. Students, who fail to fulfill the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.

iii. The same attendance regulations are to be adopted as per the rules mentioned in item No.9.

iv. **Rules for Promotion in to Next Higher Class:** (6th Semester to 7th Semester): A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to either 5th or 6th Semester.

18. SUPPLEMENTARY EXAMINATIONS:

In addition to the Regular Final Examinations held at the end of each semester, a Supplementary Examination will be conducted. A student can appear for any number courses of supplementary examinations till he/she clears the courses. However the maximum stipulated period of programme cannot be relaxed under any circumstance.

19. ADVANCED SUPPLEMENTARY EXAMINATIONS:

Candidate who fails the courses in 7th and 8th Semester can appear for Advanced Supplementary Examinations.

20. ACADEMIC REGULATIONS FOR B.TECH (LATERAL ENTRY SCHEME):

i. The students have to acquire 121 credits from 3rd Semester to 8th Semester of B. Tech Programme for the award of the degree.
ii. All mandatory courses must be completed with satisfactory for award of degree.
iii. Obtained CGPA greater than or equal to 4.5 (minimum requirements for pass).
iv. The same attendance regulations are to be adopted as per the rules mentioned in item No.09.
v. **Rules for Promotion from 6th Semester to 7th Semester**: A student shall be promoted from 6th Semester to 7th Semester only if he/she fulfills the academic requirements of 40% credits up to 6th Semester.
vi. Students, who fail to fulfill the requirement for the award of the degree in six consecutive academic years from the year of admission, shall forfeit their seat.

21. CONDUCT AND DISCIPLINE:

Students admitted in SCET are to be followed the conduct and discipline of the college and which will be updated from time to time.

22. MALPRACTICES:

If any malpractices held in internal assessment tests or Semester-End Examinations, Principal constitute a Malpractice Enquiry Committee to enquire the case. The principal shall take necessary action based on the recommendations of the committee as per stipulated norms.

23. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the institution or if any case of indiscipline is

pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

24. HONORS PROGRAMME:

a) Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

b) A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 7.75 CGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 CGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

c) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

d) In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

e) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks as recommended by the Board of studies.

f) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

g) The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

h) Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

i) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Honors will be shown in the transcript. None of the courses done under the dropped Honors will be shown in the transcript.

j) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

k) Honors must be completed simultaneously with a major degree program. A student cannot earn

Honors after he/she has already earned bachelor's degree.

25. MINOR PROGRAMME:

a) **i)** Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme; he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

ii) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

b) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE,CE,ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, VLSI etc.

c) The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

d) A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 7.75 CGPA (Cumulative Grade Point Average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 7.75 CGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An CGPA of 7.75 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

e) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

f) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.

g) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

h) Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and

should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

i) College Academic committee evaluates the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

j) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

k) In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

l) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

26. <u>GENERAL:</u>

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
b) The academic regulation should be read as a whole for the purpose of any interpretation.
c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final and which is to be ratified by the Chairman of the Governing Body.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

CIVIL ENGINEERING
COURSE STRUCTURE

SEMESTER-I

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA1T01	Linear Algebra	3	-	-	3.0	30	70	100
2	20BS1T02	Engineering Chemistry	3	-	-	3.0	30	70	100
3	20CE1T01	Building Materials and Construction	3	-	-	3.0	30	70	100
4	20ME1T01	Engineering Graphics	2	-	2	3.0	30	70	100
5	20ME1L02	Basic CAD Lab	-	-	3	1.5	30	70	100
6	20BS1L02	Engineering Chemistry Lab	-	-	3	1.5	30	70	100
7	20CE1L01	Building Planning and Drawing Lab	-	-	3	1.5	30	70	100
8	20HS1L01	English Proficiency Lab	-	-	3	1.5	30	70	100
		Total	**11**	**-**	**14**	**18**	**240**	**560**	**800**

SEMESTER-II

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA2T02	Differential Equations and Numerical Methods	3	-	-	3.0	30	70	100
2	20BS2T01	Engineering Physics	3	-	-	3.0	30	70	100
3	20HS2T01	English	3	-	-	3.0	30	70	100
4	20CS2T01	Problem Solving Using C Programming	3	-	-	3.0	30	70	100
5	20ME2T01	Engineering Mechanics	3	-	-	3.0	30	70	100
6	20ME2L01	Engineering Workshop	-	-	3	1.5	30	70	100
7	20BS2L01	Engineering Physics Lab	-	-	3	1.5	30	70	100
8	20CS2L01	C Programming Lab	-	-	3	1.5	30	70	100
9	20HS2L02	English Communications Lab	-	-	3	1.5	30	70	100
		Total	**15**	**0**	**12**	**21**	**270**	**630**	**900**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,**IM**-INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER-III

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20MA3T06	Statistical Methods	3	-	-	3.0	30	70	100
2	20BM3T01	Managerial Economics and Financial Analysis	3	-	-	3.0	30	70	100
3	20CE3T01	Strength of Materials	3	-	-	3.0	30	70	100
4	20CE3T02	Surveying and Geomatics	3	-	-	3.0	30	70	100
5	20CE3T03	Fluid Mechanics	3	-	-	3.0	30	70	100
6	20CE3L01	Surveying Lab	-	-	3	1.5	30	70	100
7	20CE3L02	Strength of Materials Lab	-	-	3	1.5	30	70	100
8	20CE3L03	Fluid Mechanics Lab	-	-	3	1.5	30	70	100
9	20CE3S01	Land Survey	-	-	2	2.0	30	70	100
10	20CE3M01	Environmental Sciences	2	-	-	-	-	-	-
		Total	**17**	**0**	**11**	**21.5**	**270**	**630**	**900**

SEMESTER-IV

S.No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CE4T01	Structural Analysis	3	-	-	3.0	30	70	100
2	20CE4T02	Concrete Technology	3	-	-	3.0	30	70	100
3	20CE4T03	Engineering Geology	3	-	-	3.0	30	70	100
4	20CE4T04	Geotechnical Engineering	3	-	-	3.0	30	70	100
5	20CE4T05	Water resources Engineering	3	-	-	3.0	30	70	100
6	20CE4L01	Geotechnical Engineering Lab-I	-	-	3	1.5	30	70	100
7	20CE4L02	Engineering Geology Lab	-	-	3	1.5	30	70	100
8	20CE4L03	Concrete Technology Lab	-	-	3	1.5	30	70	100
9	20CE4S01	Revit Architecture	-	-	2	2.0	30	70	100
10	20BM4M01	Indian Constitution	2	-	-	-	-	-	-
		Total	**17**	**0**	**11**	**21.5**	**270**	**630**	**900**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER – V

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CE5T01	Transportation Engineering	3	-	-	3.0	30	70	100
2	20CE5T02	Design of Reinforced concrete structures	3	-	-	3.0	30	70	100
3	20CS5T04	Python Programming	3	-	-	3.0	30	70	100
4		Professional Elective – I	3	-	-	3.0	30	70	100
5		Open Elective-I /Job Oriented Elective - I	3	-	-	3.0	30	70	100
6	20CE5L01	Transportation Engineering Lab	-	-	3	1.5	30	70	100
7	20CS5L03	Python Programming Lab	-	-	3	1.5	30	70	100
8	20HS5S01	Advanced Communication Skills Lab	-	-	2	2.0	30	70	100
9	20BM5M01	Essence of Indian Traditional Knowledge	2	-	-	-	-	-	-
10	20CE5I01	Internship-I	-	-	-	1.5	50	-	50
		Total	17	0	08	21.5	290	560	850

SEMESTER – VI

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CE6T01	Environmental Engineering	3	-	-	3.0	30	70	100
2	20CE6T02	Remote Sensing and GIS Applications	3	-	-	3.0	30	70	100
3	20CE6T03	Design of Steel Structures	3	-	-	3.0	30	70	100
4		Professional Elective Courses – II	3	-	-	3.0	30	70	100
5		Open Elective-II/Job Oriented Elective- II	3	-	-	3.0	30	70	100
6	20CE6L01	GIS and STAAD Lab	-	-	3	1.5	30	70	100
7	20CE6L02	Geotechnical Engineering Lab-II	-	-	3	1.5	30	70	100
8	20CE6L03	Environmental Engineering Lab	-	-	3	1.5	30	70	100
9	20CE6S01	E-TABS	-	-	2	2	30	70	100
10	20BM6M01	Professional Ethics and Intellectual Property Rights	2	-	-	-	-	-	-
11	20CE6C01	Community Service project	-	-	-	4	100	-	100
		Total	**21**	**0**	**11**	**25.5**	370	630	1000

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

SEMESTER – VII

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1		Prof. Elective Courses – III	3	-	-	3.0	30	70	100
2		Prof. Elective Courses – IV	3	-	-	3.0	30	70	100
3		Prof. Elective Courses – V	3	-	-	3.0	30	70	100
4		Open Elective – III /Job Oriented Elective-III	3	-	-	3.0	30	70	100
5		Open Elective – IV /Job Oriented Elective-IV	3	-	-	3.0	30	70	100
6	20HS7T01	Universal Human Values: Understanding Harmony	3	-	-	3.0	30	70	100
7	20CE7S01	Q-Surveying	-	-	2	2.0	30	70	100
8	20CE7I01	Internship-II	-	-	-	3	50	-	50
		Total	**18**	**0**	**2**	**23**	**260**	**490**	**750**

SEMESTER – VIII

S. No.	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CE8P01	Project Work, Seminar and Internship in Industry (6 months internship)	-	-	-	8	60	140	200
Total			-	-	-	**8**	**60**	**140**	**200**

L-LECTURE HOURS, **T**- TUTORIAL HOURS, **P**-PRACTICAL HOURS, **C**-CREDITS,
IM- INTERNAL MARKS, **EM**- EXTERNAL MARKS, **TM**- TOTAL MARKS

PROFESSIONAL ELECTIVE - I

S.NO.	COURSE CODE	COURSE NAME	SEM
1	20CE5E01	Advanced Structural Analysis	V
2	20CE5E02	Foundation Engineering	V
3	20CE5E03	Pavement Materials and Characterization	V
4	20CE5E04	Design of Hydraulic Structures	V
5	20CE5E05	Air pollution and Control	V

OPEN ELECTIVE - I

S. No	Course Code	Course Title	Offering Dept.
1	20EE5O01	Non-conventional Energy sources	EEE
2	20ME5O01	Waste to Energy Conversion	ME
3	20CS5O01	Internet of Things and Applications	CSE
4	20CS5O02	Data Engineering	CSE
5	20BM5O01	Innovations and Entrepreneurship	MBA
6	20BM5O03	Digital Marketing	MBA
7	20BM5O04	Business Environment	MBA

JOB ORIENTED COURSE – I

S. No	Course Code	Course Title	Offering Dept.
1	20IT5J01	Linux Administration	IT
2	20CS5J01	Full Stack with JAVA	CSE

PROFESSIONAL ELECTIVE - II

S.No	Course Code	Course Title	Semester
1	20CE6E01	Repairs and Rehabilitation of Structures	VI
2	20CE6E02	Geosynthetics	VI
3	20CE6E03	Railway and Airport Engineering	VI
4	20CE6E04	Open Channel Flow	VI
5	20CE6E05	Municipal and Hazardous Waste Management	VI

OPEN ELECTIVE – II

S. No	Course Code	Course Title	Offering Dept.
1	20CE6O01	Environmental Pollution and Control	CE
2	20CE6O02	Disaster Management	CE
3	20EE6O01	Fundamentals of Electrical Vehicle	EEE
4	20EC6O01	Mobile Communication and its Applications	ECE
5	20ME6O01	Basics of 3D Printing	MECH
6	20ME6O02	Farm Machinery	MECH
7	20CS6O01	Fundamentals of Software Engineering	CSE
8	20CS6O02	Fundamentals of Computer Networks	CSE
9	20BM6O01	Stress and Work Life Management	MBA
10	20BM6O02	Banking and Insurance	MBA
11	20MA6O01	Operation Research	S&H
12	20IT6O01	Introduction to Cloud Computing	IT
13	20IT6O02	E-Commerce	IT

JOB ORIENTED ELECTIVE - II

S. No	Course Code	Course Title	Offering Dept.
1	20CS6J01	AWS Cloud Practitioner	CSE
2	20CS6J02	Software Testing Tools	CSE
3	20IT6J01	Full Stack Development	IT
4	20IT6J02	Block Chain Technology	IT

PROFESSIONAL ELECTIVE - III

S.No	Course Code	Course Title	Semester
1	20CE7E01	Estimation, Specifications and Contracts	VII
2	20CE7E02	Rock Mechanics	VII
3	20CE7E03	Traffic Engineering	VII
4	20CE7E04	Ground Water Management	VII
5	20CE7E05	Environmental Impact Assessment and Management	VII

PROFESSIONAL ELECTIVE - IV

S.No	Course Code	Course Title	Semester
1	20CE7E06	Advanced structural Design	VII
2	20CE7E07	Ground Improvement Techniques	VII
3	20CE7E08	Pavement Analysis and Design	VII
4	20CE7E09	Hydropower Engineering	VII
5	20CE7E10	Waste Water Engineering and Management	VII

PROFESSIONAL ELECTIVE – V

S.No	Course Code	Course Title	Semester
1	20CE7E11	Pre Stressed Concrete	VII
2	20CE7E12	Soil Dynamics and Machine Foundations	VII
3	20CE7E13	Urban Transportation and Planning	VII
4	20CE7E14	Watershed Management	VII
5	20CE7E15	Faecal Sludge and Septage Management	VII

OPEN ELECTIVE – III

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O01	Solid waste management	CE
2	20CE7O02	Building planning and drawing	CE
3	20EE7O01	Energy auditing, conservation and management	EEE
4	20EC7O01	Introduction to global positioning systems	ECE
5	20ME7O01	Bio-mechanical engineering	MECH
6	20CS7O01	Full-stack development	CSE
7	20BM7O01	Industrial sociology and psychology	MBA

OPEN ELECTIVE – IV

S. No	Course Code	Course Title	Offering Dept.
1	20CE7O03	Introduction to Watershed Management	CE
2	20EE7O02	Introduction to Programmable Logic Controller	EEE
3	20EC7O02	Remote Sensing	ECE
4	20ME7O02	Green Engineering System	MECH
5	20CS7O02	Software Testing Techniques	CSE
6	20BM7O02	Business Skill Development	MBA
7	20IT7O01	Introduction to Software Project Management	IT

SUBJECTS FOR B. TECH. (MINOR) in CIVIL ENGINEERING

S.No	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	20CE4N01	Concrete Technology	3	1	0	4	30	70	100
2	20CE5N01	Structural Analysis	3	1	0	4	30	70	100
3	20CE6N01	Surveying	3	1	0	4	30	70	100
4	20CE7N01	Soil Mechanics	3	1	0	4	30	70	100
5	20CE7X01 20CE7X02	02 MOOCS courses @ 2credits each (Any Civil Engineering related Program Core subject from NPTEL/ SWAYAM course of 8 weeks (2 credits) other than the courses listed above needs to be taken)				4			

I SEMESTER	L	T	P	C
	3	-	-	3
20MA1T01: LINEAR ALGEBRA				

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various realworld problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit I: Matrix Operations and Solving Systems of Linear Equations

Rank of a matrix by echelon form, Normal form - solving system of homogeneous and non-homogeneous linear equations- Gauss Elimination, Jacobi and Gauss Seidel methods - Eigen values and Eigen vectors and their properties (without proof).

Learning Outcomes:

At the end of this unit, the student will be able to

solve systems of linear equations, determine the rank, Eigen values and eigenvectors(K2).

Unit II: Cayley-Hamilton theorem and Quadratic forms

Cayley-Hamilton theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton theorem - Reduction to diagonal form - Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

Learning Outcomes:

At the end of this unit, the student will be able to

- reduce to diagonal form and identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (K3)

Unit III: Multivariable calculus

Expansions of functions: Taylor's and Maclaurin's series - Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes:

At the end of this unit, the student will be able to

- Expand the given function as series of Taylor's and Maclaurin's (K3)
- Find partial derivatives numerically and symbolically and use them to analyze and interpret theway a function varies. (K3)
- Acquire the Knowledge in maxima and minima of functions of several variables (K1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables(K3)

Unit IV: Multiple Integrals

Double Integrals: change of order of integration, double integrals in polar coordinates, areas enclosedby plane curves.

Triple Integral: Evaluation of triple integrals, change of variables

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate double integrals of functions of several variables in two dimensions using Cartesian andpolar coordinates (K3)
- apply double integration techniques in evaluating areas bounded by a region (K4)

Unit V: Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- Conclude the use of special functions in multiple integrals (K3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. B.V. RAMANA, Higher Engineering Mathematics, Tata McGraw Hill, 2007.

Course Outcomes:

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

1. develop the use of matrix algebra techniques that is needed by engineers for practicalapplications (K3)
2. familiarize with functions of several variables which is useful in optimization (K3)
3. learn important tools of calculus in higher dimensions. Students will become familiar withdouble integral(K3)
4. familiarize with triple integral and also learn the utilization of special functions

I SEMESTER	L	T	P	C
	3	-	-	3
20BS1T02: ENGINEERING CHEMISTRY				

COURSE OUTCOMES

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

CO1: Explain the impurities present in raw water, problems associated and how to avoid them (K2)
CO2: Explain the advantages of Polymers in daily life (K2)
CO3: Explain the theory of construction of battery and fuel cells and theories of corrosion and prevention methods. (K2)
CO4: Differentiate conventional and non-conventional energy sources and their advantages and disadvantages. (K2)
CO5: Identify the usage of advanced materials in day to day life (K2)

UNIT I: WATER TECHNOLOGY

Hardness of water-types of hardness-disadvantages of hard water-determination of hardness by EDTA complexometric method. Portable water and its specifications-steps involved in purification of water-chlorination, break point of chlorination. Boiler troubles: Scale and sludge-priming and foaming-boiler corrosion-caustic embrittlement.

Industrial Water Treatment: Softening methods: zeolite process-ion exchange process.
Brackish water treatment (desalination methods): Reverse osmosis - electro dialysis.
Learning Outcomes: At the end of this unit, the students will be able to Explain
The impurities present in raw water, problems associated with them and how to avoid them
UNIT-II: POLYMERS AND COMPOSITE MATERIALS

Polymers-Introduction-Types of polymers-degree of polymerization-functionality-preparation properties and applications of individual polymers-Bakelite-PVC-Poly styrene.

Plastics: Types (thermosetting and thermoplastic)-compounding of plastics-moulding Process (Any Four) - recycling of e-waste.

Rubbers and elastomers: Introduction-natural rubber-vulcanization of rubber-synthetic rubbers-Buna-N, Buna-S.

Composite materials: Fiber reinforced plastics-biodegradable polymers-biomedical polymers-conducting polymers

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Discuss** natural and synthetic rubbers and their applications.

UNIT III: ELECTRO CHEMICAL CELLS AND CORROSION

Electrochemical Cells

Introduction-single electrode potential-electrochemical cell-electrochemical series and applications.

Reference electrodes-standard hydrogen electrode and calomel electrode-construction of glass electrode.

Batteries: Construction, working and cell reaction of primary (dry cell) and Secondary (Pb acid, Ni-Cd, Zinc-Air and Li-ion) battery. Fuel cells (H_2-O_2, Methanol-Air cells).

Corrosion

Defination-theories of corrosion (Chemical and Electrochemical corrosion)-types of corrosion (Galvanic, Differential aeration (waterline and pitting corrosion), stress Corrosion). Factors influencing rate of corrosion-nature of metal-nature of corrosive atmosphere.

Corrosion Prevention methods: Cathodic protection-Sacrificial anodic method-Impressed voltage method. Metallic coatings: Galvanization-Tinning-Electro plating-Electro less plating.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

UNIT IV: CONVENTIONAL AND NONCONVENTIONAL ENERGY RESOURCES

Conventional energy sources

Introduction to fuels-classification and characteristics of fuels-solid, Liquid and gaseous fuels-advantages and disadvantages-calorific value-higher and lower calorific values-construction and working of bomb calorimeter-analysis of coal-proximate and ultimate analysis-numerical problems related to bomb calorimeter, Dulong's formula and coal analysis-petroleum refining-cracking-petrol and diesel knocking-octane number and cetane number-gaseous fuels-Natural gas-CNG-LPG

Non-conventional energy sources

Solar energy: Advantages-disadvantages of solar cells-construction and working of photo voltaic cell-Introduction to hydro power-geo thermal power-tidal and wave power.

Learning Outcomes: At the end of this unit, the students will be able to

- **Differentiate** conventional and non conventional energy sources and their advantages and disadvantages.
- **Explains** energy production by different natural sources

UNIT V: CHEMISTRY OF MATERIALS

Nano materials: Introduction-sol-gel method-characterization by BET, SEM and TEM methods-carbon nanotubes and fullerenes: Types, preparation and applications

Semiconductors:Preparation (Distillation, Zone refining, Czochralski crystal pulling epitaxy, diffusion, ion implantation)-semiconductor devices (P-N junction diode as rectifier, junction transistor)

Cement: Constituents of cement-setting and Hardening of cement, Decay of Cement.

Refractories: Definition of refractory-classification and properties of refractoriness-applications of refractories.

Learning Outcomes: At the end of this unit, the students will be able to

- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure the surface properties of materials.
- **Illustrate** the commonly used industrial materials.

Text Books:

T1. N. Y. S. Murthy, V. Anuradha & K. Ramana Rao, A Text Book of Engineering Chemistry - Maruthi Publications. (2018)

T2. K. Sesha Maheswaramma, Mridula Chugh, A Text Book of Engineering Chemistry - Pearson Publications (2018).

Reference Books:

R1. Jain & Jain, Engineering Chemistry – Dhanpat Rai Publishing Company (2017)

R2. Shashi Chawla, Text Book of Engineering Chemistry - Dhanpat Rai & Co. (P) Limited (2017)

R3. Prasanta Rath, Subhendu Chakroborthy, Chemistry –Cengage publications (2018)

I SEMESTER	L	T	P	C
	3	-	-	3
20CE1T01: BUILDING MATERIALS AND CONSTRUCTION				

COURSE OUTCOMES

Students are able to

1. reproduce knowledge towards civil engineering materials like stones, bricks, tiles in building construction. (K1)
2. explain about stone masonry , wood in building construction. (K2)
3. interpret the application of lime, cement and their importance in construction field. (K2)
4. prepare building components like lintels, arches, vaults, stair cases. (K3)
5. discuss various finishing's in building construction. (K2)

SYLLABUS:

UNIT- I

STONES, BRICKS AND TILES : Properties of building stones - relation to their structural requirements, classification of stones - stone quarrying - precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminum, Gypsum, Glass and Bituminous materials - their quality.

UNIT-II

MASONRY: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry Cavity and partition walls.

WOOD: Structure – Properties - Seasoning of timber - Classification of various types of woods used in buildings - Defects in timber.

Alternative materials for wood - Galvanized Iron, Fiver - Reinforced Plastics.

UNIT-III

LIME AND CEMENT: Lime: Various ingredients of lime - Constituents of lime stone -classification of lime - various methods of manufacture of lime. Cement: Portland cement- Chemical Composition - Hydration, setting and fineness of cement- Various types of cement and their properties- Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance - various tests for concrete.

UNIT -IV

BUILDING COMPONENTS: Lintels, arches, vaults, stair cases - types. Different types of floors - Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs - King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre-fabricated roofs.

UNIT-V

FINISHINGS: Damp Proofing and water proofing materials and uses - Plastering Pointing, white washing and distempering - Paints: Constituents of a paint - Types of paints – characteristics of paints- Painting of new/old wood- Varnish-form Works and Scaffoldings.

Text Books:

1. Building Materials by S.S. Bhavikatti, Vices publications House private Ltd.
2. Building Construction by S.S. Bhavikatti, Vices publications House private Ltd.
3. Building Materials by B.C. Punmia, Laxmi Publications private Ltd.

4. Building Construction by B.C. Punmia, Laxmi Publications (p) Ltd.

Reference Books:

1. Building Materials by S.K.Duggal, New Age International Publications.
2. Building Materials by P.C.Verghese, PHI learning (P) Ltd.
3. Building Materials by M.L.Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction by P.C.Verghese, PHI Learning (P) Ltd.

E-Resources

1. https://nptel.ac.in/courses/105102088
2. https://archive.nptel.ac.in/courses/105/106/105106206/

I SEMESTER	L	T	P	C
	2	-	2	3
20ME1T01 : ENGINEERING GRAPHICS				

COURSE OUTCOMES: Students are able to

CO1: Construct polygons, conics, cycloids, involutes. (K3)

CO2: Draw the orthographic projections of points, lines and planes in different positions. (K2)

CO3: Draw the orthographic projections of solids in different views. (K2)

CO4: Draw the orthographic projections of sectioned solids and development of surface of solids. (K2)

CO5: Prepare Isometric views of simple solids and conversion of Isometric to Orthographic views and vice-versa. (K2)

UNIT I

POLYGONS AND PLANE CURVES

Basic Geometrical constructions, Curves used in engineering practices: Construction of regular polygons, Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II

PROJECTION OF POINTS, LINES AND PLANES

Orthographic Projection – Principles - Principal planes - First angle projection - Projection of points, Projection of straight lines inclined to both the principal planes (only First angle projections).

Projections of Planes: Regular planes perpendicular and parallel to one reference plane and inclined to the other reference plane; inclined to both the Reference planes.

UNIT III

PROJECTION OF SOLIDS

Projections of Solids: Prisms, Pyramids, Cone and Cylinder, Simple positions of solids and axis of the solid parallel to one plane and inclined to other plane.

UNIT IV

PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

UNIT V

ISOMETRIC PROJECTIONS

Principles of Isometric projection – Isometric scale – Isometric projections of simple solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions and Conversion of Isometric views to Orthographic views; Conversion of Orthographic views to Isometric views.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications 2016.
2. Engineering Drawing + AutoCAD by K. Venugopal, V. Prabhu Raja, New Age 2010.

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers 2016.
2. Engineering Graphics for Degree by K.C. John, PHI Publishers 2009.
3. Engineering Graphics by PI Varghese, McGrawHill Publishers 2013.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20ME1L02: BASIC CAD LAB				

COURSE OBJECTIVE

To impart the students with necessary computer aided modeling skills using standard CAD packages.

COURSE OUTCOMES: Students will be able to

CO1. Demonstrate the usage of CAD software and to draw the geometric entities, to create 2D and 3D wire frame models. [K3]

CO2. Understand the paper-space environment thoroughly [K2]

CO3. Create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection. [K3]

UNIT -I

INTRODUCTION TO COMPUTER AIDED DRAFTING- Generation of points, lines, curves, polygons, dimensioning. Types of modeling-Object selection commands, edit, zoom, cross, hatching, pattern filling, utility commands in object selection commands, 2D and 3D wire frame modeling

UNIT-II

VIEW POINTS AND VIEW PORTS - View point coordinates and views displayed, Examples to exercise different options like save, restore, delete, joint, single option

UNIT-III

COMPUTER AIDED SOLID MODELING- Isometric projections, orthographic projections of isometric projections, modeling of simple solids, machines and machine parts

- Draw the following component by Using Polar Co-Ordinate System.
- Drawing of a Title Block with necessary Text and Projection Symbol.
- Generating 2D machine component.
- Generating a 2D drawing of the machine component.
- Drawing front view, top view and side view of objects from the given pictorial views.
- Obtaining 2-D Multiview Drawings from 3-D Model.
- Creation of front view and section view of a crank.
- Generate orthographic views from a 3D Model by using V PORTS.
- 3D MODELING COMMANDS.
- Generate a 3D model of the given machine component.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20BS1L02: ENGINEERING CHEMISTRY LAB				

Outcomes: The experiments introduce volumetric analysis: Acid-Base, complexometric, Redox, Conductometric and potentiometric titrations. Then they are exposed to a few instrumental methods of chemical analysis.

Thus at the end of the lab course, the student is exposed and able to

1. Identify the concentration of given solution by different methods of chemical analysis (**K3**)
2. Analyze the water purity by checking hardness, DO and Acidity. (**K4**)
3. Estimate the Cu^{+2}, Fe^{+3}, Ca^{+2}, Mg^{+2} ions and Ascorbic acid present in given solution. (**K4**)
4. Identify the pour and cloud point of lubricants. **(K3)**
5. Understand the principles of conductometric and potentiometric titrations. (**K_2**)

Syllabus:

1. Estimation of HCl using standard Na_2CO_3 through acid-base titration.
2. Estimate the total hardness of water using standardized EDTA solution through complexometric titration.
3. Estimation of $KMnO_4$ using standard $H_2C_2O_4$ through redox titration method.
4. Estimation of Dissolved Oxygen in given water sample by Wrinkler's Method
5. Determination of ferric (Fe^{+3}) ions using standard KCr_2O_7 solution
6. Determination of copper (II) using standard hypo solution.
7. Estimation of strong acid by using strong base through conductometric titration method.
8. Estimation of strong acid by using strong base through potentiometric titration method.
9. Preparation of polymer (Demo).
10. Determination of Vitamin 'C'.
11. Determination of Pour and Cloud Point of lubricating oils

Reference Books

1. Arthur J. Vogel, A Textbook of Quantitative Analysis.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20CE1L01: BUILDING PLANNING AND DRAWING LAB				

COURSE OUTCOMES

Students are able to

1. understand the building bye-laws, plan various buildings as per the building by-laws. (K2)
2. plan the individual rooms with reference to functional and furniture requirements. (K3)
3. prepare different sign conventions and bonds. (K3)
4. learn the skills of drawing building elements like doors and windows. (K2)
5. develop the skills of Drawing Plans, Sections and Elevations of different buildings. (K3)

SYLLABUS:

UNIT-I

BUILDING BYELAWS AND REGULATIONS: Introduction - terminology - objectives of building Bye laws - floor area ratio - floor space index - principles under laying building bye laws - classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.

UNIT -II

RESIDENTIAL AND PUBLIC BUILDINGS

Residential buildings: Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types residential buildings.

Public buildings: Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT-III

SIGN CONVENTIONS AND BONDS : Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT- IV

DOORS, WINDOWS, VENTILATORS AND ROOFS: Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.

UNIT-V

PLANNING AND DESIGNING OF BUILDINGS: Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

Text /Reference Books:

1. Planning and Design of buildings by Y.S. Sane.
2. Planning, designing and scheduling by Gurucharan Singh and Jagadish Singh
3. Building planning and drawing by M. Chakravarthi.
4. ‘A’ Series & ‘B’ Series of JNTU Engineering College, Anantapur.
5. Building drawing by Shah and Kale.

I SEMESTER	L	T	P	C
	-	-	3	1.5
20HS1L01: ENGLISH PROFICIENCY LAB				

COURSE OBJECTIVES

- To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
- To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
- To assist students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES

a) Reading Skills.
- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:
- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:
- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:
- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice English language in order to acquire proficiency in English. 'Enrich your interactive Skills: Part - A' is designed to provide opportunities for engineering students to revise and consolidate the basic skills in listening, speaking, reading and writing in addition to giving ample practice in various communicative functions and Life skills.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Syllabus

Unit	TOPIC
1	Vowels, Consonants, Pronunciation, Phonetic transcripts
2	Word stress and syllables
3	Rhythm and Intonation
4	Contrastive Stress –Homographs
5	Word Stress : Weak and Strong forms , Stress in compound words

Text Book:

Board of Editors, "Infotech" by Maruthi Publications (2019)

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II SEMESTER	L	T	P	C
	3	-	-	3
20MA2T02: DIFFERENTIAL EQUATIONS & NUMERICAL METHODS				

Course Objectives:

1. To enlighten the learners in the concept of differential equations and vector calculus.
2. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Unit I: Ordinary Differential equations of first order and first degree:

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories

Learning Outcomes:

At the end of this unit, the student will be able to

- solve first order differential equations by appropriate method (K3)
- apply to geometrical and real world problems (K3)

Unit II: Linear differential equations of higher order:

Solutions of Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters. Applications: LCR circuit

Learning Outcomes:

At the end of this unit, the student will be able to

- identify the essential characteristics of linear differential equations with constant coefficients (K3)
- solve the linear differential equations with constant coefficients by appropriate method (K3)

Unit –III: Partial Differential Equations of First Order:

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply a range of techniques to find solutions of standard PDEs (K3)
- outline the basic properties of standard PDEs (K2)

Unit IV: Vector differentiation

Scalar and vector point functions, vector operator del, del applied to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, physical interpretation of Gradient Div F and Curl F, Del applied twice to point functions Del applied to products of point functions.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply del to Scalar and vector point functions (K3)
- illustrate the physical interpretation of Gradient, Divergence and Curl (K3)

Unit V: Vector integration

Integration of Vectors Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

Learning Outcomes:

At the end of this unit, the student will be able to

- find the work done in moving a particle along the path over a force field (k3)
- evaluate the rate of fluid flow along and across curves (K3)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (K3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna publishers, 2012.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2013.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

Course Outcomes:

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

1. solve the differential equations related to various engineering fields (K3)
2. identify solution methods for partial differential equations that model physical processes (K3)
3. interpret the physical meaning of scalar and vector point functoins different operators such as del,gradient, curl and divergence (K3)
4. estimate the work done against a field, circulation and flux using vector calculus and familiarize vector integral theorems. (K3)

II SEMESTER	L	T	P	C
	3	-	-	3
20BS2T01: ENGINEERING PHYSICS				

COURSE OUTCOMES
After completion of course student able to:

1. Describe Basic crystal systems and determination of crystal structures
2. Explain Magnetic and Dielectric Materials properties
3. Describe Concept of Magnetic Induction and Super Conducting properties
4. Explain Pure & Doped Semiconductor materials for better utility
5. Describe Optical fibers and Optical properties of materials and their applications

SYLLABUS

UNIT –I: CRYSTAL STRUCTURE AND X-RAY DIFFRACTION

CRYSTAL STRUCTURE:
Introduction – Space lattice – Basis – Unit Cell – Lattice parameters – Bravais lattices – Crystal systems – Structures and packing fractions of SC, BCC and FCC.

X-RAY DIFFRACTION:
Directions in crystals- planes in crystals- Miller indices and procedure to find Miller indices- Various planes in crystals- Separation between successive (h k l) planes-Bragg's law-Bragg's Spectrometer.

Learning Outcomes: At the end of this unit, the students will be able to

- **Explain** the seven crystal systems
- **Interpret** the crystal structure based on Bragg's law

UNIT – II: MAGNETIC AND DIELECTRIC PROPERTIES

MAGNETIC PROPERTIES: Introduction-Magnetic permeability – Magnetization – Relation between three magnetic vectors - Origin of magnetic moment – Classification of Magnetic materials- Dia, Para, Ferro, Anti-Ferro and Ferri-magnetism – Hysteresis- soft and Hard Magnetic materials.

DIELECTRIC PROPERTIES: Introduction-Dielectric constant- Relation between three electric vectors-Electronic and ionic polarizations (Quantitative) - orientation polarizations (Qualitative) - Internal fields in solids- Clausius - Mossotti equation.

Learning Outcomes: At the end of this unit, the students will be able to

- **Classify** the magnetic materials into dia, para, ferro, anti ferro and ferri
- **Explain** the importance of hysteresis
- **Explain** the concept of polarization in dielectric materials.
- **Summarize** various types of polarization of dielectrics .
- **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics.

UNIT-III: ELECTROMAGNETIC WAVES AND SUPERCONDUCTIVITY

ELECTROMAGNETIC WAVES: Introduction-Electric flux –magnetic flux- Gauss law in electrostatics- Gauss law in magnetostatics- Ampere's law - Biot-Savart's law-Magnetic Induction due to current carrying circular loop- Faraday's law - Maxwell's equations.

SUPERCONDUCTIVITY: General and Thermal properties –Meissner effect – Type-I and Type-II superconductors – Flux quantization – BCS Theory of Superconductivity - Josephson effects – Applications of Superconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Illustrate** the concept of electro magnetism based on fundamental laws of electro magnetism
- **Explain** Maxwell's equations
- **Summarize** various properties and applications of superconductors

UNIT-IV: PHYSICS OF SEMICONDUCTORS:

Classification of solids based on band theory - Intrinsic semiconductors- density of charge carriers- Equation for conductivity – Extrinsic semiconductors- P-type and N-type- density of charge carriers- Drift and diffusion – Einstein's equation – Hall Effect- Hall coefficient – Applications of Hall effect– direct & indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, the students will be able to

- **Summarize** various types of solids based on band theory.
- **Outline** the properties of n-type and p-type semiconductors.
- **Identify** the type of semiconductor using Hall effect

UNIT-V: LASERS AND OPTICAL FIBERS

LASERS: Introduction– Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion - Three level and four level laser pumping schemes - Ruby laser – Helium-Neon laser- Applications of Laser.

FIBER OPTICS: Introduction to Optical fibers- Critical angle of propagation- Total internal reflection- Acceptance angle and acceptance cone- Numerical aperture- Classification of optical fibers based on refractive index profile-Classification of optical fibers based on modes- Applications of optical fibers.

Learning Outcomes: At the end of this unit, the students will be able to

- **Design** various types of lasers
- **Explain** the principle and propagation of light through Optical fibers
- **Discuss** the application of lasers and Optical fibers

TEXT BOOK:

M. N. Avadhanulu, P.G. Kshirasagar & TVS Arun Murthy, A text book of "Engineering Physics", S Chand publications, 11th Addition 2019.

REFERENCE BOOKS:

1. Shatendra Sharma and Jyotsna Sharma, Engineering Physics, Pearson Education, 2018.
2. Palanisamy, Engineering Physics, Scitech Publishers-2018

II SEMESTER	L	T	P	C
	3	-	-	3
20HS2T01: ENGLISH				

COURSE OBJECTIVES

1. To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
2. To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
3. To assist students to carry on the tasks and activities through guided instructions and materials.
4. To effectively integrate English language learning with employability skills and training.
5. To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
6. To provide hands-on experience through case –studies, mini –projects, group and individual presentations.

COURSE OUTCOMES

A) Reading Skills

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

B) Writing Skills

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, e-mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

C) Interactive skills

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

D) Grammar in context

- Enable the skills of grammar using in a situation
- Identifying the needs of apt grammar in life related situation
- Promoting discourse with grammar effectively

Syllabus :

S No	Content
UNIT -I	**Vocabulary Building** **1.1** Video Lesson 1.2.1 Word formation Root words Prefixes and Suffixes Synonyms and Antonyms **Parts of Speech** **Note- making, Note-taking**

	Basic Writing Skills **2.1** Video Lesson 2.2.1 Basic sentence structure 2.2.2. Clauses and Phrases Punctuations Creating coherence Organizing principles of paragraph documents Techniques for writing precisely **Tenses** **Letter Writing**
	Identifying Common Errors in Writing **3.1** Video Lesson Sub + verb agreement Noun pronoun agreement Articles Preposition Redundancies Clichés **Active - Passive Voice** **Reported Speech** **3.4 Resume Writing**
	Nature and Style of sensible Writing **4.1** Video Lesson Describing Classifying Writing Introduction and conclusion **Conditional Sentences** **Degrees of Comparison** **4.4 Email writing**
	Writing Practice **5.1** Video Lesson Comprehension Precise writing Essay Writing **Simple Compound and Complex Sentences** **Report Writing**

TEXT BOOK: Board of Editors, Building Effective Communication Skills By Maruti Publications (2019)

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II SEMESTER	L	T	P	C
	3	-	-	3
20CS2T01: PROBLEM SOLVING USING C PROGRAMMING				

Course Objectives:

- To impart adequate knowledge on the need of programming languages and problem solving techniques and develop programming skills.
- To enable effective usage of Control Structures and Implement different operations on arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart the Knowledge Searching and Sorting Techniques.

UNIT-I

Introduction to Computer Problem Solving: Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II

Introduction to C Programming: Introduction, Structure of a C Program, Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements, Operators, Type Conversion.

Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else–if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

UNIT-III

Arrays: Introduction, Operations on Arrays, Arrays as Function Arguments, Two dimensional Arrays, Multi-dimensional arrays.

Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV

Functions: Introduction, Function Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes, Recursion.

Strings: String Fundamentals, String Processing with and without Library Functions, Pointers and Strings.

UNIT-V

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type –enum variables, Using Typedef keyword, Bit Fields.

Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

Course Outcomes:

At the end of the Course, Student will be able to:

- Illustrate the Fundamental concepts of Computers and basics of computer programming.
- Use Control Structures and Arrays in solving complex problems.
- Develop modular program aspects and Strings fundamentals.
- Demonstrate the ideas of pointers usage.
- Solve real world problems using the concept of Structures, Unions and File operations.

Text Books:

1. R. G. Dromey, How to solve it by Computer, Pearson Education.
2. Reema Thareja, Computer Programming, Oxford University Press.

Reference Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Ajay Mittal, Programming In C A-Practial Approach, Pearson.
3. Forouzan, Gilberg, C Programming – A Problem Solving Approach, Cengage.
4. Dennis Richie And Brian Kernighan, The C Programming Language, Pearson Education.
5. Ashok Kamthane, Programming In C, Second Edition, Pearson Publication.
6. Yaswanth Kanetkar, Let us C, 16th Edition, BPB Publication.

Web Links:

1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialspoint.com/cprogramming/

II SEMESTER	L	T	P	C
	3	-	-	3
20ME2T01 - ENGINEERING MECHANICS				

COURSE OUTCOMES: Student will be able to

CO1. Illustrate the various types of forces and moments.[K2]

CO2. Analyze the rigid body in equilibrium and determine the effects by the laws of friction.[K4]

CO3. Evaluate the centroid,moment of inertia of surfaces and centre of gravity, mass moment of inertia of solids. [K5]

CO4. Calculate the kinetics and kinematics force exerted in rigid body. [K3]

CO5. Perceive the concept of work energy principle and virtual work its application.[K3]

SYLLABUS

UNIT-I

Introduction to Engineering Mechanics: System of Forces, Coplanar Concurrent Forces, Components in plane - Resultant- Moment of Forces and its Application; Couples - General case of parallel forces in a plane. Equilibrium of Rigid Bodies in two dimensions - Free body diagram.

UNIT-II

Resultant- Moment of Forces: Types of Moment of Forces, Varignon Principle, Applications of Moment of Forces

Friction: Introduction, Types of friction, Laws of Friction, Limiting friction, Angle of repose, Angle of friction, Cone of friction. Equilibrium analysis of simple systems with sliding friction, Wedge friction, Screw friction.

UNIT-III

Centroid & Centre Of Gravity: Centroid- Simple and Composite figures. Centre of gravity - Simple and Composite bodies, Theorems of Pappus.

Moment Of Inertia: Moment of Inertia, Product of Inertia and Principal moment of inertia for planes. Mass moment of inertia for solids.

UNIT-IV

Kinetics: Analysis as a Particle and analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

Kinematics: Rectilinear and Curvilinear Motion – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

UNIT-V

Work Energy Method: Work-Energy principle and its Application in plane motion of connected bodies. Impulse-Momentum method.

Virtual Work: Virtual displacements, Principle of virtual work for particle and Ideal system of rigid bodies. Application of virtual work principle.

TEXT BOOKS:

1. R.K. Bansal, A Text Book of Engineering Mechanics,6th edition, Laxmi Publications, 2013.
2. S. S. Bhavikatti, Engineering Mechanics, 6th edition, New Age International Publishers, 2018.
3. R.S. Khurmi&N.Khurmi, Engineering Mechanics, 22nd edition, S. Chand publications, 2019.
4. A.K.TAYAL, Engineering Mechanics, 14th edition,UMESH Publications, 2010.

REFERENCE BOOKS:

1. S.Timoshenko & D.H. Young, Engineering Mechanics, 5th edition, McGraw Hill education, 2017.
2. D.S. Bedi and MP Poonia, Engineering Mechanics,2nd edition, Khanna Book Publishing Co. (P) Ltd, 2019.
3. DP Sharma, Engineering Mechanics, 1st edition,Pearson Education, 2011
4. Reddy Vijay Kumar K. and J. Suresh Kumar, Engineering Mechanics – Statics & Dynamics,3rd edition, BSP Books Pvt.Ltd,2010.

II SEMESTER	L	T	P	C
	-	-	3	1.5

20ME2L01: ENGINEERING WORKSHOP

COURSE OBJECTIVE: To impart hands–on practice on basic Engineering trades and skills.
COURSE OUTCOMES: Students will be able to
CO1: Model and Develop various basic prototypes in Carpentry trade [K3]
CO2: Model and Develop various basic prototypes in Fitting trade [K3]
CO3: Perform Various Forging Operations [K3]
CO4: Perform various House Wiring Techniques. [K3]
CO5: Develop various basic prototypes in the trade of Sheet metal. [K3]
NOTE: At least **Two** Exercises to be done from each trade.

TRADE:

I. CARPENTRY:
1. CROSS LAP JOINT 2. DOVETAIL JOINT 3. MORTISE and TENNON JOINT

II. FITTING:
1. SQUARE FIT 2. V-FIT 3. HALF ROUND FIT

III. FORGING:
1. ROUND ROD TO SQUARE
2. S-HOOK
3. ROUND ROD TO SQUARE HEADED BOLT

IV. HOUSE WIRING:
1. PARALLEL/SERIES CONNECTION OF THREE BULBS
2. STAIRCASE WIRING
3. FLOURESCENT LAMP FITTING

V. SHEET METAL:
1. SQUARE TRAY 2. HOLLOW CYLINDER 3. OPEN SCOOP
MANUAL:
1. Engineering Workshop Practice Lab Manual Prepared by Mechanical Faculty.

II SEMESTER	L	T	P	C
	-	-	3	1.5
20BS2L01: ENGINEERING PHYSICS LAB				

COURSE OUTCOMES

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

CO1: Demonstrate the basic knowledge to know the frequency of a vibrator, hall coefficient, (K3)

CO2: Attain knowledge to verify some of the properties of physical optics. (K4)

CO3: Develop skills to plot various characteristic curves and to calculate the physical properties of given materials. (K4)

CO4: Calculate some the properties of semiconducting materials. (K2)

STUDENT HAS TO DO ANY TEN OF THE FOLLOWING

1. Determination of wavelength of Laser using diffraction grating.
2. Determination of Numerical Aperture and Acceptance angle of an Optical Fiber.
3. Determination of the charge carrier density by using Hall Effect.
4. Determination of the Band Gap of a Semiconductor using a p-n junction diode.
5. Study of Characteristic curves (l/V) of a Zener diode to determine its Breakdown voltage.
6. Determination of Temperature coefficient of resistance of a Thermistor by using its Characteristic curve.
7. Study the variation of intensity of magnetic field along the axis of a circular current carrying coil by using Stewart and Gee's experiment.
8. Study of Characteristic curves (l/V) of a P-N diode.
9. Determine Frequency of given electrically driven tuning fork in Transverse and Longitudinal modes by using Melde's apparatus
10. Determine frequency of A.C. supply by using Sonometer.
11. Determination of the Time Constant for a C-R Circuit
12. Determination of the Planck's constant by using Photo-Cell
13. Determination of dielectric constant of a given material

II SEMESTER	L	T	P	C
	-	-	3	1.5
20CS2L01: C PROGRAMMING LAB				

Course Objectives:

- To impart knowledge on various Editors, Raptor.
- To make the students understand the concepts of C programming.
- To nurture the students on Control Structures and develop different operations on arrays.
- To make use of String fundamentals and modular programming constructs.
- To implement programs using dynamic memory allocation.
- To explain the concepts of Structure, Unions and files for solving various problems.

List of Experiments:

1. Introduction to Algorithms and Flowcharts

Implement Algorithm Development for Exchange the values of Two numbers.

Given a set of n student's examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.

Given a set of n numbers design an algorithm that adds these numbers and returns the resultant sum. Assume N is greater than or equal to zero.

2. Introduction to C Programming

Exposure to Turbo C, Code Blocks IDE, Dev C++, Falcon C++.

Writing simple programs using printf(), scanf() .

3. Raptor

Introduction to Raptor.

Draw a flow chart to find the Sum of 2 numbers.

Draw a flow chart to find Simple interest.

4. Basic Math

Write a C Program to convert Celsius to Fahrenheit and vice versa.

Write a C Program to find largest of three numbers using ternary operator.

Write a C Program to Calculate area of a Triangle using Heron's formula.

5. Control Flow- I

Write a C Program to Find Whether the Given Year is a Leap Year or not.

Write a C program to find the roots of a Quadratic Equation.

Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using Switch…case.

6. Control Flow- II

Write a C Program to Find Whether the Given Number is Prime number or not.

Write a C Program to Find Whether the Given Number is Armstrong Number or not.

Write a C program to print Floyd Triangle.

7. Control Flow- III

Write a C program to find the sum of individual digits of a positive integer.

Write a C program to check whether given number is palindrome or not.

Write a C program to read two numbers, x and n, and then compute the sum of the geometric progression $1+x+x^2+x^3+\ldots\ldots\ldots\ldots+x^n$.

Practice Programs:

Write a C program to print all natural numbers from 1 to n. - using while loop
Write a C program to print all natural numbers in reverse (from n to 1). - using while loop
Write a C program to print all alphabets from a to z. - using while loop
Write a C program to print all even numbers between 1 to 100. - using while loop
Write a C program to print sum of all even numbers between 1 to n.
Write a C program to print sum of all odd numbers between 1 to n.
Write a C program to print table of any number.
Write a C program to find first and last digit of any number.
Write a C program to count number of digits in any number.
Write a C program to calculate sum of digits of any number.
Write a C program to calculate product of digits of any number.
Write a C program to swap first and last digits of any number.
Write a C program to enter any number and print its reverse.
Write a C program to enter any number and check whether the number is palindrome or not.
Write a C program to find frequency of each digit in a given integer.
Write a C program to enter any number and print it in words.
Write a C program to print all ASCII character with their values.
Write a C program to enter any number and print all factors of the number.
Write a C program to enter any number and calculate its factorial.
Write a C program to find HCF (GCD) of two numbers.
Write a C program to find LCM of two numbers.
Write a C program to check whether a number is Prime number or not.
Write a C program to check whether a number is Armstrong number or not.
Write a C program to check whether a number is Perfect number or not.
Write a C program to check whether a number is Strong number or not.
Write a C program to print Fibonacci series up to n terms.

8. Arrays

Write a C program to search an element in the given array (Linear Search).
Write a C program to perform matrix addition.
Write a C program to perform matrix multiplication.

Practice Programs:

Write a C program to read and print elements of array.
Write a C program to find sum of all array elements. - using recursion.
Write a C program to find maximum and minimum element in an array. - using recursion.
Write a C program to find second largest element in an array.
Write a C program to copy all elements from an array to another array.
Write a C program to insert an element in an array.
Write a C program to delete an element from an array at specified position.
Write a C program to print all unique elements in the array.
Write a C program to print all negative elements in an array.
Write a C program to count total number of even and odd elements in an array.
Write a C program to count total number of negative elements in an array.
Write a C program to count total number of duplicate elements in an array.
Write a C program to delete all duplicate elements from an array.
Write a C program to count frequency of each element in an array.

Write a C program to merge two array to third array.

Write a C program to find reverse of an array.

Write a C program to convert lowercase string to uppercase.

Write a C program to convert uppercase string to lowercase.

Write a C program to toggle case of each character of a string.

Write a C program to find total number of alphabets, digits or special character in a string.

9. Pointers

Write a C Program to Perform Addition, Subtraction, Multiplication and Division of two numbers using Command line arguments.

Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.

Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions, Array & Pointers

Write a C Program to demonstrate parameter passing in Functions.

Write a C Program to find Fibonacci, Factorial of a number with Recursion and without recursion.

Write a C Program to find the sum of given numbers with arrays and pointers.

Practice Programs:

Program to change the value of constant integer using pointers.

Program to print a string using pointer.

Program to count vowels and consonants in a string using pointer.

Program to read array elements and print with addresses.

11. Strings

Implementation of string manipulation operations with library function:

a) copy
b) concatenate
c) length
d) compare

Implementation of string manipulation operations without library function:

a) copy
b) concatenate
c) length
d) compare

Verify whether the given string is a palindrome or not.

12. Structures

Write a C Program to Store Information of a book Using Structure.

Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Files

Write a C program to open a file and to print the contents of the file on screen.

Write a C program to copy content of one file to another file.

Write a C program to merge two files and store content in another file.

14. Application

Creating structures to capture the student's details save them in file in proper record format, search and prints the student details requested by the user.

Note: Draw the flowcharts using Raptor from Experiment 3 to Experiment 6.

Course Outcomes:

- Implement basic programs in C and design flowcharts in Raptor.
- Use Conditional and Iterative statements to solve real time scenarios in C.
- Implement the concept of Arrays and Modularity and Strings.
- Apply the Dynamic Memory Allocation functions using pointers.
- Develop programs using structures, and Files.

Reference Books:

1. Yashwanth Kanetkar, Let Us C,16th edition, BPB Publications.
2. Ajay Mittal, Programming in C A-Practial Approach, Pearson Education.
3. Dennis Richie and Brian Kernighan, The C programming Language, Pearson Education.
4. K Venugopal, Problem solving using C, 3rd Edition, TMG Publication.

Web Links:

1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5. https://raptor.martincarlisle.com/
6. https://nptel.ac.in/courses/106105085/2

II SEMESTER	L	T	P	C
	-	-	3	1.5
20HS2L01: ENGLISH COMMUNICATIONS LAB				

COURSE OBJECTIVES

- To improve the language proficiency of technical under graduates in English with emphasis on LSRW Skills.
- To provide learning environment to practice Listening, Speaking, Reading and Writing Skills within and beyond the classroom environment.
- To assist students to carry on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To design the main course material and exercises with authentic materials drawn from everyday use to cater to everyday needs.
- To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

COURSE OUTCOMES:

a) Reading Skills.

- Addressing explicit and implicit meaning of a text.
- Understanding the context.
- Learning new words and phrases.
- Using words and phrases in different contexts.

b) Writing Skills:

- Using the basic structure of a sentence.
- Applying relevant writing formats to create paragraphs, essays, letters, E-Mails, reports and presentations.
- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.

c) Interactive skills:

- Analyzing a topic of discussion and relating to it.
- Participating in discussions and influencing them.
- Communicating ideas effectively.
- Presenting ideas coherently within a stipulated time.

d) Life Skills and Core Skills:

- Examining self-attributes and identifying areas that require improvement self-diagnosis, self-motivation.
- Adopting to a given situation and developing a functional approach to find solutions-adaptability, problem-solving.
- Understanding the importance of helping others-community service, enthusiasm.

COURSE DESCRIPTION

Communicating in a language is also a skill. So a student has to look for an opportunity to practice the language he is learning in order to acquire communication skills. 'Enrich your interactive Skills: Part - B' is designed to provide opportunities for engineering students to revise and consolidate communication skills in different contexts formal and informal. It prepares the student for facing Interviews, participating in group discussions and making presentations.

PRE REQUISITES

The student is expected to have basic knowledge in English language and must be able to write in English. He is also expected to possess fundamental knowledge of general English grammar and vocabulary.

Syllabus

UNIT	TOPIC
1	Oral Activity : JAM, Hypothetical situations, self / peer profile, Common errors in pronunciation, Neutralizing Accent
2	Oral Activity : Telephonic Etiquette, Role plays, Poster presentations and e-mail Writing
3	Oral Activity : Oral Presentation Skills, Public Speaking Data Interpretation
4	Oral Activity : Group Discussion: Do's and Don'ts –Types, Modalities
5	Oral Activity : Interview Skills: Preparatory Techniques, FAQ, Mock Interviews Pronunciation : Connected speech (pausing, tempo, tone, fluency etc.,)

Text Book:

Board of Editors, "Infotech" by Maruthi Publications (2019)

III SEMESTER	L	T	P	C
	3	-	-	3
20MA3T06: STATISTICAL METHODS				

Course Objectives:

1. To familiarize the students with the foundations of probability and statistical methods
2. To impart probability concepts and statistical methods in various applications of Engineering
3. To introduce the correlation and to fit the curve by the method of least squares

Unit-1 Basic Statistics and Probability:

Introduction-Collection and classification of data-Graphical representation-Comparison of frequency distributions-Measures of tendency- Measures of dispersion-Coefficient of variation; Relations between measures of dispersion-Standard deviation of the combination of two groups Probability- probability axioms- addition law and multiplicative law of probability-conditional probability- Baye's theorem.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply Basic statistical methods in engineering(K_3)
- define the terms trial, events, sample space, probability, and laws of probability (K_1)
- make use of probabilities of events in finite sample space from experiments (K_3)
- apply Baye's theorem to real time problems(K_3)

Unit-2 Random Variables and Distributions :

Random variables (discrete and continuous), probability density functions, Mathematical expectation. Probability distribution-Binomial, Poisson and Normal distribution – their properties.

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the notion of random variable, distribution functions and expected value(K_2)
- apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (K_3)
- interpret the properties of normal distribution and its applications (K_2)

Unit-3 Sampling distribution and Testing of hypothesis, large sample tests:

Basic terminology in sampling, sample techniques (with and without replacement), sampling distribution of means for large and small samples (with known and unknown variance).

Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors.

Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes:

At the end of this unit, the student will be able to

- explain the concept of sampling distribution for large and small samples (K_2)
- apply the concept of hypothesis testing for large samples (K_3)

Unit-4 Small sample tests:

Student t- distribution (test for single mean, two means and paired t-test), testing of equality of variance (F- test), Chi-square test for goodness of fit and independence of attributes.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply the concept of testing of hypothesis for small samples to draw the inferences (K_3)

- examine the goodness of fit (K_3)

Unit-5 Curve Fitting and Correlation:

Curve Fitting: Method of least squares -Fitting a straight line, Second degree parabola -exponential curve-power curves
Correlation: Simple correlation, correlation coefficient (for ungrouped data), rank correlation.

Learning Outcomes:
At the end of this unit, the student will be able to

- use correlation methods and principle of least squares (K_3)

Course Outcomes:
At the end of this unit, the student will be able to

1. make use of the concepts of probability and their applications (K_3)
2. apply discrete and continuous probability distributions(K_3)
3. use the components of a classical hypotheses test(K_3)
4. examine Significance tests based on small and large sampling tests(K3)
5. use Correlation methods and Principle of Least squares (K_3)

Books:

1. Probability and Statistics by Dr. K. Murugesan & P. Gurusamy, Anuradha Publications,2011
2. Higher Engineering Mathematics, 43rd Edition, Khanna Publications by Dr. B.S.Grewal,2012

References:

1. Ramana B.V., Higher Engineering Mathematics, Tata Mc Graw Hill New Delhi 11th Reprint 2010
2. Probability and statistics for engineers by Miller & Freund

III SEMESTER	L	T	P	C
	3	-	-	3
20BM3T01 – MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

COURSE OUTCOMES:

The student will be able to

1. Describe the importance of managerial economics and its utility in decision making.(K2)
2. Generalize the meaning and usefulness of the production function and cost function in analyzing the firm's production activity (K2 & K3)
3. Comprehend the concept of market structure, different types of markets and pricing policies. (K4 & K1)
4. Identify different forms of business organization and analyze their merits and demerits. (K1)
5. Evaluate the investment proposals through techniques of capital budgeting and financial performance of the company through financial statements. (K5)

SYLLABUS:

UNIT–I Managerial Economics and Demand Analysis: Definition – Nature and Scope of Managerial Economics - Relation with other disciplines - Concept of Demand-Types-Determinants - Law of Demand - Elasticity of Demand - Types and Measurement-Demand forecasting.

UNIT–II Production and Cost Analysis: Production function - Law of Variable proportions - Isoquants and Iso costs -Law of returns- Economies of Scale - Cost Concepts - Cost Volume Profit Analysis – Applications of BEP (Simple Problems).

UNIT-III Market Structures and Pricing Policies: Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly – Features – Price & Output Determination - Pricing Methods

UNIT-IV Forms of Organizations and Business Cycles: Business Organization- Sole Trader – Partnership - Joint Stock Company - State/Public Enterprises and their forms - Business Cycles: Meaning and Features - Phases of Business Cycle.

UNIT–V Capital Budgeting and Accounting: Concept and sources-Techniques of evaluating capital budgeting(Simple problems)

Introduction to Accounting: Branches-Systems of Accounting-Single Entry-Double Entry System-Journal-Ledger-Trail Balance-Final Accounts-Ratio Analysis(Simple problems)

TEXTBOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. T.V.Ramana& B. Kuberudu: Managerial Economics and Financial Analysis, Himalaya Publishing House,Mumbai
3. Varshney &Maheswari: Managerial Economics, Sultan Chand, 2003.

REFERENCE BOOKS:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey &Chrystel, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Thomson. 7. Narayanaswamy: Financial Accounting A Managerial Perspective, PHI.
8. Raghunatha Reddy &Narasimhachary: Managerial Economics& Financial Analysis, Scitech.
9. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas.

III SEMESTER	L	T	P	C
	3	-	-	3
20CE3T01: STRENGTH OF MATERIALS				

COURSE OUTCOMES:

The student will be able to

1. Understand the basic materials behavior under the influence of different external loading conditions and the support conditions. (K2)
2. Know bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions. (K3)
3. Assess stresses across section of the thin and thick cylinders. (K3)
4. Calculate stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions. (K3)
5. Find Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections. (K3)

SYLLABUS:

UNIT- I

Simple Stresses, Strains And Strain Energy: Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them -Strain Energy – Resilience – Gradual, sudden, impact loadings – simple applications.

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads and uniformly distributed loads.

UNIT-II

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R, Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, built up beams, shear center.

UNIT-III

Deflection Of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L.

Thin And Thick Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders.

UNIT -IV

Torsion of Circular Shafts and springs: Theory of pure torsion – Derivation of Torsion equation- Assumptions– Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

Columns And Struts: Types of columns –Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory.
Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading.

UNIT-V

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.
Theories of Failures: Introduction – Various Theories of failures like Maximum Principal Stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

Text Books

1. R. K. Rajput, Strength of Materials, 7th Edition, S. Chand & Co, New Delhi, 2018.
2. R. Subramanian , Strength of Materials,3rd Editio, Oxford Publications, 2016.

Reference Books

1. R.K Bansal , Strength of Materials, 6th Edition, Lakshmi Publications, 2018.
2. B.C Punmia, Jain and Jain , 2nd Edition, Mechanics of Materials, 2017.

E-Resources

1. https://nptel.ac.in/courses/112107146
2. https://nptel.ac.in/courses/105105108

III SEMESTER	L	T	P	C
	3	-	-	3
20CE3T02: SURVEYING AND GEOMATICS				

COURSE OUTCOMES

Students are able to

1. Understand the basic principles involved in linear and angular measurements. (K2)
2. Identify to use various surveying instruments for Measure distances and bearings. (K2)
3. Understand the concepts of leveling and location of contour.(K2)
4. Measure horizontal and vertical angles using theodolite, Determine the distance and elevations of an object using tacheometeric principles. (K3)
5. Compute various data required for various methods of surveying for setting out of curves, Understand modern surveying methods, Calculate the area and volume of required boundaries. (K3)

SYLLABUS:

UNIT – I

INTRODUCTION: Definition, Objectives, Principles and classifications -overview of plane surveying (chain, compass and plane table).

UNIT - II

DISTANCES AND DIRECTION: Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements (EDM) -principles of electro optical EDM- errors and corrections to linear measurements-compass survey -Meridians, Azimuths and Bearings, declination, computation of angle. Traversing – Purpose-types of traverse-traverse computation -traverse adjustments -omitted measurements.

UNIT - III

LEVELING AND CONTOURING: Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments - method of levelling. Characteristics and Uses of contours-methods of conducting.

UNIT - IV

THEODOLITE: Theodolite, description, principles - uses and adjustments -temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite - Trigonometrical leveling..

TACHEOMETRIC SURVEYING: Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position.

UNIT - V

CURVES: Types of curves, elements of simple and compound curves - transition curves.

MODERN SURVEYING METHODS: Introduction to geodetic surveying, Total Station and Global positioning system.

COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

Text Books:

1. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain , Surveying (Vol No.1, 2 &3),16th edition, Laxmi Publications (P) ltd, New Delhi, 2015.
2. SatishGopi, R. Sathi Kumar and N. Madhu, Advance Surveying,2nd edition Pearson Publications,2016.

Reference Books

1. C. Venkataramaiah , Text book of Surveying, 2nd edition, University press, India (P) limited,2014.
2. R. Subramanian Surveying and levelling , 2nd edition, Oxford University press,2007.
3. S.K. Duggal, Text book of Surveying (Vol No.1&2), 3rd Edition, Tata McGraw Hill Publishing Co. Ltd. NewDelhi, 2008.
4. Arora, Text book of Surveying, (Vol No. 1&2),15th Edition, Standard Book House, Delhi.
5. A.M. Chandra , Higher Surveying, 2nd Edition, New Age International Pvt ltd, 2008.
6. S.K. Roy, Fundamentals of surveying, 2nd edition - PHI learning (P) Ltd, 2010.
7. Alak de, Plane Surveying, 2nd edition, S. Chand & Company, New Delhi,2014

E-Resources

1. https://nptel.ac.in/courses/105107122
2. https://nptel.ac.in/courses/105104100
3. https://nptel.ac.in/courses/105107158

III SEMESTER	L	T	P	C
	3	-	-	3
20CE3T03: FLUID MECHANICS				

COURSE OUTCOMES

At end of the course student able to

1. Understand and apply concepts of fluid statics, kinematics and dynamics for solving various fluid flow problems.(K2)
2. Analyze various losses in pipe flow problems and understand the measurement of flow.(K3)
3. Understand the concept of hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes.(K2)
4. Explain the working and performance of various types of pumps and their characteristics.(K2)
5. Know the working of various types of turbines and their characteristics.(K2)

SYLLABUS:

UNIT-I

FLUID STATICS: Dimensions and units- physical properties of fluids- specific gravity, viscosity and surface tension- vapour pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure –measurement of pressure- Piezometer, U- Tube and Differential manometers.

UNIT-II

FLUID KINEMATICS: Stream line, path line, streak lines and stream tube-Classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrational flows-Equation of continuity for one dimensional flow.

FLUID DYNAMICS: Surface and body forces -Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT-III

CLOSED CONDUIT FLOW: Reynold's experiment- Darcy Weisbach equation - Minor losses in pipes, pipes in series and pipes in parallel - Total energy line-hydraulic gradient line.

MEASUREMENT OF FLOW: Pilot tube, venture meter, orifice meter.

UNIT-IV

BASICS OF TURBO MACHINERY AND PUMPS

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes, Force exerted by jet of water on series of vanes.

Centrifugal pumps: Classification, working, work done – Manometric head- losses and efficiencies specific speed- pumps in series and parallel-performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

UNIT-V

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design – draft tube theory- functions and efficiency.

PERFORMANCE OF HYDRAULIC TURBINES: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Text Books:

1. P.N. MODI and S.M.SETH , Hydraulics, fluid mechanics,20th Edition, Standard book house. 2015
2. R.K.Bansal, A text book of Fluid Mechanics and Hydraulic Machines,10th edition Laxmi Publications.2004.

Reference Books:

1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, 2nd edition Kotaria & Sons. 2010.
2. D. Rama Durgaiah, Fluid Mechanics and Machinery, 2nd edition , New Age International.2007.

E-Resources

1. https://nptel.ac.in/courses/112104117
2. https://nptel.ac.in/courses/112104118

III SEMESTER	L	T	P	C
	-	-	3	1.5
20CE3L01: SURVEYING LAB				

COURSE OUTCOMES

Students are able to

1. Use conventional surveying tools such as chain/tape, compass, plane table, Theodolite, level in the field of civil engineering applications such as structural plotting and highway profiling. (K2)
2. Demonstrate and Plan a survey appropriately with the skill to understand the surroundings.(K2)
3. select accurate measurements, field booking, plotting and adjustment of errors can be understood.(K2)
4. prepare and Plot traverses / sides of building and determine the location of points present on field on a piece of paper.(K3)
5. generalize the field procedures using total station.(K3)

SYLLABUS:

LIST OF EXPERIMENTS

1. Survey by chain survey of road profile with offsets in case of road
2. Survey in an area by chain survey (Closed circuit).
3. Determination of distance between two inaccessible points by using compass.
4. Finding the area of the given boundary using compass (Closed Traverse).
5. Plane table survey: finding the area of a given boundary by the method of Radiation & method of intersection.
6. Two Point Problem by the plane table survey.
7. Fly levelling: Height of the instrument method. (differential levelling) and rise and fall method
8. Fly levelling: Longitudinal Section and Cross sections of a given road profile.
9. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method and reiteration method
10. Theodolite Survey: Finding the distance between two inaccessible points.
11. Tacheomatric survey: Heights and distance problems using tachometric principles.
12. Total Station: Introduction to total station and practicing setting up, levelling up and elimination of parallax error.
13. Total Station: Determination of area using total station.
14. Total Station: Traversing

E-Resources

1. http://sl-iitr.vlabs.ac.in/List%20of%20experiments.html

III SEMESTER	L	T	P	C
	-	-	3	1.5
20CE3L02 : STRENGTH OF MATERIALS LAB				

COURSE OUTCOMES

Students are able to

1. Calculate Young Modulus, torsional strength, hardness and tensile strength of given specimens.(K2)
2. Determine the compressive strength of concrete cubes and bricks.(K3)
3. Estimate stiffness of open coiled and closed coiled springs.(K3)
4. Evaluate the impact strength of the given specimen.(K3)
5. Examine the bending moment of the given material (Steel / Wood) of Cantilever beam & simply supported beam.(K3)

SYLLABUS:

LIST OF EXPERIMENTS

1. Tension test on Steel bar
2. Bending test on (Steel / Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on wood or concrete
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.

E-Resources

1. https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html

III SEMESTER	L	T	P	C
	-	-	3	1.5
20CE3L03: FLUID MECHANICS LAB				

COURSE OUTCOMES

Students are able to

1. Determine coefficient of discharge of venture meter and orifice meter.(K3)
2. Calculate friction factor and sudden contraction of given pipeline.(K3)
3. Evaluate impact of jet on vanes.(K3)
4. Test the efficiency of centrifugal pump, multi stage centrifugal pump, reciprocating pump.(K3)
5. Evaluate the efficiency of pelton wheel, Francis turbine. (K3)

LIST OF EXPERIMENTS

1. Calibration of Venturi meter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice by a constant head method.
3. Determination of Coefficient of discharge for an external mouth pieceby variable head method.
4. Calibration of contracted Rectangular Notch and /or Triangular Notch
5. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's equation.
7. Impact of jet on vanes
8. Study of Hydraulic jump.
9. Performance test on Pelton wheel turbine
10. Performance test on Francis turbine.
11. Efficiency test on centrifugal pump.
12. Efficiency test on reciprocating pump.

E-Resources

1. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html
2. http://fm-nitk.vlabs.ac.in/List%20of%20experiments.html

IV SEMESTER	L	T	P	C
	-	-	2	2
20CE4S01: LAND SURVEY				

COURSE OUTCOMES

Students are able to

1. use instruments like Auto level, Total station, Tachometer and other important survey instruments.(K2)
2. gain experience of preparing site maps of the objects in the area under consideration. (K2)
3. make significant survey decisions on survey works whenever necessary especially when facing problems at sites. (K3)
4. enhance their confident to carry out engineering survey work. (K3)

COURSE CONTENT

During the Land survey, group of students will be formed with a group leader. Necessary survey instruments will be issued to the group. The group of students will be asked to survey a reasonable area by plotting important objects and features of the land under consideration by using appropriate instruments issued to them.

The Land Survey record shall include all original field observations, calculations and plots.
They are required to submit the report of work done, during survey, which will be duly examined, while awarding the assessment.

MEANS OF ASSESSMENT − Practical work − Report Writing − Presentation − Drawing − Viva-voce

EVALUATION PROCEDURE

1. Internal Evaluation of Survey Report: 30 marks
2. External Evaluation through Viva voce examination: 70 marks

REFERENCE BOOKS

1. Punmia B.C., Surveying, Volume 1, Laxmi Publications.
2. Punmia B.C. Surveying, Volume 2, Laxmi Publications.
3. N N Basak, Surveying and Levelling TMH Private Ltd.

E-Resources

1. **https://nptel.ac.in/courses/105107122**
2. **https://nptel.ac.in/courses/105104101**

III SEMESTER	L	T	P	C
	2	-	-	-
20CE3M01 – ENVIRONMENTAL SCIENCES				

UNIT-I: Multidisciplinary nature of Environmental Studies:
Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects: Role of information technology in environment and human health.
Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

UNIT-II: Natural Resources:
Natural resources and associated problems. Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.
Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.
Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT-III: Biodiversity and its conservation:
Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

UNIT – IV Environmental Pollution:
Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his wellbeing.
Solid Waste Management: Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

UNIT – V Social Issues and the Environment:
Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.
Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics. The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

Text Books:

1. K. V. S. G. Murali Krishna , Environmental Studies,VGS Publishers, Vijayawada, 2010
2. R. Rajagopalan, Environmental Studies, 2nd Edition, Oxford University Press, 2011
3. P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani, Environmental Studies, 2nd Edition , Pearson Education, Chennai,2015

References:

1. Deeshita Dave & P. Udaya Bhaskar Text Book of Environmental Studies, Cengage Learning, 2011
2. Shaashi Chawla, A Textbook of Environmental Studies, TMH, New Delhi,2017
3. Benny Joseph, Environmental Studies, Tata McGraw Hill Co, New Delhi, 2006
4. Anubha Kaushik, C P Kaushik , Perspectives in Environment Studies, New Age International Publishers, 2014

IV SEMESTER	L	T	P	C
	3	-	-	3
20CE4T01: STRCTURAL ANALYSIS				

COURSE OUTCOMES:

Upon successful completion of this course,

1. Solve the Propped Cantilever and the fixed beam under different loading conditions.(k3)
2. Deduce the Continuous Beams by Clapeyron's theorem of three moments and slope-deflection method.(K3)
3. Apply moment distribution and kani's method to continuous beam.(K3)
4. Determine support reactions, normal thrust and radial shear for three hinged and two hinged arches.(K3)
5. Analyze cable structures and suspension bridges.(K3)

SYLLABUS:

UNIT-I

PROPPED CANTILEVERS: Analysis of propped cantilevers-shear force and Bending moment diagrams-Deflection of propped cantilevers.

FIXED BEAMS: Introduction to statically indeterminate beams with U. D. load central point load, eccentric point load. Number of point loads, uniformly varying load, couple and combination of loads shear force and Bending moment diagrams-Deflection of fixed beams effect of sinking of support.

UNIT-II

CONTINUOUSBEAMS: Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

SLOPE-DEFLECTION METHOD: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

UNIT III

MOMENT DISTRIBUTION METHOD: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports – Portal frames – including Sway-Substitute frame analysis by two cycles.

Kani's Method: Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway.

UNIT IV

THREE HINGED AND TWO HINGED ARCHES

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear –Rib shortening and temperature stresses.

UNIT V

LATERAL LOAD ANALYSIS USING APPROXIMATE METHODS: Application to building frames. (i) Portal method (ii) Cantilever method.

CABLE STRUCTURES AND SUSPENSION BRIDGES: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

Text Books:

1. V.D. Prasad, Structural Analysis, 3rd Edition,Galgotia publications, 2011.
2. T.S. Thandavamoorthy, Analysis of Structures, 1st Edition, Oxford University Press, New Delhi, 2011
3. Gupta, Pandit & Gupta; Theory of Structures, 1st Edition , Tata McGraw Hill, New Delhi, 2017.

Reference Books:

1. R.S. Khurmi , Theory of Structures, 1st Edition, S. Chand Publishers.2005.
2. R.C. Hibbeler , Structural analysis, 6th edition, Pearson, New Delhi, 2017.
3. Devdas menon , "Structural analysis" -Narosa Publishing House,2014.
4. B.C.Punmia, Jain & Jain, 'Theory of Structures – II', Laxmi Publications, India,2015.
5. C.S. Reddy , Structural Analysis', Tata Mc-Graw hill, New Delhi,2015.

E-Resources:

1. https://nptel.ac.in/courses/105105166
2. https://nptel.ac.in/courses/105101086

IV SEMESTER	L	T	P	C
	3	-	-	3
20CE4T02: CONCRETE TECHNOLOGY				

COURSE OUTCOMES

Students are able to

1. Identify the characteristics of basic ingredients and properties of concrete.(K2)
2. Distinguish the properties of fresh and hardened concrete.(K2)
3. Assess the quality of Hardened Concrete.(K2)
4. Discriminate Concepts Proportioning of concrete mixes by various methods -BIS method of mix design.(K2)
5. Justify the significance of special concretes.(K2)

SYLLABUS:

UNIT-I

INGREDIENTS OF CONCRETE & ADMIXTURES: - Concrete ingredients- Admixtures-Mineral and chemical admixtures - accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silica fume.

AGGREGATES: Classification of aggregate - Particle shape & texture - Bond, strength & other mechanical properties of aggregates - Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate -Bulking of sand -Deleterious substance in aggregate - Soundness of aggregate – Alkali aggregate reaction - Thermal properties - Sieve analysis - Fineness modulus - Grading curves - Grading of fine & coarse Aggregates -Gap graded and well graded aggregate as per relevant IS code - Maximum aggregate size. Quality of mixing water.

UNIT - II

FRESH CONCRETE: Steps in Manufacture of Concrete-proportion, mixing, placing, compaction, finishing, curing - including various types in each stage. Properties of fresh concrete-Workability - Factors affecting workability - Measurement of workability by different tests, Setting times of concrete, Effect of time and temperature on workability - Segregation &bleeding - Mixing and vibration of concrete, Ready mixed concrete, Shotcrete.

UNIT - III

HARDENED CONCRETE: Water / Cement ratio - Abram's Law –Gel space ratio - Nature of strength of concrete -Maturity concept - Strength in tension & compression - Factors affecting strength – Relation between compression & tensile strength - Curing, Testing of Hardened Concrete: Compression tests – Tension tests - Factors affecting strength -Flexure tests -Splitting tests - Non-destructive testing methods – codal provisions for NDT.

UNIT - IV

ELASTICITY, CREEP & SHRINKAGE: Modulus of elasticity -Dynamic modulus of elasticity - Poisson's ratio - Creep of concrete -Factors influencing creep - Relation between creep & time - Nature of creep – Effects of creep - Shrinkage -types of shrinkage.

MIX DESIGN: Factors in the choice of mix proportions - Durability of concrete - Quality Control of concrete - Statistical methods - Acceptance criteria - Concepts Proportioning of concrete mixes by various methods -BIS method of mix design.

UNIT – V

SPECIAL CONCRETES: Ready mixed concrete -Light weight aggregate concrete – Cellular concrete -No-fines concrete, High density concrete, Fibre reinforced concrete – Different types of fibres- Factors

affecting properties of FRC, polymer Concrete- Types of polymer concrete- properties of polymer concrete-High performance concrete-Self consolidating concrete, SIFCON, Self-healing concrete.

Text Books:

1. M.S.Shetty , Concrete Technology, S.Chand& Co. , 2004.
2. M.L. Gambhir, Concrete Technology- Tata Mc. Graw Hill Publishers, New Delhi, 2014.

Reference Books:

1. A.M.Neville, Properties of Concrete, PEARSON - 4th edition, 2016.
2. A.R. Santha Kumar , Concrete Technology, Oxford University Press, New Delhi, 2018.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/102/105102012/
2. https://archive.nptel.ac.in/courses/105/106/105106176/

IV SEMESTER	L	T	P	C
	3	-	-	3
20CE4T03: ENGINEERING GEOLOGY				

COURSE OUTCOMES

Students are able to

1. Demonstrate knowledge of how geological principles can be applied to engineering practice.(K2)
2. Identify and classify the geological minerals, measure the rock strengths of various rocks.(K2)
3. Know about geophysical studies and structural geology.(K2)
4. Predict the Landslides and subsidence.(K2)
5. Investigate the project site for mega/mini civil engineering projects. Site selection for Mega engineering projects like Dams, Tunnels, disposal sites etc…(k3)

SYLLABUS:

UNIT-I

INTRODUCTION: Branches of Geology, Importance of Geology in Civil Engineering with case studies. Weathering: Weathering of rocks, Geological agents, weathering process of Rock, River process and their development.

UNIT-II

MINERALOGY AND PETROLOGY: Definitions of mineral and rock, Different methods of study of mineral and rock, The study of physical properties of minerals and rocks for megascopic study for the following minerals and rocks, Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite And Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT-III

STRUCTURAL GEOLOGY: Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

GEOPHYSICS: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT-IV

GROUND WATER: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

EARTHQUAKES AND LAND SLIDES: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

UNIT-V

GEOLOGY OF DAMS, RESERVOIRS AND TUNNELS: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Life of Reservoirs Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

Text Books

1. N.Chennakesavulu ―A Text book of Engineering Geology, Mac-Millan Publishers India Ltd. 2nd Edition, 2013.
2. Parbin Singh ―Engineering Geology and general geology, S. K. Kataria & Sons, 8thEdition, New Delhi, 2013.

Reference Books

1. F.G. Bell, "Fundamental of Engineering Geology" Butterworths Publications, New Delhi, 2016.
2. D. Venkat Reddy , 'Engineering Geology', Vikas Publishing House pvt. Ltd, 2013.
3. P.C. Varghese , Engineering Geology for Civil Engineers', PHI learning pvt. Ltd, 2015.
4. V.Parthesarathi et al., 'Engineering Geology' , Wiley Publications,2015.
5. Subinoy Gangopadhay , 'Engineering Geology', Oxford University press,2014.

E-Resources

1. https://nptel.ac.in/courses/105105106
2. https://www.nptelvideos.com/civil_engineering/engineering_geology_video_lectures.php

IV SEMESTER	L	T	P	C
	3	-	-	3
20CE4T04: GEOTECHNICAL ENGINEERING				

COURSE OUTCOMES:

Students are able to

1. Develop different methods of index properties of the soils and classify the soils.(K2)
2. Compute different engineering properties of the soil such as compaction, permeability, consolidation and shear strength and determine them in the laboratory.(K2)
3. Relate stress distribution in soils in day-to-day civil engineering practice.(K2)
4. Estimate compressibility of soils.(K2)
5. Develop stress-strain behavior of different sands.(k2)

SYLLABUS:

UNIT - I

Introduction: Soil formation- soil structure and clay mineralogy -Adsorbed water – Mass-volume relationship - Grain size analysis - Sieve and Hydrometer methods -consistency limits and indices.

Index Properties of Soils: Various Types of soil Classifications - Unified soil classification and I.S. Soil classification-Relative density - Mechanism of compaction - factors affecting - effects of compaction on soil properties -compaction control.

UNIT -II

Permeability: Soil water - capillary rise - One dimensioned flow of water through soils - Darcy's law of permeability - Factors affecting -laboratory determination of coefficient of permeability -Permeability of layered systems. Total, neutral and effective stresses -quick sand condition - 2-D flow and Laplace's equation - Seepage through soils -Flow nets: Characteristics and Uses.

UNIT - III

Stress Distribution In Soils: Stresses induced by applied loads -Boussinesq's and Westergaard's theories for point loads and areas of different shapes- Newmark's influence chart - 2:1 stress distribution method.

UNIT - IV

Consolidation: Compressibility of soils - e-σ and e-log σ curves - Stress history - Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation - Determination of coefficient of consolidation (C_v) - Over consolidated and normally consolidated clays.

UNIT - V

Shear Strength of Soils: Basic mechanism of shear strength - Mohr -Coulomb Failure theories - Stress-Strain behavior of Sands - Critical Void Ratio - Stress-Strain behavior of clays - Shear Strength determination various drainage conditions.

Text Books:

1. Gopal Ranjan and A.S.R.Rao , 'Basic and Applied Soil Mechanics', New Age International Publishers, 2018.
2. B.C.Punmia, Ashok Kumar Jain & Arun kumar Jain , 'Soil Mechanics and Foundations', Laxmi Publications, 16th edition, 2013.

Reference Books:

1. R.F.Craig, "Soil mechanics", spon press, Talyor & Francis Group, London Seventh edition, 2017.
2. Braja M. Das and Khaled Sobhan, "Principles of Geotechnical Engineering, Cengage Learning- USA, Eight edition, 2015.
3. Holtz and Kovacs, An introduction to Geotechnical Engineering', Prentice Hall, 2014.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/101/105101201/
2. https://archive.nptel.ac.in/courses/105/105/105105185/

IV SEMESTER	L	T	P	C
	3	-	-	3
20CE4T05: WATER RESOURCES ENGINEERING				

COURSE OUTCOMES

Students are able to

1. Discuss the theories and principles governing the hydrologic processes.(K2)
2. Estimate flood magnitude and carry out flood routing.(K3)
3. Describe the design of diversion head works.(K3)
4. Generalize planning of reservoirs and stability of the dams.(K3)
5. Develop irrigation canals and canal network.(K3)

SYLLABUS:

UNIT I

Introduction: Engineering hydrology and its applications, Hydrologic cycle.

Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves.

Evaporation and Evapo-transpiration: factors affecting, measurement, reduction.

Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT – II

Runoff: Catchment characteristics, Factors affecting runoff, computation by empirical formulae, tables and curves. Components of hydrograph, Base flow separation, Unit hydrograph , assumptions, limitation, derivation, application, S-hydrograph.

Floods: Causes and effects, frequency analysis by Gumbel's and Log-Pearson type III distribution methods, flood control methods and management. Hydrologic routing, channel and reservoir routing, Muskingum and Pul's methods of routing.

UNIT – III

Irrigation: Necessity and Importance of Irrigation, advantages and ill effects of Irrigation, types of Irrigation, methods of application of Irrigation water, standards of quality for Irrigation water, principal crops and crop seasons, crop rotation. Design of erodible canals by Kennedy's silt theory and Lacey's regime theory.

Diversion Head works: Types of Diversion head works, weirs and barrages, layout of diversion head works, components. Causes and failure of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT – IV

Reservoir planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

Dams: Types of dams, selection of type of dam, selection of site for a dam.

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.

Earth dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters.

UNIT – V

Spillways: Types, design principles of Ogee spillways, types of spillway crest gates.

Falls: Types and their location, design principles of straight glacis fall.

Regulators: Head and cross regulators, design principles.

Canal outlets: types, proportionality, sensitivity and flexibility.

Cross Drainage works: Types, selection, design principles of aqueduct.

Text Books:

1. Subramanya.K., “Engineering Hydrology”, Tata McGraw Hill, New Delhi , 2014.
2. Jayarami Reddy.P., “Hydrology”, Tata McGraw Hill, New Delhi , 2016.

Reference Books:

1. Ragunath.H., “Hydrology”, Wiley Eastern Limited, New Delhi, 2015.
2. B.C Punmia & Lal , Irrigation and water power engineering, Laxmi publications pvt. Ltd., New Delhi.,2018.
3. S.K Garg , Irrigation Engineering and hydraulic structures , Khanna publishers,2015
4. PN Modi , Irrigation Water Resources and Water Power Engineering , Standard Book House,2014.

E-Resources:

1. https://nptel.ac.in/courses/105104103

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20CE4L01: GEOTECHNICAL ENGINEERING LAB-I				

COURSE OUTCOMES:

Students are able to

1. Examine index properties of soil and classify them.(K3)
2. Discover permeability of soils.(K3)
3. Describe differential free swell of soils.(K3)
4. Demonstrate field unit weight of soils by different methods (K3)

SYLLABUS:

LIST OF EXPERIMENTS

1. Determination of water content by oven drying method.

2. Determination of specific gravity by Density bottle method & Pycnometer method.

3. Sieve analysis – Mechanical analysis – dry soil.

4. Hydrometer analysis

5. Determination of Differential free Swell (DFS).

6. Determination of Shrinkage limit.

7. Determination of Liquid limit & Plastic limit.

8. Determination of field unit weight by Core cutter method & sand replacement method.

9. Determination of permeability by Constant head permeameter.

10. Determination of permeability by Variable head permeameter.

REFERENCE BOOK:

1. IS 2720 –relevant parts

E-Resources:

1. https://nptel.ac.in/courses/105101160
2. https://smfe-iiith.vlabs.ac.in/List%20of%20experiments.html

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20CE4L02: ENGINEERING GEOLOGY LAB				

Course Outcomes

Students are able to

1. Learn geology and its types, various features like fault, fissures, weathering etc., minerals, rocks, and rock formations in relation to civil engineering structures.(K2)
2. Understand various techniques to determine engineering properties of rocks etc. (k2)
3. Analyze various techniques to analyze and to made possible solutions for various geological engineering problems. (k3)

SYLLABUS:

List of Experiments:

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.
7. Identification of rocks (Metamorphic Petrolody): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps- Identification of symbols in maps.
9. Simple structural Geology Problems
10. Bore hole data

Reference Books:

1. M T Mauthesha Reddy ‘Applied Engineering Geology Practicals’, 2nd Edition., New Age International Publishers, 2018.
2. Tony Waltham, ‘Foundations of Engineering Geology’, 3rd edition , Spon Press, 2009.

E-Resources:

1. https://mg-nitk.vlabs.ac.in/List%20of%20experiments.html

IV SEMESTER	L	T	P	C
	-	-	3	1.5
20CE4L03: CONCRETE TECHNOLOGY LAB				

COURSE OUTCOMES

Students are able to

1. Describe the consistency and fineness of cement. (K2)
2. Identify the setting times of cement. (K2)
3. Estimate the specific gravity and soundness of cement.(K2)
4. Calculate the properties of coarse aggregate and fine aggregate.(K3)
5. Perform tests on fresh concrete and hardened concrete.(K3)

SYLLABUS:

LIST OF EXPERIMENTS:

At least 10 experiments must be conducted (at least one for each property)

1. Determination of normal Consistency and fineness of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Determination of grading and fineness modulus of coarse aggregate by sieve analysis.
6. Determination of specific gravity of coarse aggregate
7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.
8. Determination of bulking of sand.
9. Determination of workability of concrete by compaction factor method.
10. Determination of workability of concrete by slump test.
11. Determination of workability of concrete by Vee-bee test.
12. Determination of compressive strength of cement concrete and its young's modulus.
13. Determination of split tensile strength of concrete.
14. Non-Destructive testing on concrete (for demonstration).

E-Resources:

1. https://ms-nitk.vlabs.ac.in/marine-structures/List%20of%20experiments.html
2. https://cs-iitd.vlabs.ac.in/List%20of%20experiments.html

IV SEMESTER	L	T	P	C
	-	-	2	2
20CE4S01: REVIT ARCHITECTURE				

COURSE OUTCOMES:

Students are able to

1. examine basic knowledge of BIM (Building Information Modeling).(K2)
2. report Autodesk Revit Architecture program modeling. (K3)
3. familiarize with Revit Architecture user interface and its basic functions and properties.(K3)
4. create and edit basic objects, make cross-sections, elevations, axonometries, and perspectives. (K3)

LIST OF EXPERIMENTS

1. Introduction to BIM and familiarization with Autodesk Revit user interface.
2. File management.
3. Creation and editing of basic objects (walls, roofs, staircases, floors).
4. Working with 2D elements (lines, hatches, dimensions, details).
5. Creation and editing of cross-sections, elevations, axonometric and perspectives.
6. Working with construction features, special properties of walls and terrain modelling.
7. Creation of reports (room, area, elements reports).
8. Creating Roofs by footprint.
9. Adding room tags and working with schedules creating legend.
10. Setting up Detail Views Creating and annotating details.

Reference Book:

1. Duell, R., Hathorn T., Reist Hathorn T.: Autodesk Revit Architecture 2014 Essentials: Autodesk Official Press. John Wiley & Sons, Inc., Indianapolis, India, 2013.

IV SEMESTER	L	T	P	C
	2	-	-	-
20BM4M01 – INDIAN CONSTITUTION				

UNIT I: Introduction to Indian Constitution-Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT II: Union Government and Administration Structure of the Indian Union: Federalism, Centre State relationship, President: Role, powers and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

UNIT III: State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT IV:.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions of Pachayat Raj Institution: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials -Importance of grass root democracy.

UNIT V:Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate -State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women.

TEXTBOOKS:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics

REFERENCE BOOKS:

1. D.C. Gupta, Indian Government and Politics
2. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, Indian Government andPolitics Hans
4. J. Raj IndianGovernment and Politics
5. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hallof India Pvt. Ltd.. New Delhi
6. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right),Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

E-Resources:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

V SEMESTER	L	T	P	C
	3	-	-	3
20CE5T01: TRANSPORTATION ENGINEERING				

Course Outcomes:
Students are able to

1. Plan highway network for a given area.(K2)
2. Determine Highway alignment and design highway geometrics.(K3)
3. Illustrate Intersections and prepare traffic management plans.(K2)
4. Judge suitability of pavement materials.(K2)
5. Design of flexible and rigid pavements and their maintenance. (K3)

SYLLABUS:

UNIT-I

Highway Planning and Alignment: Different modes of transportation, Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans - First, second, third road development plans, road development vision 2021, Highway Alignment- Factors affecting Alignment- Engineering Surveys - Drawings and Reports.

UNIT - II

Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment- Gradients- Vertical curves.

UNIT - III

Traffic Engineering: Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies -spot speed studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections - Design of Rotary Intersections; Design of Traffic Signals -Webster Method.

UNIT - IV

Highway Materials: Subgrade soil: classification -Group Index - Subgrade soil strength - California Bearing Ratio - Modulus of Subgrade Reaction. Stone aggregates: Desirable properties - Tests for Road Aggregates - Bituminous Materials: Types - Desirable properties - Tests on Bitumen -Bituminous paving mixes: Requirements - Marshall Method of Mix Design.

UNIT – V

Design, construction and maintenance of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors.

Flexible Pavements: Design factors-Flexible Pavement Design Methods-CBR method-IRC method - Burmister method.

Rigid Pavements: Design Considerations - wheel load stresses - Temperature stresses - Frictional stresses - Types of Joints in CC pavements.

Highway Construction and Maintenance: Types of Highway Construction - Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation, strengthening of existing pavements.

Text Books

1. Srinivasa Kumar R , 'Transportation Engineering', Universities Press, Hyderabad, 2020.
2. Srinivasa Kumar R , 'Highway Engineering', Universities Press, Hyderabad, 2019.
3. Srinivasa Kumar R , 'Traffic Engineering', Universities Press, Hyderabad, 2018.
4. Kadiyali L.R , 'Traffic Engineering and Transportation' Planning, Khanna Publishers, New Delhi, 2017.
5. Khanna S.K., Justo C.E.G and Veeraragavan A 'Highway Engineering ', Nem Chand Bros, Roorkee, 10th Edition, 2016.

Reference Books

1. Kadiyali LR , 'Principles of Highway Engineering' by, Khanna Publishers, New Delhi, 2017.
2. Partha Chakroborthy and Animesh Das , 'Principles of Transportation Engineering', PHI Learning Private Limited, Delhi, 2014
3. Paul H. Wright and Karen K Dixon , 'Highway Engineering', Wiley Student Edition, Wiley India (P) Ltd., New Delhi, 2013.
4. Papacostas C.S. and PD Prevedouros , 'Transportation Engineering and Planning', Prentice Hall of India Pvt. Ltd; New Delhi, 2010.

IRC CODES

1. IRC -37:2018 – Design of Flexible Pavements.
2. IRC-58:2015 – Design of Rigid Pavements

E-Resources:

1. https://nptel.ac.in/courses/105105107

V SEMESTER	L	T	P	C
	3	-	-	3
20CE5T02: DESIGN OF REINFORCED CONCRETE STRUCTURES				

COURSE OUTCOMES

Students are able to

1. Work on different types of design philosophies.(K2)
2. Carryout analysis and design of flexural members and detailing.(K3)
3. Design structures subjected to shear, bond and torsion, design for serviceability.(K3)
4. Design different type of compression members and footings.(K3)
5. Design of different types of slabs and detailing.(K3)

SYLLABUS

UNIT -I

Introduction: Working stress method Design codes and handbooks, loading standards - Dead, live, wind and earthquake loads, elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design - Basic statistical principles -Characteristic loads - Characteristic strength - Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design - stress - block parameters - limiting moment of Resistance.

UNIT -II

Design for Flexure: Limit state analysis and design of singly reinforced sections-effective depth-Moment of Resistance- Doubly reinforced and flanged (T and L) beam sections- Minimum depth for a given capacity Limiting Percentage of Steel-Minimum Tension Reinforcement-Maximum Flexural Steel- Design of Flanged Sections (T&L)- Effective width of flange -Behavior- Analysis and Design.

UNIT - III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion - concept of bond, anchorage and development length, I.S. Code provisions. Design examples in simply supported and continuous beams, detailing.

Limit state design for serviceability: Deflection, cracking and code provision.

UNIT - IV

Design of Compression members: Effective length of a column, Design of short and long columns-under axial loads, uni axial bending and biaxial bending - I S Code provisions.

Footings: Different types of footings-Design of isolated and combined footings-rectangular and circular footings subjected to axial loads, uni-axial and bi-axial bending moments.

UNIT -V

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

Text Books

1. S. Unnikrishna Pillai & Devdas Menon , 'Reinforced Concrete Structures', Tata Mc Graw Hill, New Delhi, 2016.
2. N. Subrahmanyian , 'Design of Reinforced concrete Structures', Oxford; Illustrated edition, 2014.
3. A. K. Jain, 'Reinforced Concrete (Limit State Design), Nem Chand & Bros, 7th Edition, 2012.

Reference Books

1. Park and Pauley, Reinforced Concrete Structures', John Wiley and Sons, 2015.
2. Arthus H.Nilson, David Darwin, and Chorles W. Dolar , 'Design of concrete structures', Tata McGraw Hill, 3rd Edition, 2005.

IS Codes: 1) IS -456-2000 (Permitted to use in examination hall), IS-875, SP-16.

E-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105105/

V SEMESTER	L	T	P	C
	3	-	-	3
20CS5T04: PYTHON PROGRAMMING				

Course Outcomes:

CO1: Recognize core programming basics and program design with functions using Python programming language. (K2)
CO2: Interpret the high-performance programs designed to strengthen the practical expertise. (k2)
CO3: Develop applications for real time problems by applying python data structure concepts. (K2)
CO4: Understand and apply the concepts of packages, handling, multithreading and socket programming. (K2)
CO5: Analyze the importance of object-oriented programming over structured programming. (k2)

UNIT – I:

Introduction to Python: Features of Python, History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.
Data types: Integers, Strings, Booleans.

UNIT – II:

Operators and Expressions: Types - Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations
Control Flow: if, if-elif-else, for, while, break, continue, pass

UNIT – III:

Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.
Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT – IV:

Object Oriented Programming in Python: Classes, Data hiding, 'self-variable', Methods, Constructor, methods, and inheritance: Various Types of Inheritance and Function Overloading, Overriding Methods.

UNIT – V:

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions
Brief Tour of the Standard Library: Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times

Text Books:

1. Learning Python, Mark Lutz, Orielly
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. R Nageswara Rao, "Core Python Programming", Dream tech press, 2017 Edition
4. Dusty Philips, "Python 3 Object Oriented Programming", PACKT Publishing, 2nd Edition, 2015

Reference Books:

1. Think Python, Allen Downey, Green Tea Press
2. Core Python Programming, W.Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage

4. Michael H.Goldwasser, David Letscher, “Object Oriented Programming in Python”, Prentice Hall, 1st Edition, 2007.

Web References:

1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming

V SEMESTER PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20CE5E01: ADVANCED STRUCTURAL ANALYSIS				

Course Outcomes:

Students are able to

1. Determine unknowns in a structures using flexibility method. (K3)
2. Analyze structures using stiffness methods.(K3)
3. Explain plane stress & plane strain in theory of elasticity.(K2)
4. Solve multiple degrees of freedom of two dimensional problems in rectangular co-ordinates.(K3)
5. Discuss dynamic loadings and free vibrations in a structure.(K2)

SYLLABUS

UNIT- I

Flexibility Method:

Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

UNIT- II

Stiffness method:

Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

UNIT- III

Introduction to theory of elasticity: notations for forces and stresses, components of stresses, components of strains, Hooke's law.

Plane stress and plane strain: Definitions, differential equations of equilibrium, boundary conditions, and compatibility equations.

UNIT- IV

Two dimensional problems in rectangular co-ordinates: Airy stress function, solution by polynomials, saint venant principle, solution of bi-harmonic equation using Fourier series.

UNIT – V

Introduction to structural dynamics: Dynamic loadings, formulation of equation of motion-Newton's second law of motion, D'Alembert's principle, solution of undamped single degree of freedom system.

Free Vibrations: Damped single degree of freedom system, Viscous damping, equation of motion, critically damped, over damped and under damped system, logarithmic decrement.

Text Books

1. Dr. P. Dayaratnam , Advanced structural analysis, Tata McGraw hill publishing company Limited, 2015.
2. Timoshenko and Goodier , Theory of Elasticity by, McGraw Hill Book Company, New Delhi, 2015.
3. Robert E Sennet , Matrix analysis of structures- Prentice Hall-Englewood cliffs-New Jercy, 2014.

Reference Books

1. sadhu singh , Theory of Elasticity, Khanna Publishers, 2015.
2. Mario Paz , Structural Dynamics, CBS Publishers, New Delhi, 2014.
3. A.K.Chopra , Dynamics of structures, Prentice Hall of India, 2014.

E-resources

1. https://nptel.ac.in/courses/105106050

V SEMESTER PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20CE5E02: FOUNDATION ENGINEERING				

COURSE OUTCOMES:

Students are able to

1. Explain the various types of shallow foundations and decide on their location based on soil characteristics.(K2)
2. Compute the magnitude of foundation settlement and decide on the size of the foundation accordingly.(K3)
3. Develop field test data and arrive at the bearing capacity.(K3)
4. Examine the principles of bearing capacity of piles and design them accordingly.(K3)
5. Interpret load carrying capacity of piles and wells.(K3)

SYLLABUS

UNIT - I

Soil Exploration: Need- Methods of soil exploration-Boring and Sampling methods- Field tests - Penetration Tests - Pressure meter-planning of Programme and preparation of soil investigation report.

UNIT - II

Earth Slopes And Earth-Retaining Structures: Infinite and finite earth slopes in sand and clay - types of failures - factor of safety of infinite slopes - stability analysis by Swedish arc method, standard method of slices - Taylor's Stability Number-Stability of slopes of dams and embankments - different conditions. Rankine's & Coulomb's theory of earth pressure - Culmann's graphical method - earth pressures in layered soils.

UNIT-III

Shallow Foundations - Bearing Capacity Criteria: Types of foundations and factors to be considered in their location - Bearing capacity - criteria for determination of bearing capacity - factors influencing bearing capacity - analytical methods to determine bearing capacity - Terzaghi's theory - IS Methods.

UNIT-IV

Shallow Foundations - Settlement Criteria: Safe bearing pressure based on N- value - allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

UNIT -V

Pile Foundation: Types of piles - Load carrying capacity of piles based on static pile formulae - Dynamic pile formulae- Pile load tests - Load carrying capacity of pile groups in sands and clays.

Well Foundations: Types- Different shapes of well - Components of well- functions- forces acting on well foundations- Design Criteria-Determination of steining thickness and plug - construction and Sinking of wells - Tilt and shift.

Text Books

1. Das, B.M., 'Principles of Foundation Engineering ' - Cengage learning, 8th edition (Indian edition), 2017.
2. MUNI BUDHU , "Soil Mechanics and Foundations", Third edition, JOHN WILEY & SONS, INC, 2013.
3. Gopal Ranjan & ASR Rao , 'Basic and Applied Soil Mechanics', New Age International Pvt. Ltd, 2004.

Reference Books

1. B.C.Punmia, "Soil Mechanics and Foundations" , Laxmi Publications, Sixteenth edition, 2017.
2. V.N.S.Murthy , 'Soil Mechanics and Foundation Engineering',CBS publishers, 2015.
3. Michael Tomlinson and John Woodward , "Pile Design and Construction Practice", 6th Edition, CRC Press-Talyor & Francis Group, 2012.

4. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill Publishing Company, Newyork. , 4th Edition, 1988.
5. H. G. Poulos & E. H. Davis , "Pile Foundation Analysis and Design" -Rainbow Bridge Book Co., 1980.

IS CODES:

1. **IS-6403 -1981** Indian Standard Code of Practice for Determination of Breaking Capacity of Shallow Foundations.
2. **IRC**:**44-2017** Guidelines for Cement Concrete Mix Design for Pavements (Third Revision) Indian Roads Congress 2017.

E-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105176/

V SEMESTER PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20CE5E03: PAVEMENT MATERIALS AND CHARACTERIZATION				

COURSE OUTCOMES:

Students are able to

1. Identify and describe various pavement materials.(K2)
2. Identify the tests and procedure to evaluate different pavement materials and interpret the results (K2)
3. Design bituminous and mixes and analyze their performances.(K3)
4. Design pavement quality concrete. (K3)
5. List and identify alternative pavement systems and materials.(K2)

SYLLABUS

UNIT - I

Soil materials: As sub-grade, sub-base and base course, Basic engineering properties; resilient modulus, CBR and plate load test.

UNIT - II

Road Aggregates: Aggregate Classification, physical properties and evaluation, Job mix formula.

UNIT - III

Road binders: Bitumen, cutback, emulsion, modified binders and cement. Physical properties of different binders and tests, rheology binders, modified binders

UNIT - IV

Mix design: WBM and WMM mix design, Marshall mix design and Super pave procedure; design of emulsified mixes, fatigue and rutting behaviours of bituminous mixtures; visco elastic analysis of asphalt mixes. Concrete mix design, flexural test, concrete block pavement, Alternate and marginal materials in Rural Roads.

UNIT - V

Soil stabilization - Methods used in soil stabilizations; Evaluation and design of stabilized sub-grade, Use of geo-synthetics.

Text Books

1. E. J. Yoder and M. W. Witczak, Principles of Pavement Design, 2nd Edition, Yang H, 2015
2. S. K. Khanna and C. E. G. Justo, Highway Material Testing, New Chand & Bros., 1999.
3. P. H. Wright John Wiley & Sons, Highway Engineering, 1996.

Reference Books

1. A. T. Papagiannaki , and E. A. Masad, Pavement Design and Materials, John Wiley and Sons, New Jersey, USA, 2008.
2. Huang, Pavement Analysis and Design, Pearson Prentice Hall, 2004.
3. D. Croney, and P. Croney, Design and Performance of Road Pavements, McGraw- Hill, 1998.
4. Relevant IRC, ASTM, AASHTO, SHRP and other Codes, Manuals and Specifications.

E-Resources

1. https://nptel.ac.in/courses/105107219

V SEMESTER PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20CE5E04: DESIGN OF HYDRAULIC STRUCTURES				

Course Outcomes:

Students are able to

1. Design & drawing of Sloping glacis weir. (K3)
2. Design & drawing of Sloping glacis weir. (K3)
3. Design & drawing of Surplus weir. (K3)
4. Design & drawing of Trapezoidal notch fall. (K3)
5. Design & drawing of Canal regulator. (K3)

SYLLABUS

Design and drawing of the following hydraulic structures.

1. Sloping glacis weir.
2. Tank sluice with tower head
3. Surplus weir.
4. Trapezoidal notch fall.
5. Canal regulator.

Final Examination pattern:

Any two questions of the above Five designs may be asked out of which the candidate has to answer one question. The duration of examination will be three hours.

Text Books:

1. C.Satyanarayana Murthy , Design of minor irrigation and canal structures by, Wiley eastern Ltd, 2016.
2. S.K.Garg , Irrigation engineering and Hydraulic structures, Stand book house, 2015.

Reference Books

1. B.C. Punmia & Lal, Irrigation and water power engineering by, Laxmi publications pvt. Ltd. New Delhi, 2015.

V SEMESTER PROFESSIONAL ELECTIVE-I	L	T	P	C
	3	-	-	3
20CE5E05: AIR POLLUTION AND CONTROL				

Course Outcomes:

Students are able to

1. Define the ambient air quality based the analysis of air pollutants. (K1)
2. Design principles of particulate and gaseous control measures for an industry.(K2)
3. Judge the plume behavior in a prevailing environmental condition.(K2)
4. Estimate carbon credits for various day to day activities.(K2)
5. Outline the air pollution control methods.(K2)

SYLLABUS

UNIT– I :Air Pollution:

Sampling and analysis of air pollutants, conversion of ppm into µg/m3. Definition of terms related to air pollution and control - secondary pollutants - Indoor air pollution - Climate Change and its impact - Carbon Trade.

UNIT-II: Thermodynamics and Kinetics of Air-pollution:

Applications in the removal of gases like SOx, NOx, CO and HC - Air-fuel ratio- Computation and Control of products of combustion, Automobile pollution- Odor pollution control, Flares.

UNIT – III: Meteorology and Air Pollution:

Properties of atmosphere: Heat, Pressure, Wind forces, Moisture and relative Humidity, Lapse Rates - Influence of Terrain and Meteorological phenomena on plume behavior and Air Quality - Wind rose diagrams, Plume Rise Models.

UNIT-IV: Ambient Air Quality Management:

Monitoring of SPM, SO_2; NOx and CO – Stack Monitoring for flue gases - Micro-meteorological monitoring - Weather Station.-Emission Standards- Gaussian Model for Plume Dispersion.

UNIT-V: Air Pollution Control:

Control of particulates - Control at Sources, Process Changes, Equipment modifications, Design and operation of control Equipments - Settling Chambers, Cyclone separators –Fabric filters- Scrubbers, Electrostatic precipitators.

Text Books:

1. M.N. Rao and H.V.N. Rao , Air Pollution - Tata McGraw Hill Company, 2015.
2. KVSG Murali Krishna , Air Pollution and Control , Laxmi Publications, New Delhi,2014.

Reference Books

1. R.K. Trivedy and P.K. Goel An Introduction to Air pollution, B.S. Publications, 2017.
2. Wark and Warner - Harper & Row, Air pollution, New York, 2015.

E-Resources

1. https://archive.nptel.ac.in/courses/105/107/105107213/

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20EE5O01 - NON-CONVENTIONAL ENERGY SOURCES				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1	:	Analyze solar radiation data and solar thermal systems (k4)
CO2	:	Identify the methods and analysis of wind energy generation systems (k3)
CO3	:	Explain the biomass and geothermal energy, its mechanism of production and its applications (k2)
CO4	:	Explain basic principle and working of hydro, tidal energy systems. (k2)
CO5	:	Explain basics of Chemical Energy Sources(k2)

SYLLABUS

UNIT-I	**:**	**Solar Energy:**
Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.		
UNIT-II	**:**	**Wind Energy**:
Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.		
UNIT-III	**:**	**Biomass and Geothermal Energy:**
Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems		
UNIT-IV	**:**	**Energy From hydro, oceans, Waves & Tides:**
Hydro: Basic working principle – classification of hydro – types of turbines **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.		
UNIT-V	**:**	**Chemical Energy Sources:**
Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.		

TEXT BOOKS:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

REFERENCE BOOKS:

1. S.P.Sukhatme&J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20ME5O01 - WASTE TO ENERGY CONVERSION				

COURSE OBJECTIVES

- To enable students to understand of the concept of waste to energy.
- To link technical and management principles for production of energy from waste.
- To learn about the best available technologies for waste to energy.
- To facilitate the students in developing skills in the decision making process.

COURSE OUTCOMES: Students are able to

CO1. Describe of the concept of waste to energy, classifications and principles. [K2]
CO2. Explain management principles for production of energy from waste. [K2]
CO3. Explain the best available technologies for waste to energy. [K2]
CO4. Describe the waste to energy options landfill gas, and energy from plastics.[K2]
CO5. Apply the knowledge in planning and operations of waste to energy plants [K3]

UNIT-IINTRODUCTION

Waste - types of waste, Principles of waste management, Waste utilization, Waste management hierarchy, 3R Principle of Reduce, Reuse and Recycle, Waste as a resource, alternate energy source.

UNIT-II WASTE SOURCES & CHARACTERIZATION

Source of waste, Waste production in different sectors such as domestic, industrial, agriculture, postconsumer waste etc, Waste management tools and techniques for reducing waste segregation and scientific disposal, Characterization of waste for energy utilization, Waste selection criteria.

UNIT-III TECHNOLOGIES FOR WASTE TO ENERGY

Energy biochemical conversion – energy production from organic waste through anaerobic digestion, fermentation, Thermo-chemical conversion – combustion, incineration, heat recovery, pyrolysis, gasification, plasma arc technology, other newer technologies, Case studies.

UNIT-IV WASTE TO ENERGY OPTIONS

Waste to energy options - landfill gas, methane emission, collection and recovery, Refuse Derived Fuel (RDF), Fluff, Briquettes, Pellets, Alternate Fuel Resource (AFR) – production and use in cement plants, Energy from plastic wastes, Non-recyclable plastic wastes for energy recovery, Energy recovery from wastes and optimization of its use, Energy analysis.

UNIT-V WASTE TO ENERGY PLANTS & ENVIRONMENTAL IMPLICATIONS

Wasteto Energy Plants: Waste management activities – collection, segregation, transportation and storage requirements, Location and Site of waste to energy plants.
EnvironmentalImplications: Environmental impact of waste to energy, Safety and environmental standards, Savings on non-renewable fuel resources, Carbon credits and its types.

TEXT BOOKS:

1. Marc Rogoff Francois Screve, Waste-to-Energy, 3rd Edition, William Andrew, 2019.
2. B.T. Nijaguna, Biogas Technology, 1st Edition, New Age International Pvt. Ltd, 2002.

REFERENCE BOOKS:

1. Vishal Prasad, BarkhaVaish, Advances in Waste-to-Energy Technologies, 1st Edition, CRC Press, 2019.
2. Dev Vrat Kamboj, Manoj Kumar Solanki, Waste to Energy: Prospects and Applications, 1st Edition, Springer, 2021.
3. P. Jayarama Reddy, Energy Recovery from Municipal Solid Waste by Thermal Conversion Technologies, 1st Edition, CRC Press/ Balkema, 2016.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/103/107/103107125/

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O01 - INTERNET OF THINGS AND APPLICATIONS				

Course Outcome:

At the end of the course students are able to

1. Explain Arduino IDE tool and Arduino Programming concept.
2. Illustrate concept hardware configuration with Firmata protocols.
3. Explain the knowledge Arduino pin configuration.
4. Differentiate various sensors configuration and workflows.
5. Define architecture of IoT.

UNIT-I (Introduction to Arduino)

Introduction to Arduino, history of Arduino, variants, Uno board block diagram, installation of Arduino, Arduino IDE, Arduino programming, functions and statements.

UNIT-II (Configuration)

Connecting Arduino borad, introducing the Firmata Protocol, uploading a Firmata sketch to the Arduino board, testing the Firmata protocol.

UNIT-III (Components)

List of components, software flow design, hardware flow design, hardware prototyping software, designing the hardware prototype, Arduino sketch default functions and custom function, setting Arduino board, pin configuration, working with pins.

UNIT-IV (Prototype)

Potentiometer-continuous observation from an analog input connection, Buzzer-generating sound alarm pattern, DC motor-controlling motor speed using PWM, LED- controlling LED brightness using PWM, Servomotor- moving the motor to a certain angle.

UNIT-V (Networking and cloud)

Arduino and computer networking, networking fundamentals, Obtaining the IP address, Networking extensions for Arduino with libraries and class, architecture of IoT web applications, IoT cloud platforms, develop cloud-based IoT applications.

Textbooks:

1. Python programming for Arduino by Pratik desai, Packt Publishing.
2. Internet of Things with Arduino Cookbook by Marco Schwartz.
3. Introduction to Arduino by Alan G. Smith.

References

1. Beginning Arduino by Michael McRoberts, 2e.
2. Getting Started with Arduino Massimo Banzi Second Edition.

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20CS5O02 - DATA ENGINEERING				

Course Outcomes:

Student able to state and analyze:

1. Preprocessing techniques for various datasets,
2. Standard database systems concepts like tables, relations, query,NoSQL
3. Information retrieval techniques such as **Relevance Ranking,Indexing etc**
4. Data processing algorithms and data structures
5. Visualization techniques like Table, graph, histogram, pie-chart

UNIT- I:

Data Engineering:introduction, importance of data engineering, Data engineering vs data science
Data Collection: Various sources of data, types of data: text, video, audio, biology etc.
Data Preprocessing: data Cleaning: missing values, noise elimination, data integration, data transformation: Normalization, Data Reduction: data cube aggregation, dimensionality reduction.

UNIT-II

Data bases: Database Schema, ER diagram, introduction to SQL, functions and stored procedures, indexing: B+tree index files, data base system architecture: Client-Server Architecture, introduction to MongoDB,
NoSQL: The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL

UNIT-III

Information Retrieval:Relevance Ranking Using Terms,Relevance Using Hyperlinks,Synonyms, Homonyms, and Ontologies,Indexing of Documents,Measuring Retrieval Effectiveness,Crawling and Indexing the Web,Information Retrieval: Beyond Ranking of Pages, Directories and Categories

UNIT-IV

Data Analysis: correlation analysis: bivariate correlation, partial correlation, correlation coefficients. Regression: simple linear regression, multiple linear regression, principal component analysis, analysis of variance
UNIT- V

Data Visualization: Table, graph, histogram, pie-chart, area-plot, box-plot, scatter-plot, bubble-plot, waffle charts, word clouds.

Text Books:

1. Data mining concepts and techniques Jiawei Han and Micheline Kamber (UNIT-I)
2. Silberschatz, Korth, Sudarshan, "Database System Concepts" McGraw Hill Education, Sixth edition, 2010, ISBN-13: 978-9332901384 (UNIT-II, UNIT-III)

3. “NoSQL distilled” A Brief Guide to the Emerging World of Polyglot PersistencePramod J. Sadalage Martin Fowler, Addison Wesley (UNIT-II)
4. correlation and regression analysis by Dr. Mohamed Ahmed Zaid (UNIT-IV)

Reference Books:

1. Brian Shive, “Data Engineering: A Novel Approach to Data Design”, Technics Publications, 2013. ISBN-13: 978-1935504603.
2. Joel Grus, “Python Data Science Handbook: Essential Tools for Working with Data”, 1st Edition, O’Reilly, 2016. ISBN-13: 978-9352134915.

Web links:

https://chartio.com/learn/charts/essential-chart-types

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O01 - INNOVATIONS AND ENTREPRENEURSHIP				

UNIT-I INNOVATION MANAGEMENT: Concept–Objectives-types of Innovation process of Innovation- sources of Innovation-Levels of Innovation -barriers of Innovation-– Open and Closed Innovation-challenges faced while managing innovation.

UNIT-IICREATIVE INTELLIGENCE: Concept of Creativity-Importance Characteristics-Types of Creativity-Traits Congenial to Creativity-Triarchic theory of Intelligence – Creative thinking –Types-process of creative thinking-Sources and techniques for generating ideas.

UNIT-III ENTREPRENEURSHIP: Concept- characteristics-Importance classification-Theories of Entrepreneurship-entrepreneurship development-entrepreneurial process- challenges-Women Entrepreneurs.

UNIT-IVPROJECT FORMULATION AND APPRAISAL: Concept -Need Significance-steps - Economic Analysis; Financial analysis; Market analysis; Technical feasibility-project Appraisal-techniques of project appraisal.

UNIT-V INSTITUTIONS PROMOTING SMALL BUSINESS ENTERPRISES: Central level Institutions; SIDBI, NSIC, KVIC,SSIDC - State level Institutions- DICs – SFC SSIDC- other financial assistance, Government policy and taxation benefits- government policy for SSIs

TEXT BOOKS:

1. Vasanth Desai, ―Entrepreneurship, Himalaya Publishing House, New Delhi, 2012 2. Arya Kumar: ―Entrepreneurship, Pearson, Publishing House, New Delhi, 2012. 3. Keith Goffin and Rick Mitchell-Innovation Management,Springer,2016

REFERENCES BOOKS:

1. Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata McGraw Hill, 2004.
2. Vinnie Jauhari, SudanshuBhushan, Innovation Management, Oxford Higher Education, 2014

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O03 - DIGITAL MARKETING				

UNIT I- Introduction to Digital Marketing: Concept – scope- importance of digital marketing - Traditional marketing versus digital marketing – Types of digital marketing marketing mix and its implications for digital marketing--Challenges and opportunities for digital marketing

UNIT II- Content Marketing: Understanding Content Marketing, Content Creation Framework, Content marketing strategy and planning- Types of content marketing - Measuring and Analysing Your Content-Viral Marketing-Blog Marketing.

Unit III- Search Engine Optimization (SEO): What is SEO? SEO Importance and Its Growth in recent years, Ecosystem of a search Engine , kinds of traffic, Keyword Research & Analysis (Free and Paid tool & Extension), Recent Google Updates

UNIT IV-Email and Mobile Marketing: Introduction, process, design, content,email marketing metrics. Mobile Marketing: Concept, Process-tools-opportunities and challenges.

UNIT V-Social Media Marketing: Concepts- Process - Tools- Google and the Search Engine, Facebook, Twitter, YouTube and LinkedIn- Issues: Credibility, Fake News, Paid Influencers; social media and Hate/ Phobic campaigns.

TEXT BOOKS:

1.Puneet Singh Bhatia, “Fundamentals of Digital Marketing”, Pearson Education Publications, 2nd edition 2019

2. Seema Gupta, “Digital Marketing”, McGraw Hill Publications”, 2nd edition 2020 3.Ryan Deiss, Russ Henneberry, “Digital Marketing For Dummies”, Wiley Publications, 2020

REFERENCES BOOKS:

1. Joe Pulizzi, “Epic Content Marketing”, McGraw Hill Education, 2019 2. Puneet Singh Bhatia , “Social Media & Mobile Marketing”, Wiley Publications, 2019

V SEMESTER (OPEN ELECTIVE –I)	L	T	P	C
	3	-	-	3
20BM5O04 - BUSINESS ENVIRONMENT				

Unit-I Business Environment: Components and Significance – Economic Scope – Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

Unit-II: Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy - Policy Resolutions of 1991- Economic Reforms-PPP

Unit-III Indian Business Environment: Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment

Unit-IV: International Trade: Balance of Payments – Concepts, Disequilibrium in BOP: Methods of Correction - Trade Barriers and Trade Strategy - Free Trade vs. Protection - World Financial Environment: Foreign Exchange Market Mechanism, Exchange Rate Determination, and Euro Currency.

Unit-V: Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trading Blocks – WTO Origin, Objectives, Organisation, Structure and Functioning – WTO and India.

TEXT BOOKS:

1. Chidambaram, Indian Business Environment, Vikas, New Delhi

2. Suresh Bedi: Business Environment, Excel, New Delhi.

3. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.

REFERENCES BOOKS:

1. Pandey G.N., Environmental Management, Vikas Publishing House.

2. Sundaram& Black, International Business Environment – The Text and Cases, Prentice Hall of India.

3. Ghosh PK., Business Environment,Sultan Chand & Sons, New Delhi

4. Daniel John D and Redebough, Lee. H., International Business, AddisionWesley India

5. Saleem, Business Environment, Pearson, New Delhi.

6. Bhalla, V.K., & S. Sivaramu, International Business Environment and Business, Annual Publications

V SEMESTER (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20IT5J01 - LINUX ADMINISTRATION				

Course Outcomes:

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

1. Use various Linux commands that are used to manipulate system operations at admin level.
2. Write Shell Programming using Linux commands.
3. Design and write application to manipulate internal kernel level Linux File System.
4. Explain the user, group and storage management.
5. Configure SSH client and server.

UNIT – I

Introduction To Linux And Linux Utilities: A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, unlink, du, find, unmask, ulimit, ps, finger, tail, head, sort, nl, uniq, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio, apt.

UNIT – II

Introduction to Shells: Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization.

Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT - III

Grep: Operation, grep Family(grep, egrep, fgrep), Searching for File Content.

Sed: Scripts, Operation, Addresses, commands, Applications, grep and sed.

Unix File Structure: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers.

UNIT – IV

User and Group Management: User accounts, local groups and group memberships, Configure networking and hostname resolution statically or dynamically, start, stop, and check the status of network services and network related commands.

Storage Management: List, create, delete, and modify physical storage partitions and tools

UNIT – V

Configuring SSH: Enabling the SSH Server, Using the SSH Client, Configuring Key- Based SSH Authentication, Using Graphical Applications with SSH.

Practical Learning: Installation of Any open source Linux Distribution, AWS Instance Creation and Learn How to Access through SSH.

TEXT BOOKS:

1. W. Richard. Stevens, Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India.
2. Behrouz A. *Forouzan, Richard F. Gilberg,* Unix and shell Programming Thomson

REFERENCES:

1. *Robert Love, O'Reilly*, Linux System Programming, SPD.
2. *W.R.Stevens,* Advanced Programming in the UNIX environment, 2nd Edition, PearsonEducation.
3. *W.R. Stevens*, UNIX Network Programming, PHI.
4. *Graham Glass, King Ables*, UNIX for Programmers and Users, 3rd Edition, Pearson Education.

V SEMESTER (JOB ORIENTED ELECTIVE-I)	L	T	P	C
	3	-	-	3
20CS5J01 - FULL STACK WITH JAVA				

COURSE OUTCOMES:

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

Design simple web pages using markup languages like HTML and CSS.

Create dynamic web pages using DHTML and java script that is easy to navigate and use.

Create web pages using AngularJS.

Build web applications using Servlet and JSP.

Understand various operations on Mongo Database.

UNIT-I:

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds,CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II:

Client-Side Scripting using Java Script and DOM

Java Script: The Basics of Java Script, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.

DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III:

Angular JS

Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV:

Servlet and JSP

Servlet: Servlet Basics, Need of Server Side Programming,Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives-include (), forward(), sendRedirect(), HttpServletRequest and HttpServlet Response in Servlet, Servlet and JDBC Integration.

JSP: JSP Basics, JSP Scripting Elements (Declaration, Expression, Scriptlet), Directive Elements (page,include,taglib) , Action Elements (jsp:forward, jsp: include,jsp:useBean), JSP Implicit Objects.

UNIT-V

Mongo DB: Introduction to Mongo DB, Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

TEXT BOOKS:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Head First Servlet and JSP
4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

REFERENCE BOOKS:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman
4. MEAN Web Development by Amos Q. Haviv

V SEMESTER	L	T	P	C
	-	-	3	1.5
20CE5L01: TRANSPORTATION ENGINEERING LAB				

COURSE OUTCOMES:

Students are able to

1. Evaluate the desirable properties of the pavement materials. (K3)
2. Perform quality control tests on pavements and pavement materials. (K3)
3. Design the job mix formula for Bituminous Mixes. (K3)
4. Demonstrate Marshall Stability test. (K3)

SYLLABUS

LIST OF EXPERIMENTS

I. ROAD AGGREGATES:

1. Aggregate Crushing value
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption.
4. Abrasion Test.
5. Shape tests.

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume studies at mid blocks.
2. Traffic volume Studies at intersection.
3. Spot speed studies.
4. Parking study.
5. Accident Studies

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers.
4. Los angles Abrasion test machine
5. Length and elongation gauges
6. Bitumen penetration test setup.
7. Bitumen Ductility test setup.
8. Ring and ball apparatus
9. Viscometer.
10. Marshal Mix design apparatus.
11. Stop Watches

Reference Books

1. S.K. Khanna, C.E.G Justo and A.Veeraraghavan: Highway Material Testing Manual, Neam Chan Brothers New Chand Publications, New Delhi, 2018.
2. IRC Codes of Practice, 2019.
3. Asphalt Institute of America Manuals.
4. Code of Practice of B.I.S.

E-Resources

1. https://ts-nitk.vlabs.ac.in/transportation-engineering/

V SEMESTER	L	T	P	C
	-	-	3	1.5
20CS5L03: PYTHON PROGRAMMING LAB				

COURSE OUTCOMES:

At the end of the course students are able to

CO1: Apply core programming basics and program design with functions using Python Programming language. K3

CO2: Interpret the high-performance programs designed to strengthen the practical expertise. K3

CO3: Develop applications for real time problems by applying python data structure concepts. K3

CO4: Test and apply the concepts of packages, handling, multi threading and socket programming. K3

CO5: Divide the importance of object oriented programming over structured programming. K3

CO6: Apply the data from existing packages in various application developments. K3

Programs List

1. Write a program to find the given number is positive or negative.
2. Write a program to find the maximum of given three numbers.
3. Write a program to find the given year is leap year or not
4. Write a program for sum of N numbers
5. Using functions: To convert Decimal to Binary, Decimal to Octal and Decimal to Hexa Number system
6. Write a program to find the ASCII value of a given character
7. Write a program to make a simple calculator
8. Write a program to display calendar
9. Write a program to create a List collection using methods (Square Brackets and Constructor) and also perform the following operations on Lists
   a) append() b)copy() c) count()
   d)extend() e)insert() f)pop()
   g)remove() h)reverse() i)sort()
10. Write a program to create a Tuple collection using parenthesis and tuple constructor and perform the following operations
    a) count b)Index
11. Write a program to create a Set collection using curly braces and set constructor and Perform the following operations
    a) Add b) copy c) difference
    d) insertion e) isSubset f)union
    g) update h) isSuperset
12. Write a program to create a Dictionary and perform the following operations
    a) copy b)get c) items d)keys
    e) popitem f)values g)update
13. Data analysis or manipulation using the following packages
    a) Pandas b)Numpy c)Scipy d) matplotlib

V SEMESTER	L	T	P	C
	0	0	2	2.0
20HS5S01: ADVANCED ENGLISH COMMUNICATION SKILLS LAB				

At the end of the course students will be able to prepare themselves for their career which may require them to listen and speak in English both for their professional and interpersonal communication in the globalized context.

Course objectives

- Analyzing a topic of discussion and relating to it.
- Planning and executing an assignment creatively.
- Presenting ideas coherently within a stipulated time.
- Communicating ideas effectively in prescribed oral activities.
- Applying relevant writing formats for resume and presentations.
- Facing interviews with confidence.

Course outcomes

At the end of the course students will be able to

- Gather ideas and organize information relevantly and coherently. (K2)
- Participate in group discussions and face interviews with confidence. (K2)
- Write Resume with covering letter. (K2)
- Make oral presentations and public speaking. (K2)
- Take part in social and professional communication. (K2)

SYLLABUS

The following course content is prescribed for the **Advanced English Communication Skills Lab:**

UNIT I

Communication Skills

- Introduce Yourself
- JAM
- J2M

➢ Identifying one's career objective, projecting strengths and skills, organization of ideas within given time.

UNIT II

Interaction Skills

- Body Language
- Role- Plays

➢ Students start a conversation-Respond appropriately and relevantly in different situations with right body language.

UNIT III

Oral Skills

- Presentations
- Public Speaking

➢ Planning preparation and presentation- organization of ideas with clarity, coherence and style.

UNIT IV

Writing Skills

- Covering Letter
- Resume Writing

➢ To communicate the ideas relevantly and coherently in writing.

UNIT V

Team Work Skills

- Group Discussion

- Dynamics of Group Discussion - Modulation of voice, Body language, relevance , fluency and coherence.

Interview Skills

- Pre-interview planning, opening strategies, answering strategies, interview through tele and video conference.

Reference Books:

1. Ashraf Rizvi- Effective Technical Communication-McGraw Hill Education- 2017.
2. MadhaviApte- ACourse in English Communication – Prentice - Hall of India- 2007.
3. Dr.ShaliniVerma - Body Language – Your Success Mantra- S. Chand- 2006.
4. Sunita Mishra &C.Murali Krishna- Communication Skills for Engineers - Pearson Education - 2007.

V SEMESTER	L	T	P	C
	2	-	-	-
20BM5M01: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE				

SYLLUBUS

1. Basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
2. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature.
3. Introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.
4. Basics of Indian Traditional knowledge modern scientific perspective.
5. Basic Structure of Indian Knowledge System
6. Modern Science and Indian Knowledge System
7. Yoga and Holistic Health care
8. Case Studies.

Text Books

1. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi,2016.
2. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
3. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

Reference Books

1. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
2. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad,Amaku,am
3. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
4. P R Sharma (English translation), Shodashang Hridayam.

E-Resources

1. https://www.youtube.com/watch?v=sSgj_GZOwU8

VI SEMESTER	L	T	P	C
	3	-	-	3
20CE6T01: ENVIRONMENTAL ENGINEERING				

COURSE OUTCOMES

Students are able to

1. Recognize the importance of protected water supply, water demand and water quality. (K2)
2. Acquire knowledge about different treatment methods. (K2)
3. Identify a source of water for water supply to a town or city with respect to quality and quantity of water through distribution system.(K2)
4. Understand the sources of sewerage, Estimation and design of sewers and its appurtenances. (K2)
5. Explore the FSSM technologies in general. (K2)

SYLLUBUS

UNIT- I: Introduction and Sources of Water

Introduction: Water demand: Types of demand – factors affecting – fluctuations – fire demand in detail – storage capacity, water quality and testing, drinking water standards.

Sources of Water: Sources of water and comparison between quality and quantity and other considerations, Types of Intake, Infiltration galleries, Jack wells, springs, confined and unconfined aquifers and wells.

UNIT- II: Sedimentation and Filtration& Disinfection

Sedimentation: Sedimentation: Types of sedimentation, principles, uniform settling velocity, design of sedimentation tank, Coagulation- flocculation Definition and principles, Types of coagulants, feeding arrangements. Optimum dosage of coagulant- Jar test.

Filtration& Disinfection: Filtration theory/ Principles, Construction and working of slow and rapid gravity filters, multimedia filters, design of filters, troubles in operation, comparison of filters, Disinfection – Types of disinfection - Theory of chlorination - chlorine demand, Residual chlorine test.

UNIT- III: **Conservancy and Water Carriage System**

Definition of sewage, characteristics of sewage, Decomposition of sewage, cycles of decay examination of sewage – B.O.D, – C.O.D equations. Sewage and storm water estimation – time of concentration – storm water overflows, combined flow, Sewers shapes and materials, Design of Sewer, Sewer appurtenances: Manholes – Inverted siphon – Catch basins – Flushing tanks – Ejectors, pumps and pump houses, house drainage – components requirements, sanitary fittings-traps, one pipe and two pipe systems of plumbing.

UNIT- IV: **Waste Water Effluent Treatment methods and disposal**

Lay out of Waste Water Effluent Treatment plant, Primary treatment: Types and classification of screens, grit chambers, skimming tanks, sedimentation tanks, principles and design of biological treatment: Trickling filters, standard, high rate Trickling filter and Activated sludge process. Ultimate disposal of sewage, sewage farming dilution, Sludge digestion tanks– Sludge disposal by drying – septic tanks, working principles and design, design of oxidation ponds.

UNIT-V Introduction to faecal sludge and septage management

Overview of faecal sludge- the importance of an integrated approach to faecal sludge management -The Global Situation- Designing for faecal sludge management treatment- end use.

Text books

1. Dr. B.C.Punmia, Ashok Jain &Arun Kumar Jain, “Water Supply Engineering”, Vol. I “Waste water Engineering”, Vol. II, Laxmi PublicationsPvt.Ltd, New Delhi 2nd Edition 2016.
2. G.S. Birdi“Water supply and sanitary Engineeringy”, Dhanpat Rai & Sons Publishers 2010.

3. S.K. Garg, "Water Supply Engineering: Environmental Engineering" Vol.I Khanna Publications,New Delhi 2010.

Reference books

1. Faecal Sludge and Septage Management-V.Srinivas Chary,G Bala Subramanyam- Dr Y.Malini Reddy, Mayank Gupta, G.V.L.N.Murthy, Dr M.S.V.K.V.Prasad, A.Venkata Krishna-Administrative Staff College of India-Hyderabad-2019.
2. S.C.Rangwala, revised by K.S.Rangwala&P.S.Rangwala"WaterSupply and Sanitary Engineering" 14th edition, 2014.
3. Mark J. Hammer, Sr. Mark J. Hammer "Water and WastewaterTechnology", 6th Edition, HDR Engineering, Inc. ©, 2008.

E-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105201/
2. https://nptel.ac.in/courses/105106119
3. https://archive.nptel.ac.in/courses/105/105/105105178/
4. https://www.slideshare.net/ircuser/overview-of-faecal-sludge-management-challenges-and-practices
5. https://www.youtube.com/watch?app=desktop&v=f7tPPMhL0I0&feature=youtu.be

VI SEMESTER	L	T	P	C
	3	-	-	3
20CE6T02: REMOTE SENSING & GIS APPLICATIONS				

Course outcomes:

Students are able to

1. Describe the basic principles of Remote Sensing and GIS techniques. (K2)
2. Identify familiar with ground, air and satellite based sensor platforms. (K2)
3. Interpret the aerial photographs and satellite imageries. (K2)
4. List and create input spatial data for GIS application. (K2)
5. Recognize the application of RS and GIS in Civil engineering. (K2)

SYLLABUS

UNIT – I

Introduction to remote sensing: Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces characteristics of remote sensing systems.

Sensors and platforms: Introduction, types of sensors, airborne remote sensing, space borne remote sensing, image data characteristics, digital image data formats-Band Interleaved by Pixel, Band Interleaved by Line, Band Sequential, IRS, LANDSAT, SPOT.

UNIT – II

Image analysis: Introduction, elements of visual interpretations, digital image processing- image Preprocessing, image enhancement, image classification, supervised classification, unsupervised Classification.

UNIT - III

Geographic Information System: Introduction, key components, application areas of GIS, map projections. Data entry and preparation: spatial data input, raster data models, vector data models.

UNIT - IV

Spatial data analysis: Introduction overlay function-vector overlay operations, raster Overlay operations, arithmetic operators, comparison and logical operators, conditional Expressions, overlay using a decision table, network analysis-optimal path finding, network Allocation, network tracing.

UNIT - V

RS and GIS applications General: Land cover and land use, agriculture, forestry, geology, Geomorphology, urban applications.

Application to Hydrology and Water Resources: Flood zoning and mapping, groundwater Prospects and potential recharge zones, watershed management.

Text Books

1. Lillesand, T.M, R.W. Kiefer and J.W. Chipman ‘Remote Sensing and Image Interpretation’, Wiley India Pvt. Ltd., New Delhi, 2013.
2. George Joseph, ‘Fundamentals of Remote Sensing’ Universities Press, 2013.
3. Bhatta B , ‘Remote sensing and GIS’, Oxford University Press,2008.
4. Schowenger, R. Remote Sensing Elsevier publishers, 2006.

Reference Books

1. Narayan LRA ‘Remote Sensing and its Applications’ Universities Press, 2012.
2. Pang Lo and A K W Yeung, ‘Concepts and Techniques of Geographical Information System’ Chor Prentice Hall (India), 2006.
3. Kumar S, ‘Basics of Remote sensing & GIS’, Laxmi Publications, New Delhi, 2005.

4. Burrough P A and R.A. McDonnell, 'Principals of Geographical Information Systems', Oxford University Press, 1998.

E-Resources

1. https://nptel.ac.in/courses/105103193

VI SEMESTER	L	T	P	C
	3	-	-	3
20CE6T03: DESIGN OF STEEL STRUCTURES				

COURSE OUTCOMES:

Students are able to

1. Design bolted connections and welded connections. (K3)
2. Design tension members. (K3)
3. Design compression members. (K3)
4. Design columns bases. (K3)
5. Design simple beams and compound beams. (K3)

SYLLABUS

UNIT – I

Introduction: Fundamental Concepts of limit state design of structures, Different types of rolled steel sections available to be used in steel structures. Stress – Strain relationship for mild steel.

Connections:

Bolted connections: Behaviour of bolted joints, Design strength of ordinary black bolts, high strength friction grip bolts, and Simple connections.

Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses - IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT - II

Tension members: Types of tension members, slenderness ratio, displacement of tension members, behaviour of tension members, modes of failure, factors affecting strength of tension members, design of tension members, Lug angles.

UNIT - III

Compression members: Possible failure modes, behaviour of compression members, Effective length, radius of gyration and slenderness of compression members, Allowable stresses in compression, Design of axially loaded compression members, built up compression members with Laced and Battened columns.

UNIT - IV

Design of Column Splices: Splicing of columns of same size, slightly different sizes and considerably different sizes.

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected moment.

UNIT -V

Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

Text Books

1. N.Subramanian, 'Steel Structures Design and Practice', Oxford University Press, 2015.
2. Ramachandra 'Design of Steel Structures' Vol - 1, Universities Press, 2014.
3. S.K. Duggal, 'Design of steel structures', Tata Mcgraw Hill, and New Delhi, 2013.
4. S.S. Bhavakatti , Design of Steel Structures', I K International Publishing House Pvt. Ltd, 3rd edition, 2013.

Reference Books

1. Sarwar Alam Raz , 'Structural Design in Steel', New Age International Publishers, New Delhi, 2015.
2. M. Raghupathi, 'Design of Steel Structures' Tata Mc. Graw-Hill, 2015.
3. P. Dayaratnam , 'Design of Steel Structures' S. Chand Publishers, 2014.
4. N. Krishna Raju 'Structural Design and Drawing' University Press, 2014.

IS Codes: 1) IS -800 – 2007, **2)** IS – 875**,** 3) Steel Tables.
These codes and steel tables are permitted to use in the examinations.

E-Resources: https://nptel.ac.in/courses/105105162

VI SEMESTER PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20CE6E01: REPAIRS AND REHABILITATION OF STRUCTURES				

COURSE OUTCOMES:

Students are able to

1. Identify the Materials for repair and rehabilitation. (K2)
2. Know the Strengthening and stabilization Techniques. (K2)
3. Acquire knowledge about Bonded installation techniques. (K2)
4. Discuss different types of concrete. (K2)
5. Develop high performance concrete. (K2)

SYLLABUS

UNIT-I

Materials for repair and rehabilitation -Admixtures- types of admixtures-purposes of using admixtures-chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms-moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT-II

Strengthening and stabilization- Techniques- design considerations-Beam shear capacity strengthening-Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT-III

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding CDC debonding-plate end debonding- strengthening of floor of structures.

UNIT-IV

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete-Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes.

UNIT-V

High performance concretes- Introduction- Development of high performance concretes Materials of high performance concretes. Properties of high performance concretes- Self Consolidating concrete-properties qualifications.

Text Books

1. M S Shetty & A.K Jain, Concrete technology, S. Chand publication, 2018.
2. A.M Neville & J J Brooks, Concrete technology, Pearson Publishers, 2nd Edition, 2015.

Reference Books

1. Peter H Emmons, Concrete repair and maintenance illustrated. 2015.
2. Rafat Siddique , Special Structural concrete, 2000.

E-Resources

1. https://archive.nptel.ac.in/courses/105/106/105106202/

VI SEMESTER PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20CE6E02: GEOSYNTHETICS				

Course Outcomes:

Students are able to

1. Identify the type of geosynthetics and their relevance in geotechnical field. (K2)
2. Understand the mechanism of formation of different geo-synthetics. (K2)
3. Analyze and compute different properties of geosynthetics. (K2)
4. Apply the knowledge for designing the structures using Geosynthetic materials.(K2)

SYLLABUS

UNIT- I

An Overview of Geosynthetic in Geotechnical Engineering: Historical development Types of Geosynthetics, geo textiles, geo grids, geo nets, geo membranes, geo composites, Recent use in India.

UNIT- II

Manufacturing : Materials and Process: Raw materials : polyamide , polyester , polyethylene , polypropylene , poly vinyl chloride, Different type of geosynthetics based on manufacturing woven, monofilament , multifilament , slit filament , non-woven Different bonding process : Mechanically bonded, Chemically bonded ,Thermally bonded.

UNIT- III

Properties of Geosynthetics : Physical Properties: Mass per unit area , Thickness , Specific gravity Hydraulic properties: Apparent open size, Permittivity, Transmissivity Mechanical Properties: Uniaxial Tensile Strength , Burst and Puncture Strength , Soil Geosynthetic friction tests Durability : Abrasion resistance ,Ultraviolet resistance.

UNIT- IV

Functions of Geosynthetics: Reinforcement, Separation Filtration, Drainage Barrier Functions Confinement.

UNIT-V

Applications of Geosynthetics: Use of geosynthetics in roads, Use of reinforced soil in Retaining walls Improvement of bearing capacity, Geosynthetics in environmental control and landfills, Ground Improvement by geo drains, Use of Geosynthetics in lining of canals

Text books

1. Sanjay Kumar Shukla, Jian-Hua Yin, Fundamentals of Geosynthetic Engineering, CRC Press, 2000.
2. G.VenkatappaRao and G.V.S SuryanarayanaRaju , Engineering with Geosynthetics– Tata McGraw Hill, New Delhi, 1990.

References books

1. Sanjay Kumar Shukla, Thomas Telford, Handbook on Geosynthetics and their applications, 2002.
2. Robert M. Koerner , Designing with Geosynthetics, Prentice Hall, New Jersey, UAS,1989.
3. Robert M. Koerner –, Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill, New York, 1985.

E-Resources

1. https://nptel.ac.in/courses/105106052

VI SEMESTER PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20CE6E03: RAILWAY AND AIRPORT ENGINEERING				

Course Outcomes:

Students are able to

1. apply geometrics in a railway track. (K3)
2. develop good transportation network. (K3)
3. prepare airport planning and geometrics. (K3)
4. describe airfield pavements. (K3)
5. plan and maintenance of Docks Harbours. (K3)

SYLLABUS:

A.RAILWAY ENGINEERING

UNIT - I

Components of Railway Engineering: Permanent way components -Railway Track Gauge Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast -Rail Fastenings - Creep of Rails- Theories related to creep - Adzing of Sleepers- Sleeper density - Rail joints.

UNIT - II

Geometric Design of Railway Track: Alignment - Engineering Surveys -Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency - Degree of Curve – safe speed on curves - Extra clearance on curves - widening of gauge on curves- vertical curves - cheek rails on curves.

UNIT - III

Turnouts & Controllers: Track layouts - Switches - Crossings - Turnouts – Layout of Turnout - Double Turnout - Diamond crossing - Scissors crossing. Signal Objectives - Classification – Fixed signals - Stop signals - Signaling systems Mechanical signaling system - Electrical signaling system – System for Controlling Train Movement – Interlocking- essentials and objectives.

B.AIRPORT ENGINEERING

UNIT - IV

Airport Planning & Design: Airport Master plan- Airport site selection-Air craft characteristics-Zoning laws - Airport classification - Runway orientation - Wind rose diagram Type-I and Type-II - Runway length - Taxiway uses - Terminal area and Airport layout - Visual aids and Air traffic control.

Runway Design: Various Design factors - LCN system of Pavement Design- Airfield Pavement Failures - Maintenance and Rehabilitation of Airfield pavements- Evaluation & Strengthening of Airfield pavements-Airport Drainage- Importance of surface and subsurface drainage.

C.DOCKS AND HARBOURS

UNIT - V

Planning, Layout, Construction & Maintenance of Docks and Harbours

Classification of ports - Requirement of a good port -classification of Harbours - Docks - Dry and wet docks - Transition sheds and ware houses - Layouts; Quays - construction of Quay walls - Wharves - Jetties - Tides - Tidal data and Analysis - Break waters - Dredging - Maintenance of Ports and Harbours - Navigational aids.

Text books

1. Srinivasa Kumar R, 'Transportation Engineering',University Press, Hyderabad, 2019.
2. Satish Chandra and Agarwal M.M , Railway Engineering., Oxford University Press, New Delhi, 2018.
3. Khanna & Arora , Airport Engineering - Nemchand Bros, New Delhi, 2015.

4. Subramanian KP , 'Highway, Railway, Airport and Harbour Engineering', Scitech Publications (India) Pvt. Limited, Chennai, 2010.

Reference Books

1. Saxena & Arora , 'Railway Engineering'- Dhanpat Rai, New Delhi, 2015.
2. Wright P.H. & N.J , 'Transportation Engineering Planning Design'. - John Wiley & Sons, 2015.
3. Bindra S.P , Docks and Harbour Engineering - Dhanpathi Rai & Sons, New Delhi, 2014.
4. Virendra Kumar , 'Airport Engineering', Dhanpat Rai Publishers, New Delhi , 2012.

E-Resources

1. https://nptel.ac.in/courses/105107123
2. https://www.civilsutras.com/nptel-lectures-on-transportation-engineering-ii/

VI SEMESTER PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20CE6E04: OPEN CHANNEL FLOW				

Course Outcomes:

Students are able to

1. Understand basic concepts of surface flows. (K2)
2. Compute methods and analysis of gradually varied flow. (K2)
3. Know the characteristics of Rapidly Varied Flow. (K2)
4. Identify principles and classification of spatially varied flow. (K2)
5. Estimate flow in channel of non-linear alignment. (K2)

SYLLABUS

UNIT - I

Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections Energy-depth relations: Concept of specific energy, specific force, critical flow, critical depth, hydraulic exponents, and channel transitions.

UNIT - II

Gradually Varied Flow (GVF): Equation of gradually varied flow and its limitations, flow classification and surface profiles, Control sections, Computation methods and analysis: Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels.

UNIT - III

Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater, Flow measurement: by sharp crested and broad crested weirs, critical depth flumes, sluice gate, Free overfall. Rapidly varied unsteady flow: Equation of motion for unsteady flow, “Celerity” of the gravity wave, deep and shallow water waves, open channel positive and negative surge

UNIT - IV

Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, Flow over side-weir and Bottom-rack.

UNIT - V

Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert.

Text Books

1. Ranga Raju, K.G., Flow through open channels, T.M.H, 2018.
2. Subramanya, K., Flow in Open Channels, Tata McGraw Hill, 2017.
3. Henderson, F.M., Open Channel Flow, McGraw Hill International, 2012.
4. Chow, V.T., Open channel Hydraulics, McGraw Hill International, 2010.

Reference Books

1. French, R.H., Open channel Hydraulics, McGraw Hill International, 2015.
2. Srivastava, Flow through Open Channels, Oxford University Press, 2012.
3.M. Hanif Chaudhry, Open Channel Flow, PHI, 2010.

E-Resources

1. https://nptel.ac.in/courses/105107059

VI SEMESTER PROFESSIONAL ELECTIVE-II	L	T	P	C
	3	-	-	3
20CE6E05: MUNCIPAL AND HAZARDOUS WASTE MANAGEMENT				

Course Outcomes:

Students are able to

1. Acquire knowledge in classification of solid waste and quality assessment methods of sampling. (K2)
2. Understand the solid waste collection and transport methods, and other design requirements, operational maintenance. (K2)
3. Gain knowledge in waste processing techniques and to engage in reduce and recycle, and reuse methods. (K2)
4. Identify different techniques for waste disposal. (K2)
5. Use different solid waste management techniques. (K2)

SYLLUBUS

UNIT-I: Introduction to Municipal Solid Waste

Definition - Sources and Impacts of solid waste on environment, Classification of solid waste-composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization.

UNIT-II: Integrated Solid Waste Management

Collection: Collection of Solid waste, equipments, time and frequency of collection, factors affecting collection, analysis of collection system, collection routes. Transfer and Transport: Need for transfer operation, transfer stations – types – transport means and methods – location of transport stations Transfer stations & design requirements.

UNIT-III: Hazardous Waste Management

A: Introduction to Hazardous Waste

Definition, Identification, Characteristics and Classification, Sources, Collection and Transport.

B: Hazardous waste Treatment

Physical & chemical Treatment: Solidification and Stabilization; Thermal: Incineration, Pyrolysis, Biological: Aerobic, Anaerobic and Biochemical.

UNIT-IV: Waste to Energy options

Introduction- Five Waste to Energy Technologies, Composting, principles of composting, factors affecting composting, vermi composting, Landfill technique, and design and operating procedure of landfill.

UNIT-V: Solid & Hazardous Waste Management Legislations

Solid waste management Hierarchy, waste avoidance /waste prevention, Definition of source Reduction, waste reduction at source using 5R's Technique, Solid and Hazardous waste management rules and regulations.

Text books:

1. Sunil Kumar, "Municipal Solid Waste Management in Developing Countries", CRC Press, 1st edition, 2016.
2. Jimmy Alexander Faria Albanese, M. Pilar Ruiz, "Solid Waste as a Renewable Resource: Methodologies", Apple Academic Press, 1st edition, 2015.

Reference books

1. Elena Cristina Rada, "Solid Waste Management: Policy and Planning for a Sustainable Society", Apple Academic Press, 1st edition, 2016.
2. P. Jayarama Reddy, "Municipal Solid Waste Management: Processing - Energy Recovery - Global Examples", CRC Press - BS Publications 1st edition, 2015.
3. Syeda Azeem Unnisa, S. Bhupatthi Rav, "Sustainable Solid Waste Management", Apple Academic Press, 1st edition, 2012.

E-Resources

1. https://nptel.ac.in/courses/105106056

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CE6O01:: ENVIRONMENTAL POLLUTION AND CONTROL				

Course Outcomes:

Students are able to

1. Identify the air pollutant causes and control devices. (K2)
2. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods. (K2)
3. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city. (K2)
4. know the causes for noise pollution and ISO14000 standards. (K2)
5. know Treatment and management of hazardous waste. (K2)

SYLLUBUS

UNIT – I : Air Pollution

Air pollution causes-control methods–particulate control devices – methods of controlling Gaseous Emissions – Air quality standards.

UNIT –II: Industrial wastewater Management

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

UNIT – III : Solid Waste Management

Solid waste characteristics–basics of on-site handling and collection–separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of landfilling.

UNIT – IV: Noise Pollution

Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000

UNIT – V: Hazardous Waste

Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Text books

1. K. Sasi Kumar, S.A. Gopi Krishna ,"Solid Waste Management",PHI New Delhi,2014.
2. D. Srinivasan, "Environmental Engineering", PHI Learning Private Limited, New Delhi, 2011.

References books

1. Ruth F. Weiner and Robin Matthews , 'Environmental Engineering', 4th Edition Elesevier, 2003.
2. J.G. Henry and G.W. Heinke,'Environmental Science and Engineering'– Pearson Education,2002
3. Mackenzie L Davis & David A Cornwell, "Environmental Engineering ',McGraw Hill Publishing,2002.
4. Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus,"Environmental Engineering", Mc-Graw-Hill Book Company, New Delhi, 1985.

E-Resources

1. https://nptel.ac.in/courses/123105001

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CE6O02 :: DISASTER MANAGEMENT				

Course Outcomes:

Students are able to

1. identify the tools of integrating disaster management principles in disaster mitigation process. (K2)
2. discuss about different approaches needed to manage pre and post- disaster activities**. (K2)**
3. prepare the process of risk management and develop a basic understanding method for the role of public in risk management. (K2)
4. administer the role of technology in Disaster management. (K2)
5. conclude the planning strategies for education and community preparedness programmes. (K2)

SYLLUBUS

UNIT-I : Natural Hazards and Disaster management:

Introduction of DM – Inter disciplinary nature of the subject- Disaster Management cycle- Five priorities for action. Case study methods of the following: floods, draughts -Earthquakes- global warming, cyclones & Tsunamis- Post Tsunami hazards along the Indian coast - landslides.

UNIT-II: **Man Made Disaster and their management along with case study methods of the following**: Fire hazards - transport hazard dynamics -Solid waste management- post disaster – Bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.

UNIT-III: **Risk and Vulnerability**:

Building codes and land use planning - social vulnerability - environmental vulnerability - Macroeconomic management and sustainable development, climate change risk rendition - financial management of disaster - related losses.

UNIT-IV: **Role of Technology in Disaster managements**:

Disaster management for infra structures, taxonomy of infrastructure - treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes -flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training transformable indigenous knowledge in disaster reduction.

UNIT-V: **Education and Community Preparedness**

Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.

Text Books

1. Jagbir Singh , 'Disaster Management - Future Challenges and Opportunities' , I K International Publishing House Pvt. Ltd-2017
2. Tushar Bhattacharya, 'Disaster Science & Management', Tata McGraw Hill Education Pvt. Ltd., New Delhi.-2012.

References Books

1. Prof. R.B. Singh , "Disaster Management and Mitigation", World Focus 2016.
2. Rajib shah & R. Krishnamurthy, 'Disaster Management - Global Challenges and Local Solutions' Universities press-2009.
3. H K Gupta , **'**Disaster Management', Universities press-2003

E-resources

1. https://archive.nptel.ac.in/courses/105/104/105104183/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EE6O01 :: FUNDAMENTALS OF ELECTRIC VEHICLES				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1	:	Illustrate different types of electric vehicles
CO2	:	Select suitable power converters for EV applications
CO3	:	Design HEV configuration for a specific application
CO4	:	Choose an effective method for EV and HEV applications
CO5	:	Analyse a battery management system for EV and HEV

SYLLABUS

UNIT-I	**:**	**INTRODUCTION**
Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles		
UNIT-II	**:**	**COMPONENTS OF ELECTRIC VEHICLES**
Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.		
UNIT-III	**:**	**HYBRID ELECTRIC VEHICLES**
Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.		
UNIT-IV	**:**	**MOTORS FOR ELECTRIC VEHICLES**
Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)		
UNIT-V	**:**	**ENERGY SOURCES FOR ELECTRIC VEHICLES**
Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it's working.		

TEXT BOOKS:

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.

2. Denton - Tom. Electric and hybrid vehicles. Routledge - 2020.

REFERENCE BOOKS:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press -

2020.

2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.

3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EC6O01 :: MOBILE COMMUNICATION AND IT'S APPLICATIONS				

COURSE OUTCOMES:

Students are able to

CO1. Design Hexagonal shaped cells and how these are implemented in real world.
CO2. Explain different types of antenna systems in mobile communication.
CO3. Analyze Handoffs and different types of handoffs and Dropped call rates and their evaluation.
CO4. Describe the Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-I

INTRODUCTION :
Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs), A Simplified Reference Model, Applications.

UNIT-II
ELEMENTS OF MOBILE COMMUNICATIONS:
General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of Cellular system.

UNIT-III
THE MOBILE CONCEPT :
Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring.

UNIT-IV
MOBILE RADIO PROPAGATION :
Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

UNIT-V
FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT:
Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

TEXTBOOKS:

1. Wireless Communications by Theodore S. Rappaport, principles and practice,2nd Editions. (**Unit-I, III, IV & V)**
2. Mobile Cellular Communication by Gottapu Sasibhushana Rao, Pearson International, 2012.
(UNIT - I, II, III &IV)
3. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006. **(UNIT - V & VI)**

REFERENCES:

1. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.
2. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O01 :: BASICS OF 3D PRINTING				

COURSEOBJECTIVES:

- To explore technology used in additive manufacturing.
- ToacquireknowledgeforselectingcorrectCADformatsinmanufacturingprocess.
- To understand the operating principles and limitations of liquid, solid and laser based additive manufacturing system.
- To design the process of additive manufacturing including tools used for design.
- Toacquireknowledgeonimportantprocessparametersforbio-manufacturing

COURSEOUTCOMES: Students are able to

CO1: To impart the fundamentals of Additive Manufacturing Technologies for engineering applications. [K2]

CO2:Selectand use correct CAD for mats in the manufacture of a3D printed part. [K2]

CO3: Explain the operating principles, capabilities, and limitations of liquid, solid and laser based additive manufacturing system. [K2]

CO4:Enumerate the design process for additive manufacturing including tools used for design and some features required for design. [K2]

CO5: Describe the important process parameters for bio-manufacturing and determine the suitable additive technique for bio-manufacturing, aerospace and manufacturing engineering. [K2]

UNITI INTRODUCTION

3D printing Overview, History ,Need, Classification ,Additive Manufacturing Technology in product development, Materials for Additive Manufacturing Technology

UNITII
REVERSEENGINEERING

BasicConcept–3DScanningDigitizationtechniques,ModelReconstruction,DataProcessingforAdditive Manufacturing Technology, Part Orientation and support generation, Model Slicing, Tool path Generation.

UNITIII
ADDITIVEMANUFACTURINGSYSTEMS

SOLID& LIQUID BASED- Classification ,Stereo lithography Apparatus (SLA) - Principle, process, advantages, Fused Deposition Modeling –Principle, process, advantages.
LASERBASED-Selective LaserSintering–Principle,Process,advantages,ThreeDimensionalPrinting –Principle, process, advantages – Laser Engineered Net Shaping(LENS)

UNITIV
DESIGNFORAM

Motivation,DesignforManufacturingandAssembly(DFMA)
conceptsandobjectives,AMuniquecapabilities,Exploringdesignfreedoms,DesigntoolsforAM-PartOrientation,RemovalofSupports,

Hollowing out parts, Inclusion of Undercuts, Other Manufacturing Constraining Features,

Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/numbers etc.

UNITV
APPLICATIONSOF3DPRINTING.

Customized implants and prosthesis: Design and development, Bio-Additive Manufacturing-Computer Aided Tissue Engineering (CATE), Applications of 3D Printing in Aerospace, Automotive, Manufacturing and Architectural Engineering.

TEXTBOOKS

1. Patri K. Venuvinod., and Weiy in Ma., Rapid prototyping Laser based and other Technologies, First Edition, Springer Science +Business Media, LLC, 2004.
2. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, Third Edition, World Scientific Publishers, 2016.
3. GebhardtA,Rapidprototyping,HanserGardenerPublications,2017.
4. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications, World Scientific Publishers, Fourth Edition of Rapid Prototyping, 2018.

REFERENCES

1. Liou L.W.andLiouF.W.,RapidPrototypingandEngineeringapplications:Atoolboxforprototypedevelopment,CRC Press, 2017.
2. Kamrani A.K. and Nasr E.A.,Rapid Prototyping: Theoryand practice, Springer, 2016.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press,2015.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20ME6O02 :: FARM MACHINERY				

COURSE OBJECTIVES: The objectives of this course are

- To impart the students to understand the fundamentals of machinery in farming.
- To enable the students to acquire knowledge on tillage and equipment used.
- To introduce the students about various types of earth moving equipment.
- To enable the students to acquire knowledge on seeding and spraying equipment.
- To introduce the fundamentals of transplanting machinery and fertilizer equipment.

COURSE OUTCOMES: Students will be able to

CO1. Explain various types of machinery in farming. [K2]
CO2. Illustrate types of farm operation for craft cultivation with scientific understanding. [K2]
CO3. Explain various types of earth moving equipment. [K2]
CO4. Summarize various seeding methods and sprayer types. [K2]
CO5. Explain transplanting methods and fertilizer equipment. [K2]

UNIT I
FARM MECHANIZATION:
Farm mechanization- objectives of farm mechanization, sources of farm power, classification of farm machines. Materials of construction and heat treatment. principles of operation and selection of machines used for production of crops, Field capacities of different implements and their economics, Problems on field capacities and cost of cultivation

UNIT II
TILLAGE EQUIPMENT:
Tillage equipment - classification and types of tillage, Primary tillage implements-mould board plough and its parts, disc plough, and other ploughs, Secondary tillage equipment- disc harrows, Implements-cultivators, intercultural implements. Forces acting on tillage tools, Problems on forces analysis, Draft measurement of tillage equipment, Draft and unit draft related problems.

UNIT III
EARTH MOVING EQUIPMENT
Earth moving equipment - terminology, construction and their working principles, shovels, bulldozers, trenches and elevators.

UNIT IV
SEED DRILLS AND SPRAYER:
Seeding - methods, types of seed metering mechanism, types of furrow openers. Calibration of seed drills, Adjustment of seed drills – objectives, uses of plant protection equipment
Sprayers - types of sprayers and dusters, sprayer calibration and selection, Constructional features of different components of sprayers and dusters

UNIT V
TRANSPLANTING AND FERTILIZER:
Transplanting and fertilizer - transplanting methods, different types of transplanting machinery, working principle, adjustments in transplanting equipment
Fertilizer - application equipment, fertilizer meeting mechanism calibration of fertilizer equipment.

TEXTBOOKS

1. Fakir Chara Das, Kishore Chandra and Shishira Kanth, Farm Machinery and Equipment, 1st Edition, Akinik Publications, 2020

2. Triveni Prasad Singh, Farm Machinery, 1st Edition, Prentice Hall India Pvt, Limited, 2016.

REFERENCES

1. Surendra Singh, Farm Machinery Principal And Applications, 1st Edition, ndian Council of Agricultural Research, 2017
2. Smith H P, Farm Machinery and Equipment, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2007.

WEB REFERENCE:

1. https://nptel.ac.in/courses/126105009

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1	2					1	1	
CO2	3	2	2			1	2					1	1	
CO3	3		2			1	2					1	1	
CO4	3		1			1	2					1	1	
CO5	3		2			1	2					1	1	
Avg	**3**	**0.8**	**1.8**			**1**	**2**					**1**	**1**	

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20EC6O01:: FUNDAMENTALS OF SOFTWARE ENGINEERING				

COURSE OUTCOMES:

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

1. Identify, formulate the various software engineering concepts
2. different software development process models.
3. analyze and specify software requirements with various stakeholders of a software development project
4. Apply systematic procedure for software design and deployment.
5. Compare and contrast the various testing methods and art of debugging

UNIT I

SOFTWARE AND SOFTWARE ENGINEERING: The nature of Softwaree: Define software (Software Characteristics), Software Application Domains, **Software Engineering**: Definition, Llayered Technology, **Software Process:** Generic Process framework activities, Umbrella activities, Software Myths and Reality, Generic Process model, Capability Maturity Model Integration (CMMI).

UNIT-II

PROCESS MODELS: Process Assessment and improvement. Prescriptive Process models: Waterfall Model, Incremental Process Model**,** Evolutionary Process Models: Prototyping, Spiral model, The Unified Process.Personal and Team process models: Personal software process (PSP), Team software process (TSP), Product and Process,

UNIT-III

REQUIREMENTS ANALYSIS AND SPECIFICATION: Functional Requirements, Non- Functional Requirements, Software Requirements Document (Software Requirements Specification SRS), Requirements Specification, Requirements Engineering**,** Eliciting Requirements(elicitation), Developing Use cases, Validating Requirements, Requirements Management: Requirements Planning, Requirements Change management.

UNIT-IV

SOFTWARE DESIGN: Design process**, Design concepts**: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information hiding, Functional independence, Refinement, Aspects, refactoring, Object oriented design concepts, Design classes.

The Design Model: Data Design Elements, Architectural Design elements, Designing Class Based Components: Basic Design Principles, Component-Level Design guidelines, Cohesion and coupling.

User Interface Design: The Golden Rules

UNIT-V

TESTING: The strategies for Conventional Strategies: Unit Testing – Integration Testing. Test Strategies for Object-Oriented Software, Software testing fundamentals, white box testing- Basis path testing: Flow graph Notation, independent Program paths, Deriving test cases, Graph Matrices. control structure testing. black box testing: Graph Based Testing Methods, Equivalence Partitioning, Boundary value Analysis. Validation Testing, System Testing. Art of Debugging: The Debugging process.

TEXT BOOK:

1. Software Engineering, A practitioner's Approach- Roger S. pressman, 8th edition,

McGraw-Hillinternational Edition, 2014.

2. Software Engineering, Ian Sommerville, 10th Edition, Pearson Education Asia, 2016.

REFERENCE BOOKS:

1. Software Engineering, Pankaj Jalote, A Precise Approach", Wiley India, 2010.
2. Systems Analysis and Design- Shely Cash man Rosenblatt, 9th Edition, Thomson publications, 2016.
3. Software Project Management, Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edition,

Tata McGrawHill, New Delhi, 2012.

4. https://nptel.ac.in/courses/106101061/

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6O02 :: FUNDAMENTALS OF COMPUTER NETWORKS				

COURSE OUTCOMES

At the end of the course students are able to

1. Differentiate network referenc**e** models such as OSI**,** TCP/IP
2. Classify variousData Link Layer protocols such as sliding window.
3. Distinguish various MAC sublayer protocols such as ALOHA, CSMA, CSMA/CD
4. Differentiate Network layer protocols IPv4 and IPv6
5. Distinguish various Transport layer protocols and its applications

UNIT 1:

Data communication Components: Representation of data and its flow of networks, Categories of Networks, Various Connection Topologies, Protocols and Standards, OSI network model, TCP/IP Protocol suit, addressing

UNIT 2:

Physical Layer: Transmission Media: Guided Media, Unguided Media

Data Link Layer: Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC, Flow Control and Error control protocols: Stop and Wait, Go back – N ARQ, Selective Repeat ARQ

UNIT 3:

Medium Access Sub Layer: Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA. Controlled Access protocols: Reservation, Polling, Token passing

UNIT 4:

Network Layer: IPv4 address: Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation (NAT) **IPv6 Addresses**: Structure, Address Space

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP)

UNIT 5:

Application layer:

Domain name system (DNS), E-mail, File Transfer Protocol (FTP), www and HTTP

Text Books:

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGrawHill, 2017
2. Computer Networks, 6th Edition, Andrew S. Tanenbaum, Pearson New International Edition, 2021.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India, 2007

Reference Books:

1. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
2. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
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20BM6O01 :: STRESS AND WORK LIFE MANAGEMENT				

UNIT-I

Understanding stress**:** Meaning – Symptoms – Works Related Stress – Individual Stress –Reducing Stress – Burnout. Setting to Stress- Stress: Meaning - Approaches to stress, Good Stress Vs Bad Stress, The individual and work.

UNIT-II

Common stress factors time & career plateauing**:** Time Management – Techniques – Importance of planning the day – Time management schedule – Developing concentration – Organizing the Work Area – Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say 'No

UNIT-III

Introduction to Work-Life Balance - Importance of Work-Life Balance - Benefits of Work-Life Balance to Employees - Benefits of Work-Life Balance for Organization - Effects of Poor Work-Life Balance on Employees - Relation between Work-Life Balance & Stress - Outline for Work-Life Balance Planning- Approaches to Work-Life Balance planning - Process of Work-Life Balance - Steps of Work-Life Balance Planning

UNIT-IV

Work place humour**: Developing** a sense of Humour – Learning to laugh – Role of group cohesion and team spirit – Using humour at work – Reducing conflicts with humour.

UNIT-V

Self-development: Improving Personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Meditation for peace – Yoga for Life. Organization and Stress Management - Recognize the signs, Approaches to the problem, Providers Assistance.

References

1. Cooper, Managing Stress, Sage, 2011
2. Waltschafer, Stress Management, Cengage Learning, 4th Edition 2009.
3. Jeff Davidson, Managing Stress, Prentice Hall of India, New Delhi, 2012.
4. Juan R. Alascal, Brucata, Laurel Brucata, Daisy Chauhan. Stress Mastery. Pearson
5. Argyle. The Psychology of Happiness. Tata McGraw Hill. 2012
6. Bartlet. Stress – Perspectives & Process. Tata McGraw Hill. 2012
7. Handbook on Work –Life Balance-A New Approach, 2017, Dr. C Swarnalatha,Mrs.S. Rajalakshmi,Lulu Press.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
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20BM6O02 :: BANKING AND INSURANCE				

Unit I

Origin of banking: Definition, Types of deposits, Origin, and growth of commercial banks in India. India's Approach to banking Sector Reforms, International security standards in banking, Global Financial Crisis and India's banking Sector.

UnitII

Introduction to E-Banking-Impact of Information Technology on Banking Changing Financial Environment and IT as a strategic response Hardware and Software.

Unit III

Delivery Channels-ATM, EFTPOS, Phone Banking, Internet Banking, SMS Banking, Mobile Banking, Credit/Debit Cards, Smart Cards E-Commerce-Secure Electronic Transfer (SET), Payment Gateways (Credit card/Debit cards), Authentication of payments, etc.

Unit IV

Principles and Practice of Insurance-Introduction to Risk and Insurance, Types of Insurance-General and Life, Basic principles of General and Life Insurance,

Unit V

General insurance products, underwriting concepts, standard conditions and warranties with respect to Fire, Marine, Motor, Engineering and Miscellaneous products.

Reference Books:

1. Agarwal, OP, Banking & Insurance, Himalaya Publishing House, Mumbai
2. George E Rejda, Principles of Risk Management & Insurance, Pearson Education, New Delhi
3. Balachandran S., General Insurance, Insurance Institute of India, Mumbai
4. Arthur C., William Jr., Michael Smith, Peter Young, Risk Management and Insurance, Tata McGraw Hill Publishing Company, New Delhi
5. Tripathy Nalini Prava & Prabir Pal, Insurance Theory & Practice, Prentice Hall of India Pvt. Ltd., New Delhi
6. Balachandran S., Life Insurance, Insurance Institute of India, Mumbai

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20MA6O01 :: OPERATION RESEARCH				

COURSE OBJECTIVES:

1.Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, machines etc) more effectively.

2.Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry

UNIT—I

LINEAR PROGRAMMING:

Introduction-General formulation LPP- Formulation of LP problems - Graphical solution –Slack and Surplus and Artificial variables-simplex method (simple problems) - artificial variable techniques – twophase method, Big-M-method(simple problems) –Concept of Duality-general rules for converting any primal into its dual.

UNIT – II

TRANSPORTATION PROBLEM:

Introduction-mathematical formulation-Feasible, Basic Feasible and Optimum solution -Methods for initial basic feasible solution to transportation problem-optimal Test by u, v method(MODI)-Degeneracy in Transportation problems –.Unbalanced Transportation problems

UNIT – III

SEQUENCING PROBLEM:

Introduction –Johnson's Algorithm for n jobs 2 machines- Optimal Solution for processing n jobs through two machines- processing n jobs through three machines - processing n jobs through m machines - processing two jobsthrough m machines

UNIT – IV

REPLACEMENT PROBLEMS:

Introduction – replacement policy for items whose maintenance cost increases with time, and money value is constant – Money value, present worth Factor and Discount Rate- replacement policy when maintenance cost increases with time and money valuechanges with constant rate – Individual Replacement Policy-group replacement of items that fail completely.

UNIT – V

WAITING LINES:

Introduction- transient and steady states-Probability Distributions in Queening systems-Kendall's notation for Representing Queening models- Single channel-Poisson arrivalsExponential service times-with infinitepopulation model (M/M/1: FIFO/∞/∞)

INVENTORY:

Introduction – types of inventory models – Costs involved in Inventory problems-Variables in inventory problem-Classification of Inventory Models-Concept of EOQ-The EOQ model without shortage – Quantity Discounts-purchase inventory models with one price break - purchase inventory models with two price breaks- purchase inventory models with any number of price breaks-shortages are not allowed

COURSE OUTCOMES: Students can able to

CO1: Formulate the resourcemanagement problem andidentify appropriate methods to solve them. [K3]

CO2: Applytransportation model to optimize the industrial resources. [K3]

CO3: Solve sequencing problems using operation research techniques. [K3]

CO4: Apply thereplacement model to increase the efficiency of the system. [K3]

CO5: Apply theinventory and queuingmodel to increase the efficiency of the system. [K4]

.**TEXT BOOKS:**

1. Operations Research / S.D.Sharma, Ramnath co,Meerut
2. Operations Research, P.K.Gupta, D.S.Hira,S.Chand

REFERENCE BOOKS:

1. Operations Research /A.M.Natarajan,P.Balasubramani, A.Tamilarasi/PearsonEducation.
2. Operations Research / R. Pannerselvam, PHI Publications.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O01 :: INTRODUCTION TO CLOUD COMPUTING				

Course Outcomes:

Upon completion of the course, it is expected that student will be able to:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Learn the key and enabling technologies that help in the development of cloud.
3. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
4. Explain the core issues of cloud computing such as resource management and security.
5. Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

UNIT-I:

Introduction: Introduction to Cloud Computing, Definition of Cloud, Evolution of Cloud Computing, Underlying Principles of Parallel and Distributed Computing, Cloud Characteristics, Elasticity in Cloud – On-Demand Provisioning.

UNIT-II:

Cloud Enabling Technologies: Service Oriented Architecture, REST and Systems of Systems, Web Services, Publish-Subscribe Model, Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices, Virtualization Support and Disaster Recovery.

UNIT-III:

Cloud Architecture, Services And Storage: Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public, Private and Hybrid Clouds, IaaS, PaaS, SaaS, Architectural Design Challenges, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage, Cloud Storage Providers, S3.

UNIT-IV:

Resource Management And Security In Cloud: Inter Cloud Resource Management, Resource Provisioning and Resource Provisioning Methods, Global Exchange of Cloud Resources, Security Overview, Cloud Security Challenges, Software-as-a-Service Security, Security Governance, Virtual Machine Security, IAM, Security Standards.

UNIT-V:

Cloud Technologies And Advancements: Hadoop, MapReduce, Virtual Box, Google App Engine, Programming Environment for Google App Engine, Open Stack, Federation in the Cloud, Four Levels of Federation, Federated Services and Applications, Future of Federation.

Text Books:

1. Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, Morgan KaufmannPublishers.
2. Cloud Computing: Implementation, Management and Security, Rittinghouse, John W., and James F. Ransome, CRCPress.

References:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Tata McgrawHill.
2. Cloud Computing - A Practical Approach, Toby Velte, Anthony Velte, Robert Elsenpeter, Tata McGrawHill.
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), George Reese, O'Reilly.

VI SEMESTER : OPEN ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6O02 :: E-COMMERCE				

COURSE OUTCOMES

After the completion of the course the students are able to

1. Define the fundamentals E-commerce framework.
2. Explain the basics of Consumer Oriented Electronic models.
3. Distinguish different electronic payment systems and their issues.
4. Demonstrate Inter-organizational and intra-organizational electronic commerce.
5. Explain advertising and marketing on the Internet, consumer search and resource discovery and key multimedia concepts.

UNIT-I

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT-II

Consumer Oriented Electronic commerce - Mercantile Process models, Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

UNIT-III

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks. Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management.

UNIT-IV

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

UNIT-V

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.
Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Text Books:

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

References Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, TharamDillon,Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
3. Electronic Commerce – Gary P.Schneider – Thomson.
4. E-Commerce – Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver.

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20CS6J01 :: AWS CLOUD PRACTITIONER				

Course outcomes:

After completing this course, students should be able to

1. Define AWS cloud and identify the Global Infrastructure components of AWS.
2. Demonstrate when to use Amazon EC2, AWS Lambda and AWS Elastic Beanstalk.
3. Differentiate Storage Services and demonstrate when to use AWS Database services.
4. Demonstrate Networking and Content Delivery Services.
5. Understand the Cloud economics and security.

UNIT 1:

CLOUD CONCEPTS OVERVIEW – Introduction to cloud computing, Cloud service models, Cloud computing Deployment models , Advantages of the cloud, Introduction to AWS.
AWS GLOBAL INFRASTRUCTURE OVERVIEW: AWS GLOBAL INFRASTRUCTURE, AWS Services and Service categories

UNIT 2:
COMPUTE – Compute services overview, Amazon EC2, Amazon EC2 pricing models, Benefits, use cases, four pillars of cost optimization, Container services, Introduction to AWS Lambda, Benefits of Lambda, Introduction to AWS Elastic Beanstalk, Benefits.

UNIT 3:
STORAGE: Amazon Elastic Block Store (EBS), Amazon Simple Storage Service (Amazon S3), Amazon Elastic File System (Amazon EFS), Amazon Simple Storage Service Glacier (Amazon S3 Glacier).
DATABASES: Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon RedShift, Amazon Aurora.

UNIT 4:
Networking and Content Delivery: Networking Basics, Amazon VPC, VPC Networking, VPC SECURITY, Amazon ROUTE-53, Amazon Cloud Front

UNIT 5:
CLOUD ECONOMICS AND BILLING: Fundamentals of pricing, AURI,PURI,NURI ,Total cost of Ownership (TOC).
AWS CLOUD SECURITY: AWS Shared Responsibility Model, AWS IAM (Identity and Access Management),Elastic Load Balancing (ELB), Amazon CloudWatch.

Web references and AWS LMS portal :

https://aws.amazon.com/ec2
https://aws.amazon.com/ecs/
https://aws.amazon.com/about-aws/global-infrastructure/

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
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20CS6J02 :: SOFTWARE TESTING TOOLS				

COURSE OUTCOMES:
At the end of the course students are able to

1. learn Manual testing techniques and software test levels
2. practice Java Programme for Selenium and Test frame works
3. learn Apache JMeter and Building a JMeter Test Plan
4. Running Multiple Scripts with JMeter and Different Types of JMeter Test Plans
5.practicing JIRA and Test Management In JIRA (Using Zephyr Plug-in)

UNIT-I:
Manual Testing : Software Development Life Cycle (Requirements Gathering, Analysis and Planning, Software Design, Coding/Implementation, Testing, and Release and Maintenance Phase)

Software Test Levels (Unit Testing, Integration Testing, System Testing, and Acceptance Testing)
Software Test Types
Software Test Design Techniques
Software Test Life Cycle
Software Documents
Software Testing Standards
Software Testing certification/s

UNIT-II:

'Selenium with Java' : Java Programme for Selenium (Data Types, Variables, Operators, Control Flow, Strings, Arrays, IO, Methods, Exception Handling, and Object-Oriented Programming.)

- Selenium WebDriver (Web/HTML Elements, Inspecting Web Elements, Locating Elements, Selenium WebDriver API commands, Wait statements, and Page Object Model.)
- TestNG Testing Framework (Create Test cases, Prioritise Test cases, Grouping Test Cases, Batch Testing, and Generating Test Results.)
- Automation Framework

UNIT-III:

JMeter:

- Introduction to Apache JMeter
- Elements of JMeter Test Plan
- Building a JMeter Test Plan
- Recording Tests Using JMeter
- Enhancements in Test Scripts

UNIT-IV:
JMeter Result Analysis
- Running Multiple Scripts with JMeter
- Different Types of JMeter Test Plans
- JMeter Distributed (Remote) Testing
- JMeter Functions, Variables and Regular Expressions
- JMeter Best Practices

UNIT-V:

Jira Tool Syllabus:

- Introduction of JIRA
- Getting started with JIRA
- Test Management In JIRA (Using Zephyr Plug-in)
- Defect Management In JIRA
- Advanced Search Using JQL
- Generating Reports In JIRA

Web references:

https://www.lambdatest.com/blog/selenium-with-java/
https://www.gcreddy.com/2021/09/apache-jmeter-syllabus.html
https://www.javatpoint.com/jira-tutorial

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
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20IT6J01 :: FULL STACK DEVELOPMENT				

Course Outcomes:

At the end of the course students will be able to

1. Identify the Basics concepts of Web Page and Markup Languages
2. Develop web Applications using Scripting languages and Frameworks
3. Creating and Running Applications using PHP
4. Creating First Controller Working with and Displaying in AngularJS and Nested Forms with ng-form
5. Working with the Files in React JS and Constructing Elements with Data

Unit- 1: HTML

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols- The World Wide Web-HTTP request message-response message-Web clients Web Servers. Markup Languages: XHTML, an introduction to HTML, History, Versions, Basics, XHTML Syntax and semantics some fundamentals of HTML Elements-Relative URLs-Lists-Tables-Frames-Forms-HTML 5.0

Unit- 2: Cascading Style Sheets (CSS)

Style Sheets: CSS-Introduction to Cascading Style Sheets- Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance- Text Properties-Box Model Normal Flow Box Layout beyond the Normal Flow-CSS3.0, Introducing to Java Script, JavaScript basics, JavaScript objects, JSON.

Unit- 3: PHP

Introduction to PHP, Language Basics, Functions, Strings, Arrays. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables, Selecting Data from a Table, Updating Table, Deleting data from Table, Webpage creation.

Unit- 4: Angular JS

Introducing Angular JS, Starting out with Angular JS, Basic AngularJS, Directives and Controllers, AngularJS Modules, Creating First Controller, working with and Displaying, Arrays, more Directives, working with ng-repeat, Unit Testing in AngularJS, Forms, inputs and Services, Working with ng-model, Working with Forms, Leverage Data-Binding and Models, Form Validation and States, Error Handling with Forms, ngModelOptions, Nested Forms with ng-form, Other Form Controls.

Unit- 5: React JS

Introduction to react, Obstacles and Roadblocks, keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, React DOM, Children, Constructing Elements with Data, React Components, DOM Rendering , Factories

Text Books:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
3. Brad Green, Shyam Seshadri, AngularJS, Up and Running Enhanced Productivity with Structured Web Apps, Publisher O'Reilly Media
4. Alex Banks, Eve Porcello,Learning React, Functional Web Development with React and Redux Publisher O'Reilly Media

Reference Books:

1. Bert Bates, Kathy Sierra,Head First Java, 2nd Edition Publisher O'Reilly Media, Inc

VI SEMESTER : JOB ORIENTED ELECTIVE - II	L	T	P	C
	3	-	-	3
20IT6J02 :: BLOCK CHAIN TECHNOLOGY				

Course Outcomes

After the completion of the course the students are able to

CO1 Discover the secure and efficient transactions with crypto-currencies

CO2 Experiment with cryptocurrency trading and crypto exchanges

CO3 Explain bitcoin usage and applications

CO4 Develop private block chain environment and develop a smart contract on Ethereum

CO5 Build the hyper ledger architecture and the consensus mechanism applied in the hyperledger

Unit-I

CRYPTOCURRENCY AND BLOCKCHAIN- INTRODUCTION:

Blockchain- An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains

Unit-II

CRYPTO CURRENCIES: Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks

Unit-III

BITCOIN: Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

Unit-IV

ETHEREUM: The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain- Deploying contract from web and console

Unit-V

HYPERLEDGER: Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Block chain network- Creating and

Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

TEXT BOOKS

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018

2. Henning Diedrich, Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016

ONLINE REFERENCES

1. https://www.coursera.org/learn/ibm-blockchain-essentials-for-developers

2. https://museblockchain.com/

3. https://www.provenance.org/

4. https://www.coursera.org/learn/blockchain-basics

5. https://steemit.com/

6. https://101blockchains.comhttps://followmyvote.com/

VI SEMESTER	L	T	P	C
	0	0	3	1.5
20CE6L01: GIS and STAAD Lab				

Course outcomes:

Students are able to

1. Work comfortably on GIS software. (K3)
2. Digitize and create thematic map and extract important features. (K3)
3. Develop digital elevation model. (K3)
4. Use structural analysis software to analyze and design 2D and 3D frames. (K3)
5. Design and analyze retaining wall and simple towers using STAAD software. (K3)

SYLLABUS

LIST OF EXPERIMENTS:

GIS:

SOFTWARE:

1. Arc GIS 9.0
2. ERDAS 8.7
3. Mapinfo 6.5

Any one or Equivalent.

EXCERCISES:

1. Geo-referencing & Rectifying the given Map/Toposheet
2. Digitization of Map/Toposheet
3. Creation of thematic maps.
4. Study of features estimation
5. Simple applications of GIS in water Resources Engineering or Transportation Engineering.

STAAD:

SOFTWARE:

1. STAAD PRO or Equivalent

EXCERCISIES:

1. 2-D Frame Analysis and Design
2. Steel Tabular Truss Analysis and Design
3. 3-D Frame Analysis and Design
4. Retaining Wall Analysis and Design
5. Simple tower Analysis and Design

Reference Books

1. Concept and Techniques of GIS by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers, 2002.

E-Resources

1. https://nptel.ac.in/courses/105102015

VI SEMESTER	L	T	P	C
	-	-	3	1.5
20CE6L02: Geotechnical Engineering Lab-II				

Course Outcomes:
Students are able to

1. Determine Compaction characteristics of soil. (K3)
2. Determine Consolidation characteristics of soils. (K3)
3. Determine the shear strength characteristics of soils. (K3)
4. Determine the relative density of sand. (K3)

SYLLABUS:

LIST OF EXPERIMENTS

1. Determination of OMC, MOD- Standard proctor compaction test.
2. Determination of OMC, MOD- Modified proctor compaction test.
3. Determination of Relative Density of Sand
4. CBR test.
5. Determination of C and φ by direct shear test.
6. Determination of C and φ -Unconfined compression test.
7. Determination of Shear strength by Vane shear test.
8. Triaxial shear test.
9. Consolidation test
10. Determination of pH value of Soil

At least eight experiments shall be conducted.

LIST OF EQUIPMENT:

1. Apparatus for I.S light and heavy compaction tests.
2. Shaking table, funnel for sand raining technique.
3. Apparatus for CBR test
4. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity 5.
5. One dimensional consolidation test apparatus with all accessories.
6. Box shear test apparatus
7. Tri-axial cell with provision for accommodating 38 mm diameter specimens.
8. Laboratory vane Shear apparatus
9. Hot air ovens (range of temperature 50)

Reference Books

1. IS 2720 –relevant parts.

E-Resouces

1. https://smfe-iiith.vlabs.ac.in/

VI SEMESTER	L	T	P	C
	0	0	3	1.5
20CE6L03: ENVIRONMENTAL ENGINEERING LAB				

COURSE OUTCOMES

Students are able to

1. Estimate some important characteristics of water, wastewater in the laboratory. (K3)
2. Draw some conclusion and decide whether the water is suitable for Drinking/Construction / Agriculture/ Industry. (K3)
3. Estimate Chloride, EC and Salinity and suggest their suitability for Construction/Agriculture.(K3)
4. Estimate the strength of the sewage in terms of BOD and COD and Decide whether the water body is polluted or not with reference to the stated parameters in the list of experiments. (K3)
5. Demonstrate various instruments used in testing of water and study of Drinking water standards, WHO guidelines, Effluent standards and standards for Construction/ Agriculture/ Industry. (K3)

List of Experiments

1. Determination of pH of water and soil
2. Determination of Turbidity of water from different sources
3. Determination of Conductivity of water sample
4. Determination of Total dissolved solids of water
5. Determination of Alkalinity
6. Determination of Acidity
7. Determination of Chlorides and Fluorides
8. Determination of Iron and Nitrates
9. Determination of Dissolved Oxygen.
10. Determination of Total Hardness.
11. Determination of B.O.D.
12. Determination of sulphates.
13. Determination of Optimum coagulant dose.
14. Determination of Chlorine demand.
15. Presumptive Coli form test.

NOTE: At least 10 of the experiments enlisted are to be conducted.

Reference books:

1. KVSG Murali Krishna , "Chemical Analysis of Water and Soil", Environmental Protection Society, 14th Edition, 2021.
2. Sawyer and Mc.Carty , "Chemistry for Environmental Engineering", McGraw Hill Education; 5th edition ,2017.
3. Standard Methods for Analysis of Water and Waste Water –APHA, 2012

E-Resources

1. https://ee1-nitk.vlabs.ac.in/
2. https://ee2-nitk.vlabs.ac.in/

VI SEMESTER	L	T	P	C
	0	0	2	2
20CE6S01: ETABS				

COURSE OUTCOMES

Students are able to

1. develop the knowledge about specialized software such as ETABS to model and analyze for buildings. (K3)
2. demonstrate model, analyze, solve structural models and access analysis results such as force, displacement etc for structural design. (K3)
3. tabulate the work in the group flexibly and efficiently. (K3)
4. identify foundation analysis using SAFE. (K3)

List of Experiments

1. Basics of Structures.
2. Basics about the ETABS.
3. Introduction to various commands of ETABS and their applications in detail.
4. 2D model, analysis and design for Trusses, Beams and Frames
5. 3D model and analysis for Steel and RC Buildings.
6. Earthquake load application to RC and steel structures along with the design.
7. Members grouping
8. Design Grouping in Steel structures
9. Application of different building codes in the design of concrete and steel structures
10. Foundation analysis using SAFE, independent as well as importing results from the ETABS.

At least eight experiments shall be conducted.

SYSTEMS REQUIREMENTS:

Processor: Minimum: Intel Pentium 4 or AMD Athlon 64

Operating System: Microsoft® Windows Vista, Microsoft® Windows 7, Microsoft® Windows 8 or Microsoft® Windows 10

Video Card: Minimum: Supporting 1024 by 768 resolution and 16 bits colors for standard (GDI+) graphics mode.

E-Resources

1. https://www.csiamerica.com/products/etabs/videos

VI SEMESTER (MANDATORY COURSE)	L	T	P	C
	2	-	-	-
20BM6M01: PROFESSIONAL ETHICS &INTELLECTUAL PROPERTY RIGHTS				

SYLLUBUS

UNIT I

Engineering Ethics: Importance of Engineering Ethics-–Professional and Professionalism – Professional Roles to be played by an Engineer –Professional Ethics.

UNIT II

Engineering as Social Experimentation: Role of engineering in knowledge society- Knowledge acquired – Conscientiousness – Relevant Information –Engineers as Managers, Consultants, and Leaders. Engineers' Responsibility for Safety and Risk: Role and importance of Safety and risk- Types of Risks – Threshold Levels for Risk– Risk Benefit Analysis.

UNIT III

Engineers' Responsibilities and Rights: Collegiality-Conflict of Interest-solving conflict problems – Ethical egoism-Collective bargaining -Confidentiality-Acceptance of Bribes/Gifts--Occupational Crimes-industrial espionage-Whistle Blowing-types of whistle blowing.

UNIT IV

Intellectual property and Copy Rights: Introduction to Intellectual Property Law - Types of Intellectual Property -Infringement Copyrights: Introduction to Copyrights – Principles of Copyright – Rights Afforded by Copy right Law – Copyright Formalities and Registration.

UNIT V

Patents and Trademarks: Introduction to Patent Law –Rights under Patent Law – Patent Requirements – Patent Application Process and Granting of Patent – Double Patenting – Patent Cooperation Treaty. Trademarks: Introduction to Trade Mark – Trade Mark Registration Process – Trade Mark maintenance – Likelihood of confusion.

Text Books

1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar, "Engineering Ethics and Human Values", PHI Learning Pvt. Ltd-2009.
2. Prof.A.R.Aryasri, DharanikotaSuyodhana, "Professional Ethics and Morals", Maruthi Publications.
3. Deborah E.Bouchoux: "Intellectual Property". Cengagelearning , NewDelhi, BS Publications (Press)
4. PrabhuddhaGanguli: ' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi
5. A.Alavudeen, R.KalilRahman and M.Jayakumaran, "Professional Ethics and Human Values", Laxmi Publications.

Reference Books

1. Harris, "Engineering Ethics", Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
2. Richard Stim, "Intellectual Property", Cengage Learning, New Delhi.
3. R. Radha Krishnan and S. Bala subramanian "Intellectual Property Rights", Excel Books. New Delhi.

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E01: ESTIMATION, SPECIFICATIONS AND CONTRACTS				

COURSE OUTCOMES:

Students are able to

1. Determine the quantities of different components of buildings. (K3)
2. Find the cost of various building components. (K3)
3. Determine the quantities of earthwork and prepare bar bending schedule.(K3)
4. Finalize the contract, specifications and value of structures. (K3)
5. Prepare detailed estimation of buildings. (K3)

SYLLABUS

UNIT – I

General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT – II

Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT-III

Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT – IV

Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings-Standard specifications for different items of building construction.

UNIT-V

Detailed Estimation of Buildings using individual wall method and centre line method.

Text Books

1. Rajiv Gupta , 'Construction Planning and Technology', CBS Publishers & Distributors Pvt. Ltd. New Delhi, 2014.
2. B. S. Patil 'Civil Engineering Contracts and Estimates', Universities Press (India) Pvt. Ltd., Hyd, 2010.
3. B.N. Dutta , 'Estimating and Costing', UBS publishers, 2000.

Reference Books

1. M. Chakraborthi , 'Estimation, Costing and Specifications', Laxmi publications, 2018.
2. G.S. Birdie , 'Estimating and Costing, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
3. 'Standard Schedule of rates and standard data book' by public works department.
4. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works – B.I.S.)
5. National Building Code.

E-Resources

https://nptel.ac.in/courses/105103093

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E02: ROCK MECHANICS				

ELECTIVE-III

COURSE OUTCOMES:

Students are able to

1. Describe the importance of in the field of mining. (K2)
2. Identify the physical and mechanical properties of rocks. (K2)
3. Able to calculate the stress and strain in rocks and rock mass. (K2)
4. Understand the time dependent behavior by rheological models. (K2)
5. Determine elastic constants of rocks. (k3)

SYLLABUS

UNIT-I

INTRODUCTION: Definition, Importance, History of Rock Mechanics,Distribution of rocks – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks,Palaeozoick Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps,Steriographic presentation of Geological data – Representation and plottingline and plane.

UNIT-II

LABORATORY TESTS ON ROCKS: Tests for Physical Properties,Compressive strength, Tensile strength, Direct shear, Triaxial Shear, SlakeDurability, Schmidt Rebound Hardness, Sound Velocity, Swelling Pressure& Free Swell, Void Index

UNIT-III

STRENGTH, MODULUS AND STRESS STRAIN BEHAVIOUR OF ROCKS: Factors influencing rock behaviour, Strength criteria for Isotropic IntactRocks, Modulus of Isotropic Intact Rocks, Compressive strength andmodulus from SPT, Stress Strain models – Elastic model, Elasto plasticmodel, Visco elastic model.

UNIT-IV

ENGINEERING CLASSIFICATION OF ROCK AND ROCK MASS

RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMRSand RSR System. Classification based on strength and modulus, Clasificationbased on strength and failure strain, rock discontinuity qualitativedescription, friction in rocks – Amonton's law of friction.

UNIT-V

FIELD TESTS ON ROCKS AND ROCK MASS: Geophysical methodsSeismc Refraction method, Electrical Resistivity method, Deformability tests– Plate Jack Test, Goodman Jack Test, Field shear test - Field PermeabilityTest – Open end Test, Packers Test.

Text Books

1. T Ramamurthy, Engineering in rocks, PHI learning, 3rd edition, 2014.
2. Jeremic, K.L. Jeremic, Rotterdam, Balkema , Strata Mechanics in Coal Mining, 1985.
3. CsabaAsszonyi , Continuum Theory of rock Mechanics, Transtech Publications, 1979.
4. Jager & Cook, Methuen andco , Fundamentals of Rock Mechanics. London, 1969.

Reference Books

1. M.L. Jeremic , Ground Mechanics in Hard rock Mining, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2015.
2. Brady and Brown , Rock Mechanics for Underground Mining, Kluwer Academic Publlishers, 2nd edition, 1993
3. Richard E Goodman, Introduction to rock mechanics, Wiley publications, 2nd edition, 1988.
4. Charles Jaeger , Mechanics and Engineering, Cambridge University Press, 1979.
5. R.D. Lama, V.S.Vutukuri, , Hand Book on Mechanical Properties of rocks Vol. I to IV, Transtech Publications, 1978.

E-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105212/

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E03: TRAFFIC ENGINEERING				

ELECTIVE-III

COURSE OUTCOMES:

Students are able to

1. Understand the human factors and vehicular factors in traffic engineering design. (K2)
2. Conduct different types of traffic surveys and analysis of collected data using statistical concepts. (K2)
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis. (k2)
4. Understand the basic knowledge of Intelligent Transportation System. (K2)

SYLLABUS

UNIT-I

Traffic Planning and Characteristics:

Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.

UNIT-II

Traffic Surveys:

Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.

UNIT-III

Traffic Design and Visual Aids:

Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle track.

UNIT-IV

Traffic Safety and Environment:

Road accidents, Causes, effect, prevention, and cost, road safety audit, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.

UNIT-V

Traffic Management:

Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.

Text Books

1. R. Srinivas Kumar, Introduction to Traffic Engineering, University Press 2018.
2. S K Khanna and CEG Justo and A Veeraragavan, “Highway Engineering”, Nem Chand and Bros., 2018.
3. Kadiyali.L.R. “Traffic Engineering and Transport Planning ”, Khanna Publishers, Delhi, 2013.
4. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management, 2015.

Reference Books

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
5. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994

IS Code book

1. **IRC**: **SP**:**88-2010**. Manual on Road Safety Audit published by Indian Roads Congress.

E-resources

1. https://nptel.ac.in/courses/105101008

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E04: GROUND WATER MANAGEMENT				

ELECTIVE-III

Course Outcomes:

Students are able to

1. Estimate aquifer parameters and well hydraulics. (K2)
2. Design wells and understand the construction practices.(K3)
3. Determine the process of artificial recharge for increasing groundwater potential. (K3)
4. Interpret geophysical exploration data for scientific source finding of aquifers. (K3)
5. Apply appropriate measures for groundwater management. (K3)

SYLLUBUS

UNIT–I: Introduction

Groundwater in the hydrologic cycle, groundwater occurrence, aquifer parameters and their determination, general groundwater flow equation.

Well Hydraulics: Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

UNIT-II: Well Design

Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery.

Well Construction and Development

Water wells, drilling methods-rotary drilling, percussion drilling, well construction installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT-III: Artificial Recharge:

Concepts of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge. Saline Water Intrusion Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.

UNIT–IV: Geophysics: Surface methods of exploration of groundwater - Electrical resistivity and Seismic refraction methods, Sub-surface methods - Geophysical logging and resistivity logging. Aerial Photogrammetry applications.

UNIT–V: Groundwater Modeling and Management:

Basic principles of groundwater modeling- Analog models viscous fluid models and membrane models, digital models-Finite difference and finite element models, Concepts of groundwater management, basin management by conjunctive use case studies.

Text books

1. Todd D.K., 'Groundwater Hydrology', Wiley India Pvt Ltd., 2014.
2. Raghunath H M , 'Groundwater', New Age International Publishers, 2005.
3. Todd D K and L W Mays , 'Groundwater Hydrology, CBS Publications, 2005.

References books

1. Willis R and W.W.G. Yeh , 'Groundwater Systems Planning and Management', Prentice Hall Inc., 1986
2. Bouwer H, 'Groundwater Hydrology', McGraw Hill Book Company, 1978.
3. Walton W C 'Groundwater Resources Evaluation', Mc Graw Hill Book Company, 1978.

E-Resources

1. https://nptel.ac.in/courses/105103026

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E05: ENVIRONMENTAL IMPACT ASSESSMENT & MANAGEMENT				

ELECTIVE-III

Course Outcomes:

Students are able to

1. Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project. (K2)
2. Select an appropriate EIA methodology. (K2)
3. Evaluate impacts on environment.(K2)
4. Evaluate risk assessment. (K2)
5. Understand the latest acts and guidelines of MoEF & CC. (K2)

SYLLUBUS

UNIT-I: Basic concepts of EIA:

Elements of EIA-factors affecting EIA-Initial environmental Examination- life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities- application of remote sensing and GIS for EIA.

UNIT-II: EIA Methodologies:

Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods.

Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area.

UNIT-III Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Generalized approach for assessment of Air pollution Impact.

UNIT-IV: Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation.

Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V EIA: MoEF &CC Acts, Notifications and Guidelines:

Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books

1. Y. Anjaneyulu , Environmental Impact Assessment Methodologies, B. S. Publication, Sultan Bazar, Hyderabad, 2018.
2. Canter Larry W , Environmental Impact Assessment, McGraw-Hill education Edi, 1996.

References Books

1. H. S. Bhatia , Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi, 2016.
2. J. Glynn and Gary W. Hein Ke , Environmental Science and Engineering,– Prentice Hall Publishers, 2015.
3. Suresh K. Dhaneja , Environmental Science and Engineering, S. K. Katania& Sons Publication., New Delhi, 2014.

E-Resources

1. https://nptel.ac.in/courses/120108004

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E06: ADVANCED STRUCTURAL DESIGN				

ELECTIVE-IV

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

1. Design Retaining walls and detailing. (K3)
2. Design Circular and Rectangular water tanks. (K3)
3. Design flat slabs, Raft and Pile foundations. (K3)
4. Design Concrete Bridges. (k3)
5. Design Chimneys, Bunkers & Silos. (K3)

SYLLABUS

UNIT-I

Design and Detailing of cantilever type of Retaining walls – Stability Check. Principles of Counterfort Retaining walls and shelf type retaining walls.

UNIT-II

Design of Circular and Rectangular Water tanks at Ground level and elevated with staging.

UNIT-III

Design of Flat slabs- Design of Raft and pile foundations.

UNIT-IV

Design of Concrete Bridges – IRC loading Design of Stab bridge, T-beam girder bridge. Introduction to Steel bridges.

UNIT-V

Design of RCC Chimneys Bunkers & Silos.

Text Books

1. Varghese, Advanced Reinforced Concrete Structures, Pranties Hall of India Pvt. Ltd., 2015.
2. S Ponnuswamy , Bridge Engineering, Mc Graw Hill Co, 2013.
3. S.A. Pillai and D. Menon , Reinforced Concrete Design, Tata Mc. Ghrawhill Publishing Company, 2007.

References Books

1. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain , Reinforced Concrete Structures Vol. 2, Laxmi, Publications Pvt. Ltd., New Delhi, 2018.
2. Krishna Raju., Advanced Reinforced Concrete Structures, CBS Publishers and Distributors Pvt Ltd, 3rd Edition, 2016.
3. D. John Son Victor, Essentials of Bridge Engineering, Oxford and IBM Publication Co., Pvt. Ltd, 2015.

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E07: GROUND IMPROVEMENT TECHNIQUES				

ELECTIVE-IV

Course Outcomes:

Students are able to

1. Explain various methods of ground improvement and their suitability to different field situations.[K2]
2. Describe the dewatering techniques of ground improvement. [K2]
3. Express different methods of soil stabilization. [K2]
4. Know the design principles of reinforced earth embankment and check its stability. [K2]
5. Discuss various functions of Geosynthetics and their applications in Civil Engineering practice and applications of grouting. [K2]

SYLLABUS

UNIT- I

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth - in situ densification of cohesive soils – preloading – pre fabricated vertical drains– sand drains and stone columns, deep compaction.

UNIT -II

Dewatering - sumps and interceptor ditches - single and multi stage well points – vacuum well points - horizontal wells - criteria for choice of filler material around drains – electro osmosis.

UNIT- III

Stabilization of soils - methods of soil stabilization - mechanical - cement - lime - bitumen and polymer stabilization - use of industrial wastes like fly ash and granulated blast furnace slag.

UNIT- IV

Reinforce earth - principles - components of reinforced earth – design principles of reinforced earth walls - stability checks - soil nailing.

UNIT- V

Geosynthetics – geo textiles - types - functions, properties and applications - geogrids, geo membranes and gabions - properties and applications.

Grouting - objectives of grouting - grouts and their applications - methods of grouting – stage of grouting - hydraulic fracturing in soils and rocks - post grout tests.

Text Books

1. Jie Han, Principles and practice of ground improvement, Wiley publications, 1st edition, 2015.
2. Purushotham Raj ‘Ground Improvement Techniques’, Laxmi Publications, New Delhi, 2018.
3. Nihar Ranjan Patro , ‘Ground Improvement Techniques’ , Vikas Publishing House (P) Limited, New Delhi, 2015.

References Books

1. G.L.Siva Kumar Babu , ‘An introduction to Soil Reinforcement and Geosynthetics’, Universities Press, 2000.
2. Shukla. S. K , “Handbook of Geosynthetic Engineering”. ICE Publishing, London, UK, 2012.
3. MP Moseley , ‘Ground Improvement’ , Blackie Academic and Professional, USA, 2013.
4. RM Koerner , ‘Designing with Geosynethetics’, Prentice Hall, 2002.

E-Resorces

1. https://nptel.ac.in/courses/105108075

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E08: PAVEMENT ANALYSIS AND DESIGN				

ELECTIVE-IV

Course Outcomes:

Students are able to

1. Design flexible and rigid pavements using various methods. (K3)
2. Design shoulders, overlays and drainage. (K3)
3. Develop several designs of pavement structures. (K3)
4. Analyze traffic and geotechnical data from real-life projects. (K3)
5. Gain experience in calculating pavement response using state-of-the-art mechanistic Software. (K2)

SYLLABUS:

UNIT-I

Factors Affecting Pavement Design: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane, Directional Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT-II

Stresses In Pavements: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements;

Stress in Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts;

Stresses in Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, Stresses in Dowel Bars & Tie Bars, Introduction to DAMA, KENLAYER & KENSLABS Programs.

UNIT-III

Material Characterization & Mix Design Concepts: CBR and Modulus of Subgrade Reaction of Soil, Mineral aggregates - Blending of aggregates, binders, polymer and rubber modified bitumen, Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilisation and Use of nthetics; Marshall's Bituminous Concrete Mix Design, Field Implications of Stability and Flow Values.

UNIT-IV

Design of Flexible Pavements: Flexible Pavement Design Concepts, Asphalt Institute's Methods with HMA and other Base Combinations, AASHTO, Road Note No 29 & IRC Methods, Design of Runways & Taxiways, Design of Low Volume Rural Roads.

Design of Rigid Pavements: Calibrated Mechanistic Design Process, PCA, AASHTO & IRC Specifications, Introduction to Pre stressed and Continuously Reinforced Cement Concrete Pavement Design, Rigid Pavement Design for Low Volume Rural Roads.

UNIT-V

Design of Shoulders, Overlays & Drainage: Shoulder Design Considerations, Traffic Prediction, Parking, Regular & Encroaching Traffic, Thickness Design Specifications for Flexible & Rigid Shoulders;

Types & Design of Overlays: AI's Principal Component Analysis & IRC Methods of Overlay Design, Importance of Profile Correction Course; Pavement Drainage Concepts, Drainage Related Failures, Inflow- Outflow Concepts, Condition of Continuity, Surface and Sub Surface Drainage Design Specifications.

Text/References Books:

1. Srinivasa Kumar R , 'Principles of Pavement Design', 'Pavement Design' by, Universities Press, Hyderabad, 2019.
2. Yang H. Huang , 'Pavement Analysis and Design', Pearson Education, Second Edition.. 2003.

References Books

1. Micheal Sargious , 'Pavement and Surfacings for Highway & Airports', Applied Science Publishers Limited, 2016.
2. G. Martineek, Chapmen & Hall Inc.'Dynamics of Pavement Structures', 2012.
3. Patha Chakroborty and Animesh Das , 'Principles of Transportation Engineering', PHI Learning Private Limited, Delhi, 2010.
4. AF Stock , 'Concrete Pavements', Elsevier, Applied Science Publishers, 2009.
5. Nai C. Yang , 'Design of Functional Pavements', McGraw Hill Publications, 2005.

E-Resources

1. https://nptel.ac.in/courses/105104098

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E09: HYDROPOWER ENGINEERING				

ELECTIVE-IV

Course Outcomes:

Students are able to

1. Know sources and forms of energy. (K2)
2. Understand hydropower plant and its components. (K2)
3. Identify Flow of water through penstock. (K2)
4. Design simple surge tank. (K3)
5. Have knowledge on Hydraulic turbines and types and classification. (K2)

SYLLABUS:

UNIT-I

Introduction: Sources and forms of energy, types of power plants, elements of hydropower scheme, hydropower development in India. Power house structures-substructure and superstructure Layout and dimensions, deign considerations.

UNIT-II

Hydropower plants classification: Surface and underground power stations, Low medium-high head plants-layout and components, pumped storage plants, tidal power plants, microtydal units. Load and power studies: load curve, load factor, load duration curve, firm capacity, reservoir capacity, capacity factor

UNIT-III

Penstocks and power canals: Classification of penstocks, Design of Penstocks, economic diameter, bends, anchor blocks, surges in canals design criteria of power canals. Intake structures: Location function and types of intakes, energy losses at intake trash rock, design of intakes

UNIT-IV

Water hammer and surge tanks: Rigid and elastic water column theories, water hammer pressure. Behavior of surge tanks, types of surge tanks, hydraulic design, design of simple surge tank-stability

UNIT-V

Hydraulic turbines and types and classification, constructional features, hydraulic analysis, selection, characteristic curves, governing of turbine, drafts tubes-types, hydraulic principles, and design. Gates and valves- types. Design of air vent

Text Books

1. M.M.Desmukh , Water Power Engineering, Dhanpat rai and Sons, 2018.
2. R.S.Varshiray , Hydropower structures, Nem Chand and Bros. Roorkee, 2015.

References Books

1. Creagar, W.P. and Justin, J.D., Hydroelectric hand book:, John Wiley & Sons, New York, 2013.
2. M.M. Dnadeker and K.L.Sharma , Water Power Engineering:, Vikas Publishing house, 2012.
3. Zipparro, V. J. and Hasen H Davis , Handbook of applied hydraulics, Mc-Graw Hill, Inc., New York, 2002.

E-Resources

1. https://nptel.ac.in/courses/112107291

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E10: WASTE WATER ENGINEERING AND MANAGEMENT				

ELECTIVE-IV

Course Outcomes:

Students are able to

1. Estimate sewage generation and design sewer system including sewage pumping stations. (K2)
2. Understand on the characteristics and composition of sewage, self-purification of streams. (K2)
3. Perform basic design of the unit operations and processes that are used in sewage treatment.(K2)
4. Acquire the standard methods for disposal of sewage. (K2)
5. Gain knowledge on sludge treatment and disposal. (K2)

SYLLUBUS

UNIT-I: PLANNING AND DESIGN OF SEWERAGE SYSTEM

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping-drainage in buildings-plumbing systems for drainage - Rain Water ting.

UNIT-II: PRIMARY TREATMENT OF SEWAGE

Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank-Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks –Construction, Operation and Maintenance aspects.

UNIT-III: SECONDARY TREATMENT OF SEWAGE

Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds – - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

UNIT-IV: DISPOSAL OF SEWAGE

Standards for Disposal - Methods – dilution – Mass balance principle - Self purification of river-Oxygen sag curve – deoxygenation and reaeration - Streeter–Phelps model - Land disposal –Sewage farming – sodium hazards - Soil dispersion system.

UNIT-V: SLUDGE TREATMENT AND DISPOSAL

Sludge characterization – Thickening - Design of gravity thickener- Sludge digestion – Standard rate and High rate digester design- Biogas recovery – Sludge Conditioning and Dewatering – Sludge drying beds- ultimate residue disposal.

Text/ Reference books:

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

Reference books

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim “Wastewater Treatment Plants”, CRC Press, Washington D.C.,20104. Gray N.F, “Water Technology”, Elsevier India Pvt. Ltd., New Delhi, 2006.

E-Resources

1. https://nptel.ac.in/courses/105105048

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E11: PRESTRESSED CONCRETE				

ELECTIVE-V

COURSE OUTCOMES:

Students are able to

1. Discriminate the different methods of pre stressing. (K2)
2. Generalize &Equip student with different systems and devices used in prestressing. (K2)
3. Estimate the effective pre stress including the short and long term losses. (K2)
4. Analyze and design of pre stressed concrete beams under flexure. (K3)
5. Develop and Familiarize students with the analysis and design of prestressed concrete members under shear and torsion. (K3)

SYLLABUS

UNIT – I

Introduction-Historic development -Basic concepts of Prestressing- Advantages –limitations and Applications of Prestressed Concretes, High Strength Concrete- Permissible Stresses, Shrinkage, Creep, Deformation Characteristics, High strength Steel- Types, Strength- Permissible Stresses- Relaxation of Stress, Stress Corrosion- Durability, Fire Resistance, Cover Requirements.

Prestressing Systems- Introduction, Tensioning devices, Pre-tensioning Systems, Post tensioning Systems, Basic Assumptions in Analysis of prestress and design, Analysis of prestress, Resultant Stresses at a section-pressure line- Concepts of load balancing- Stresses in Tendons, Cracking moment.

UNIT-II

Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes -Elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage, differential shrinkage- bending of members and frictional losses-Total losses allowed for design.

UNIT-III

Design for Flexural resistance- Types of flexural failure – Code procedures- Design of sections for flexure- Control of deflections- Factors influencing- Prediction of short term and long term deflections.

UNIT-IV

Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear reinforcements- Codal Provisions- Design for Torsion, Design for Combined bending, shear and torsion.

UNIT-V

Transfer of Prestress in pre tensioned members- Transmission length- Bond stresses- end zone reinforcement- Codal provisions- Anchorage zone Stresses in Post tensioned members- Stress distribution in end block- Anchorage Zone reinforcement.

Text Books

1. N. Krishna Raju, 'Prestressed Concrete', 6th Edition, Tata McGraw hill, 2018.
2. S. Ramamrutham 'Prestressed Concrete' 5th Edition, Dhanpat Rai Publishing Company, 2013.

Reference Books

1. P. Dayaratnam 'Prestressed Concrete', 5th Edition, Medtech Publishers, 2017.
2. T. Y. Lin & Burns 'Prestressed Concrete', 3rd , Wiley India Private Limited, 2010.

E-Resources

1. https://nptel.ac.in/courses/105106117

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E12: SOIL DYNAMICS AND MACHINE FOUNDATIONS				

ELECTIVE-V

Course Outcomes:

Students are able to

1. Define theory of vibrations to find the behavior of soil under dynamic loading. (K2)
2. Design machine foundations under different loads and soil conditions. (K2)
3. Describe the liquefaction phenomena. (K3)
4. Perform various laboratory and filed tests to determine the dynamic soil Properities and its interpretation. (K3)
5. Design vibration isolators under any vibratory machines. (K3)

SYLLABUS

UNIT-I

Introduction: Types of motion- SHM- Fundamental definitions- SDOF systems- Free and forced vibration with and without damping - Constant force and rotating mass type excitation -Types of damping-Equivalent stiffness of springs in series and parallel. - Resonance and its effect - magnification-logarithmic decrement -Transmissibility.

UNIT-II

Theories of Vibration Analysis- EHS Theory and lumped parameter model- Different modes of vibration- Natural frequency of foundation soil system - Barkan and IS methods- Pressure bulb concept- Reisner Theory - Limitations of Reisner theory - Sung's solutions-- Pauw's Analogy - Heigh's Theory.

UNIT-III

Dynamic properties of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes- Stress waves in bounded elastic medium- Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests.- Block vibration test - Determination of Damping factor.

UNIT-IV

Types of machine foundations - general requirements design - criteria for machine foundations, permissible amplitudes and bearing pressure Design data, design criteria, IS code provisions for the design foundations of reciprocating machines.

UNIT-V

Design data, design criteria, IS code provisions for the design foundations of Impact type of machines. Vibration Isolation: Transmissibility, Principles of isolation- Methods of isolation- Vibration isolators- Types and their characterizes Special Topics: Liquefaction of soils, CSR, CRR, Factor of safety against liquefaction - Dynamic bearing capacity, Earth retaining structures under dynamic loads.

Text Books

1. NSV KameswaraRao , 'Vibration Analysis and Foundation Dynamics, Wheeler Publishing, NewDelhi, 2015.
2. B M Das, 'Fundamentals of Soil Dynamics', Cengage learning, 2nd edition, 2011.
3. Richart Hall and Woods , Vibrations of Soils and Foundations, Printice Hall publications, 2010.

Reference Books

1. Prakash andPuri , 'Foundations of Machines- Analysis and Design', 2015.
2. D D Barkar. 'Dynamics of bases and Foundations', 2008.
3. P J Moore , 'Analysis and design of Foundations for Vibrations', 2000.

E-Resources

1. https://nptel.ac.in/courses/105101005

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E13: URBAN TRANSPORTATION AND PLANNING				

ELECTIVE-V

Course Outcomes:

Students are able to

1. Estimate travel demand for an urban area. (K2)
2. Design the transportation network for a city. (K3)
3. Identify the corridor and plan for providing good transportation facilities. (K3)
4. Evaluate various alternative transportation proposals. (K3)
5. Evaluate traffic assignment in a town and develop Corridor identification. (K3)

SYLLABUS

UNIT -I

Urban Transportation Problems & Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand –Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT -II

Data Collection And Inventories: Collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment –Vehicle Owner Ship.

UNIT -III

Trip Generation & Distribution: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT -IV

Mode Choice Analysis: Mode Choice behavior, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation

UNIT -V

Traffic Assignment: Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, mCapacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

Corridor Identification, Plan Preparation & Evaluation: Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies

Text Books

1. Kadiyali.L.R , 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi, 2017.
2. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill, 2015.
3. Papacostas , 'Fundamentals of Transportation Planning', Tata McGraw Hill, 2010.

Reference Books

1. Bruton M.J , 'Introduction to Transportation Planning', Hutchinson of London, 2013.
2. Khisty C.J.,'Transportation Engineering - An Introduction', Prentice Hall, 2012.
3. Mayer M and Miller E , 'Urban Transportation Planning: A decision oriented Approach', Mc Graw Hill, 2000.
4. Hutchinson, B.G , 'Introduction to Urban System Planning', McGraw Hill, 2000.

E-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105208/

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E14: WATERSHED MANAGEMENT				

ELECTIVE-V

Course Outcomes:

Students are able to

1. Calculate watershed parameters and analyze watershed characteristics to take appropriate management action. (K2)
2. Quantify soil erosion and design control measures. (K2)
3. Apply land grading techniques for proper land management. (K3)
4. Suggest suitable harvesting techniques for better watershed management. (K2)
5. Apply appropriate models for watershed management. (K3)

SYLLUBUS

UNIT-I: Introduction:

Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics.

UNIT-II: Principles of Erosion:

Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT-III: Water Harvesting:

Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT-IV: Land Management:

Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

UNIT-V: Watershed Modeling:

Data of watershed for modeling, application and comparison of watershed models, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

Text books

1. Das MM and M.D Saikia , ‘Watershed Management’, PHI Learning Pvt. Ltd, 2013.
2. Murthy.VVN , ‘Land and Water Management’, Kalyani Publications, 2007.

References books

1. Murthy J V S , ‘Watershed Management’, New Age International Publishers, 2006.
2. Wurbs R A and James R A ‘Water Resource Engineering’, Prentice Hall Publishers, 2002.
3. Black P E , ‘Watershed Hydrology’, Prentice Hall, 1996.

E-Resources

1. https://archive.nptel.ac.in/courses/105/101/105101010/

VII SEMESTER	L	T	P	C
	3	-	-	3
20CE7E15: FAECAL SLUDGE AND SEPTAGE MANAGEMENT				

ELECTIVE-V

Course Outcomes:

Students are able to

1. Understand the importance of an integrated approach for faecal sludge management. (K2)
2. Know the existing FS treatment technologies, their advantages, constraints and field of application. (K2)
3. List the social, procedural, technical aspects related to the collection and transport of faecal sludge from onsite sanitation technologies. (K2)
4. Design selected technologies and know the operation, maintenance and monitoring necessary to achieve desired treatment goals. (K3)
5. Indicate how regulations, contracts, stakeholders' roles and a proper institutional framework are essential for an effective faecal sludge management. (K3)

SYLLUBUS

UNIT-1: Introduction to faecal sludge management

Overview of faecal sludge- the importance of an integrated approach to faecal sludge management -The Global Situation- Designing for faecal sludge management treatment- end use.

UNIT-II: Technological fundaments of FSM

Faecal Sludge Quantification- Characterization, Operational factors- Treatment Objectives- Sampling procedures.

UNIT-III: Collection and transport of faecal sludge

Duties and responsibilities of collection personals- mechanical collection- Transport of faecal sludge- Manual, Motorised transport- transfer station -Delivering to the treatment plant.

UNIT-IV: Faecal sludge treatment technologies

Overview of treatment technologies- Anaerobic digestion- Settling and Thickening Tanks- Drying beds - Co-treatment of Faecal Sludge – End use of treatment product.

UNIT-V: Management in faecal sludge

Operation, Maintenance and Monitoring of Faecal Sludge Treatment Plant - Institutional Frameworks for Faecal Sludge Management - Financial Transfers and Responsibility in Faecal Sludge Management Chains

Text Books

1. V.Srinivas Chary, G Bala Subramanyam- Dr Y.Malini Reddy, Mayank Gupta, G.V.L.N.Murthy, Dr M.S.V.K.V.Prasad, A.Venkata Krishna, Faecal Sludge and Septage Management- - Administrative Staff College of India-Hyderabad-2019.
2. Linda Strande, Mariska Ronteltap & Damir Brdjanovic , Faecal Sludge Management- IWA Publishing- London-UK-2014.

References Books

1. Kevin Tayler , Faecal Sludge and Septage Treatment- Practical Action Publishing Warwickshire-2018.
2. Linda Strande, Mariska Ronteltap, Damir Brdjanovic , Faecal Sludge Management – Systems Approach for Implementation and Operation- - IWA Publishing-Volume:13- July 2014.

E-Resources

1. https://www.slideshare.net/ircuser/overview-of-faecal-sludge-management-challenges-and-practices
2. https://www.youtube.com/watch?app=desktop&v=f7tPPMhL0I0&feature=youtu.be

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CE7O01 :: SOLID WASTE MANAGEMENT				

Course Outcomes:

Students are able to

1. Recall classification of solid waste generated.
2. Know the collection systems of solid waste of a town.
3. Analyze the importance of transfer and transport of solid waste.
4. Apply the knowledge in processing of solid waste.
5. Design treatment of municipal solid waste and landfill.

SYLLUBUS:

UNIT- I

Introduction to Solid Waste Management:

Goals and objectives of solid waste management, Classification of Solid Waste – Factors Influencing generation of solid waste - sampling and characterization – Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT- II

Collection of Solid Waste:

Type and methods of waste collection systems, analysis of collection system optimization of collection routes– alternative techniques for collection system.

UNIT- III

Transfer and Transport:

Need for transfer operation, compaction of solid waste - transport means and methods, transfer station types and design requirements.

UNIT- IV

Processing and Treatment:

Processing of solid waste – Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT- V

Disposal of Solid Waste:

Methods of Disposal, Landfills: Site selection, design and operation, drainage and leachate collection systems –designated waste landfill remediation.

Text/ Reference books:

1. George Techobanoglous, Frank Kreith , Integrated Solid Waste Management- McGraw Hill Publication, 1993.
2. R.Saravanan, R.Dinesh Kumar, A.Suriya , Muncipal solid waste management, Lakshmi publications- 2015.
3. Vesilind, P.A., Worrell, W., Reinhart, D.,“Solid Waste Engineering”, Cenage learning, New Delhi, 2004.

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20CE7O02 :: BUILDING PLANNING AND DRAWING				

COURSE OUTCOMES

Students are able to

1. Understand the building bye-laws, plan various buildings as per the building by-laws.
2. Plan the individual rooms with reference to functional and furniture requirements.
3. prepare different sign conventions and bonds
4. Learn the skills of drawing building elements like doors and windows.
5. Develop the skills of Drawing Plans, Sections and Elevations of different buildings.

SYLLABUS:

UNIT-I

BUILDING BYELAWS AND REGULATIONS: Introduction - terminology - objectives of building Bye laws - floor area ratio - floor space index - principles under laying building bye laws - classification of buildings - open space requirements - built up area limitations- height of buildings- wall thickness - lightening and ventilation requirements.

UNIT -II

RESIDENTIAL AND PUBLIC BUILDINGS

Residential buildings: Minimum standards for various parts of buildings -requirements of different rooms and their grouping- characteristics of various types residential buildings.

Public buildings: Planning of educational institutions, hospitals, dispensaries, office buildings, banks, industrial buildings, hotels & motels, buildings for recreation.

UNIT-III

SIGN CONVENTIONS AND BONDS : Brick, stone, plaster, sand filling, concrete, glass, steel, cast iron, copper alloys, aluminum alloys etc., lead, zinc, tin etc., earth, rock, timber and marbles. English bond and Flemish bond- odd and even courses for one, one-half, two and two & half brick walls in thickness at the junction of a corner.

UNIT- IV

DOORS, WINDOWS, VENTILATORS AND ROOFS: Panelled door, panelled and glassed door, glassed windows, paneled windows, swing ventilators, fixed ventilators, coupled roof, collar roofs. King Post truss, Queen Post truss Sloped and flat roof buildings: drawing plans, Elevations and Cross Sections of given sloped roof buildings.

UNIT-V

PLANNING AND DESIGNING OF BUILDINGS: Draw the Plan, Elevation and sections of a Residential & Public buildings from the given line diagram.

TEXT /REFERENCE BOOKS:

1. Y.S. Sane., Planning and Design of buildings, 2010.
2. Gurucharan Singh and Jagadish Singh , Planning, designing and scheduling, 2015.
3. M. Chakravarthi., Building planning and drawing, 2015.
4. ‘A’ Series & ‘B’ Series of JNTU Engineering College, Anantapur.
5. Shah and Kale , Building drawing, 2013.

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20EE7O01 :: ENERGY AUDITING, CONSERVATION AND MANAGEMENT				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1	:	Understand the principles of energy audit
CO2	:	Explain the role of Energy Manager and Energy Management program.
CO3	:	Design a energy efficient motors and good lighting system
CO4	:	Evaluate the methods to improve the power factor
CO5	:	Estimate the computational techniques with regard to economic aspects.

SYLLABUS

UNIT-I	**:**	**PRINCIPLES OF ENERGY AUDIT**
Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts – Sankey diagrams and load profiles - Energy conservation schemes and energy saving potential - Energy audit of industries- energy saving potential - energy audit of process industry - thermal power station - building energy audit– Numerical problems.		
UNIT-II	**:**	**ENERGY MANAGEMENT**
Principles of energy management - organizing energy management program - initiating – planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions – language - Questionnaire – check list for top management.		
UNIT-III	**:**	**ENERGY EFFICIENT MOTORS AND LIGHTING**
Energy Efficient Motors: Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. **Lighting :** lighting system design and practice - lighting control - lighting energy audit.		
UNIT-IV	**:**	**POWER FACTOR IMPROVEMENT AND ENERGY INSTRUMENTS**
Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.		
UNIT-V	**:**	**ECONOMIC ASPECTS AND COMPUTATION**
ECONOMIC ASPECTS: Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis. **COMPUTATION ASPECTS:** Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.		

TEXT BOOKS:

1. Energy management by W.R.Murphy & G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

REFERENCE BOOKS:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition – 1995.
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition – 1998.

Energy management and good lighting practice : fuel efficiency- booklet12

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20EC7O01 :: INTRODUCTION TO GLOBAL POSITIONING SYSTEMS				

COURSE OUTCOMES:

After completion of this course, the students are able to,

CO1: Describe global navigation satellite systems (K1)
CO2: Understand GNSS Satellite signal characteristics (K2)
CO3: Develop GNSS Receiver (K3)
CO4: Analyze the impact of various error sources on the precision of positioning. (K4)

UNIT I : FUNDAMENTALS OF SATELLITE NAVIGATION:
Concept of Ranging using Time of arrival Measurements: Two-Dimensional Position Determination, Principle of Position Determination via Satellite-Generated Ranging signals, Fundamentals of satellite orbits: Orbital Mechanics, Constellation Design, Positioning determination using Ranging codes: Determining Satellite-to-User Range, Indian Developed GNSS- Indian Regional Navigation Satellite System (IRNSS) : NavIC and its applications, GPS-Aided Geo-Augmented Navigation (GAGAN)

UNIT II : GLOBAL POSITIONING SYSTEM SEGMENTS:
Space Segment Description: GPS Satellite Constellation Description, Constellation Design Guidelines, Space Segment Phased Development, Control Segment: Current Configuration, CS Planned Upgrades , User Segment: GPS Set Characteristics, GPS Receiver Selection

UNIT-III : GPS SATELLITE SIGNAL CHARACTERISTICS:
Modulations for Satellite Navigation: Modulation Types, Multiplexing Techniques, Signal Models and Characteristics, Legacy GPS Signals: Frequencies and Modulation Format, Power Levels, Autocorrelation Functions and Power Spectral Densities, Cross-Correlation Functions and CDMA Performance, Navigation Message Format.

UNIT-IV : GNSS RECEIVER:
Acquisition: Single Trial Detector, Tong Search Detector, M of N Search Detector, Combined Tong and M of N Search Detectors, FFT-Based Techniques, Direct Acquisition of GPS Military Signals, Vernier Doppler and Peak Code Search, carrier tracking, code tracking: Carrier Loop Discriminator, sequence of initial receiver operation.

UNIT-V: GNSS ERRORS: Introduction, Measurement errors: satellite clock error, ephemeris error, relative effects, atmospheric effects, receiver noise and resolution, multipath and shadowing effects, hardware bias errors, Pseudo range error budgets.

TEXTBOOKS:

1. Elliott D. Kaplan, Christopher J. Hegarty, Understanding **GPS/GNSS** principles and applications, third edition, artech house publishers, Boston, 2017
2. G S Rao, Global Navigational satellite system, Tata McGraw-Hill education private Ltd, New Delhi, 2015.

REFERENCES:

1. ISRO-IRNSS-ICD-SPS-1.1, Bangalore, 2017
2. Bhatta, B. ". Global Navigation Satellite Systems: Insights Into GPS, Glonass, Galileo, Compass, and Others", BS Publications, New Delhi, 2015.

E-REFERENCES:

1. https://archive.nptel.ac.in/courses/105/107/105107194/
2. https://d1.amobbs.com/bbs_upload782111/files_33/ourdev_584835O21W59.pdf

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20BM7O01 :: INDUSTRIAL SOCIOLOGY AND PSYCHOLOGY				

UNIT I: Industrial Sociology: Nature and Scope of Industrial Sociology-Development of Industrial Sociology, Factors of social change – the technological factors, the cultural factors, effects of technology on major social institutions, social relations in industry.

UNIT II: Group Dynamics: Concept- factors influencing individual behaviour- Work Teams & Groups, Group Behavior, Group formation & development, Decision Making by Individuals, Groups Decision making process-techniques.

UNIT III: Industrial Psychology: Nature and Meaning of Industrial Psychology, Role of Industrial Psychology, Organizational Attitude, Motivation at work-Theories of Motivation (Theory X and Y, McClelland's Theory, Maslow's Need Theory, Herzberg's Two Factor Theory), Cultural Differences in Motivation.

UNIT IV: Organizational Design and Leadership: Organizational Design & Structure- organizational design- process, Structural differentiations, factors influencing design of organizations, Leadership-concept, types, Leadership vs. Management, Leadership Theories, Emerging issues in Leadership.

UNIT V: Organizational Conflicts and Change management: - Causes and Consequences of Conflict-Conflict handling techniques, Managing Change, Forces for change in Organization, Resistance to change.

TEXT BOOKS:

1. Nelson, Quick and Khandelwal, ORGB : An innovative approach to learning and teaching Organizational Behaviour. A South Asian Perspective, Cengage Learning, 2012
2. Luthans, Fred, Organizational Behavior, McGraw Hill, 2008.
3. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

REFERENCES BOOKS:

1. Schneider Engno V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi,2011.
2. Ivancevich, Konopaske & Maheson, Organisational Behaviour & Management, 7th edition, Tata McGraw Hill, 2008.
3. L.M.Prasad.,Organisational Behaviour, 5th Edition, Sulthan Chand & Sons.,2014

VII SEMESTER : OPEN ELECTIVE – III	L	T	P	C
	3	-	-	3
20ME7O01 :: BIO-MECHANICAL ENGINEERING				

COURSE OBJECTIVES: The main objectives of this course are

- To make the student familiar with fundamentals of bio mechanics.
- To gain knowledge about musculoskeletal system.
- To impart knowledge about linear kinetics and angular kinetics
- Make the student to illustrate the mathematical models used in the analysis of biomechanical systems

COURSE OUTCOMES: Students are able to

CO1: Explain about fundamentals of Bio mechanics. [K2]
CO2: Describe the mechanics of musculoskeletal system. [K2]
CO3: Relate the concept of kinetics with human motion. [K3]
CO4: Explain mechanical analysis of human motion. [K3]
CO5: Analyze human movements. [K4]

UNIT-I
INTRODUCTION TO BIO MECHANICS
Principles of mechanics in human movement, Qualitative and quantitative Analysis, Key mechanical concepts of mechanics and basic units, Nine fundamentals of biomechanics, Nine principles for application of Biomechanics.

UNIT-II
MECHANICS OF MUSCULOSKELETAL SYSTEM
Principles of joint motions, Muscle structures, Mechanical method of muscle action analysis, Tissue loads and forces, Biomechanics of bones and ligaments, Three mechanical characters of muscle, stretch-shortening cycle (SSC).

UNIT-III
LINEAR KINETICS AND ANGULAR KINETICS
Vector analysis of angle of pull and muscle angle pull, Contact forces, Impulse-Momentum Relationship, Force-Time Principle, Work-Energy relationship, Segmental interaction principle, Torque, Equilibrium, Center of gravity and Principle of balance.

UNIT-IV
MECHANICAL ANALYSIS OF HUMAN MOTION
Linear kinematics - linear kinematic analysis, position and displacement, velocity and speed, acceleration, differentiation and integration, kinematics of running, kinematics of projectiles, equations of constant acceleration, Angular kinematics - angular motion, measurements of angles, types of angles, representation of angular motion vectors, lower extremity joint angles, relationship between angular and linear motion, angular kinematics of running.

UNIT-V
APPLICATIONS OF MEDICAL REHABITATION
Qualitative analysis of kicking technique, batting, catching, throwing techniques, injury risk assessment, equipment design for strength training, Injury mechanics, injury prevention.

TEXT BOOKS:

1. Ronald L. Huston, Principles of Biomechanics,1st edition CRC Press, 2019
2. Joseph E. Muscolino, " Kinesology", 3rd edition, Mosby, 2016.
3. Subrata Pal, "Textbook of Biomechanics", 1st edition, Springer US, 2016.

REFERENCE BOOKS:

1. Duane Knudson, “Fundamentals of Biomechanics”, 2nd edition, Springer, 2013.
2. Ajay Bahl, “Basics of Biomechanics”, 1st edition, Jaypee Brothers Medical Publishers, 2010.
3. Robert frost, “Applied Kinesiology”, 1st edition, North Atlantic Books, 2013
4. David A. Winter, “Biomechanics and Motor Control of Human Movement”, John Wiley & sons, 2009.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/112/105/112105305/
2. https://archive.nptel.ac.in/courses/112/106/112106248/

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1						2	2	
CO2	3	2	2			1						2	2	
CO3	3	2	2			1						2	2	
CO4	3	2	2			1						2	2	
CO5	3	1	1			1						2	2	
Avg	3	1.8	1.8			1						2	2	

VII SEMESTER : OPEN ELECTIVE - III	L	T	P	C
	3	-	-	3
20CS7O01 :: FULL-STACK DEVELOPMENT				

COURSE OUTCOMES:

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

1. Design simple web pages using markup languages like HTML and CSS.
2. Create dynamic web pages using DHTML and java script that is easy to navigate and use.
3. Create web pages using AngularJS.
4. Build web applications using Servlet and JSP.
5. Understand various operations on Mongo Database.

UNIT-I: HTML and CSS

HTML: An Introduction to HTML, Basic XHTML Syntax and Semantics, Basic HTML Elements: Images, Links, Lists, Tables, Forms, Frames, Division and Spanning, HTML 5.0.

CSS: Levels of Style sheets, Style specification formats, Selector forms, CSS Colors and Backgrounds, CSS Text and Font Properties, The Box Model, CSS Margins, Padding, and Borders Conflict Resolution.

UNIT-II: Client-Side Scripting using Java Script and DOM

Java Script: The Basics of Java Script, Objects, Primitive operations and Expressions, Screen output and Keyboard input, Control statements, Object Creation and modification, Arrays, functions, Constructors, Pattern matching using Regular Expressions, DHTML: Positioning moving and Changing Elements.
DOM: Introduction to the Document Object Model DOM, HTML DOM Event Handling, Modifying Element Style, Document Tree, DOM Event Handling

UNIT-III: Angular JS

Introduction to AngularJS: Expressions, Modules, Data Binding, Scopes, Directives & Events, Controllers, Filters, Services, HTTP, Tables, Select, Fetching Data from MySQL.

UNIT-IV: Servlet and JSP

Servlet: Servlet Basics, Need of Server Side Programming, Servlet Life Cycle, Servlet Hello World Application, Web.xml Structure, Servlet Directives- include(), forward(), sendRedirect(), HttpServletRequest and HttpServletResponse in Servlet, Servlet and JDBC Integration.
JSP: JSP Basics, JSP Scripting Elements(Declaration, Expression, Scriptlet), Directive Elements(page, include, taglib), Action Elements(jsp:forward,jsp:include,jsp:useBean), JSP Implicit Objects.

UNIT-V Mongo DB

Introduction to Mongo DB: Mongo DB Environment, Create Database, Drop Database, Create Collection, Drop Collection, Read Operations, Write Operations.

Text Books:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
2. Web Technologies, Uttam K Roy, Oxford
3. Head First Servlet and JSP
4. Node.js, MongoDB, and AngularJS Web Development by Brad Dayley

Reference Books:

1. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
2. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage
3. Pro Angular JS by Adam Freeman

4. MEAN Web Development by Amos Q. Haviv

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CE7O03 :: INTRODUCTION TO WATERSHED MANAGEMENT				

Course Outcomes:

Students are able to

1. Analyze watershed characteristics to take appropriate management action.
2. Quantify soil erosion and design control measures.
3. Apply land grading techniques for proper land management.
4. Suggest suitable harvesting techniques for better watershed management.
5. Apply appropriate models for watershed management.

SYLLUBUS:

UNIT-I: Introduction:

Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics.

UNIT-II: Principles of Erosion:

Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT-III: Water Harvesting:

Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, farm ponds and dugout ponds, percolation tanks.

UNIT-IV: Land Management:

Land use and Land capability classification, management of forest, agricultural, grassland and wild land, Reclamation of saline and alkaline soils.

UNIT-V: Watershed Modeling:

Data of watershed for modeling, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

Text/ References books:

1. Abrar Yousuf and Manmohanjit Singh, 'Watershed Hydrology, Management and Modeling', Taylor & Francis Ltd; 1st edition, 2021.
2. Das MM and M.D Saikia , 'Watershed Management', PHI Learning Pvt. Ltd, 2013.
3. Murthy VVN , 'Land and Water Management', Kalyani Publications, 2007.
4. Murthy J V S, 'Watershed Management', New Age International Publishers, 2006.
5. Wurbs R A and James R A 'Water Resource Engineering', Prentice Hall Publishers, 2002.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20EE7O02 :: INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER				

COURSE OUTCOMES:

After successful completion of this course, students should be able to:

CO1	:	Illustrate I/O modules of PLC systems and ladder diagrams
CO2	:	Demonstrate various types registers and programming instructions.
CO3	:	Examine various types of PLC functions and its applications
CO4	:	Assess different data handling functions and its applications.
CO5	:	Describe the analog operations and PID modules

SYLLABUS

UNIT-I	**:**	**INTRODUCTION TO PLC SYSTEMS**
I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O Modules. Digital logic gates - programming in the Boolean algebra system - conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system		
UNIT-II	**:**	**PLC PROGRAMMING & REGISTERS**
PLC Programming: Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation. **PLC Registers:** Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.		
UNIT-III	**:**	**PLC FUNCTIONS**
Timer functions & Industrial applications - counters - counter function industrial applications - Arithmetic functions - Number comparison functions - number conversion functions		
UNIT-IV	**:**	**DATA HANDLING FUNCTIONS**
SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS – CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register – sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions		
UNIT-V	**:**	**ANALOG PLC OPERATION**
Analog modules & systems - Analog signal processing - Multi bit Data Processing - Analog output Application Examples - PID principles - position indicator with PID control - PID Modules - PID tuning - PID functions.		

TEXT BOOKS:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition – PHI.
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth & nF.D Hackworth Jr. –Pearson - 2004

REFERENCE BOOKS:

1. Introduction to Programmable Logic Controllers- Gary A. Dunning - 3rd edition – Cengage Learning - 2005.
2. Programmable Logic Controllers –W.Bolton - 5th Edition - Elsevier publisher - 2009.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20BM7O02 :: BUSINESS SKILL DEVELOPMENT				

UNIT- I

Communication in Business Objectives of communication - The Process of Human Communication – Types of Communication-Written, Oral, Visual, Audio Visual - Developing Listening Skills – Types, essentials of good listening and tips.

UNIT -II

Managing Organizational Communication– Formal and Informal Communication – Intra- personal– Inter-Personal Communication-Communication Models - Johari Window, Transactional Analysis, and Social Exchange theory. Role of emotion, barriers to interpersonal communication- Gateways to effective interpersonal communication.

UNIT -III

Nonverbal communication and Body language: Kinesics, Proxemics, Paralanguage, Haptics, handshakes, Appropriate body language and Mannerisms for interviews: business etiquettes- cultural effects of communication. Communication styles.

UNIT- IV

Business Correspondence- Essentials of Effective Business Correspondence, Norms for business letters-Letter for different kinds of situations- Business Letter and Forms, Resume writing, Meeting, Telephonic Communication – Use of Technology in Business Communication.

UNIT -V

Report Writing and Presentation skills – Formal and Informal Reports-Reports and Proposals Prerequisites for effective presentation -Types and Stages of presentation – Communication skills for group discussion and interviews-interview techniques.

Text / Reference Books

1. K Bhardwaj, Professional Communication, IK Int Pub House, New Delhi
2. Rayudu, CS: “Communication”, Himalaya Publishing House, Mumbai.
3. Krizan: “Essentials of Business Communication”, Cengage Learning, New Delhi.
4. UrmilaRai& S.M. Rai, Business Communication, Himalya Publishers,
5. Dalmar Fisher: “Communication in Organizations”, JAICO Publishing House, New Delhi, 2007.
6. Paul Turner: “Organisational Communication”, JAICO Publishing House, New Delhi.
7. Meenakshi Rama: “Business Communication”, Oxford University Press, New Delhi.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20EC7O02 :: REMOTE SENSING				

COURSE OUTCOMES:

After Completion of this course, students are able to

CO1: Understand the subject of satellite communication and remote sensing with the core knowledge of space and satellite, communication and the international space laws.

CO2: Comprehend different remote sensing signaling techniques, capable of interpreting signature of satellite communication from bodies like soil, vegetation and ocean.

CO3: Analyze various components used in satellite communication and remote sensing applications.

CO4: Acquire and keep abreast of designing satellite remote sensing system and also analyze the sensor data for drawing inference and conclusions.

UNIT I

Introduction: Historical background, International space laws, Advantages of space based observations, Global coverage, Multi scale observation, repeat observation immediate transmission and digital format, Source of information on remote sensing region.

UNIT II

Principles of remote sensing: Fundamentals of remote sensing signals, The electromagnetic spectrum, Terms and units of measurements, EM radiation laws, Spectral signature in the solar spectrum, vegetation reflectance, soil reflectance, water in the solar spectrum, The thermal infrared domain, characteristics of EM radiation in thermal infrared, Thermal properties of vegetation, Soils thermal domain, thermal signature of water and snow, The microwave region, Atmospheric interaction.

UNIT III

Sensors and remote sensing satellite: Type of sensors, Resolution of sensor systems, spatial, spectral, radiometric, temporal, angular - resolution, passive sensors, photographic cameras, cross and along track - scanners, active sensors, Radar and Lidar, satellite remote missions, Satellite orbits, Landsat programs, SPOT satellites, IRS program, High resolution commercial satellites, Polar orbiting meteorological satellites, Terra Aqua, Geostationary meteorological satellites.

UNIT IV

Basis for interpretations of remote sensing images: Constraints in using remote sensing data, types of interpretation, Costs of data acquisitions, end-user requirements, Thematic classification, Generation of biophysical variables, Change detection, spatial patterns, organization of remote sensing project, interpretation phase, presentation of study cases.

UNIT V

Characteristic of photographic images, Feature identification, criteria for visua interpretation, Brightness, color, texture, spatial contexts, shadows, spatial patterns, shap and size, stereoscopic view, period of acquisition, elements of visual analysis, Geometric characteristics of satellite image, Color composites, Multitemporal approaches.

TEXTBOOKS:

1. Emilio Chuvieco, “Fundamentals of Satellite Remote Sensing”, CRC press, Edition,2009.

REFERENCES:

1.C. H. Chen, “Signal Processing for Remote Sensing‖, CRC press, Edition-2007.
2. R. N Mutagi, “Satellite Communication Principles and Applications”, Oxford University press, 2016.
3. Enrico Del Re, and Marina Ruggieri, “Satellite communications and navigation systems”, Springer.

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20ME7O02 :: GREEN ENGINEERING SYSTEM				

COURSE OBJECTIVES

- To understand the basic concept of solar energy.
- To gain knowledge about renewable energy.
- To learn about the best energy efficient systems.
- To impart knowledge about energy efficient processes

COURSE OUTCOMES: Students are able to

CO1: Recognize the energy scenario and explain solar radiation conversion and collection phenomena. [K3]
CO2: Illustrate solar energy storage methods and applications and also explain the principles of wind energy, classification, conversion and applications [K4]
CO3: Explain the principle, classification, conversion and applications of Bio mass, geothermal energy and ocean energy. [K3]
CO4: Describe the importance of energy efficient systems and interpret working of a few mechanical and electrical efficient systems. [K2]
CO5: Identify the need of energy efficient processes and analyze their significance in view of their importance in the current scenario and their potential future applications. [K4]

UNIT – I

INTRODUCTION: Energy chain and common forms of usable energy – Present energy scenario – World energy status – Energy scenario in India, Traditional energy systems, Renewable energy – sources and features.

SOLAR RADIATION:

Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – IV

ENERGY EFFICIENT SYSTEMS:

ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmental friendly and energy efficient compressors and pumps

GREEN BUILDINGS: Definition features and benefits.

UNIT – V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems - vegetable based cutting fluids, zero waste manufacturing.

TEXT BOOKS:

1. Sukhatme S.P. and J. K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw Hill, 2018.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2015.
3. Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2016.

REFERENCES:

1. Alternative Building Materials and Technologies, K. S. Jagadeesh, B.V. Venkata Rama Reddy and K. S. Nanjunda Rao, New Age International (P) Ltd.
2. Principles of Solar Engineering, Yogi Goswami, Frank Krieth and John F Kreider, Taylor and Francis
3. Non-Conventional Energy , Ashok V Desai, Wiley Eastern
4. Renewable Energy Technologies, Ramesh & Kumar, Narosa
5. Non-Conventional Energy Sources, G. D. Rai, Kanna Publishers, New Delhi, 2018.

WEB REFERENCE:

1. https://archive.nptel.ac.in/courses/112/104/112104225/
2. https://archive.nptel.ac.in/courses/105/102/105102195/

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

VII SEMESTER : OPEN ELECTIVE - IV	L	T	P	C
	3	-	-	3
20CS7O02 :: SOFTWARE TESTING TECHNIQUES				

COURSEOBJECTIVES:

1. To study fundamental concepts in software testing and discuss various Software testing issues and solutions in software unit, integration, regression and system testing
2. To learn how to plan a test project, design test cases and data, conduct testing, manage software problems and defects, generate a test report
3. To expose the advanced software testing concepts such as object-oriented software testing methods, web-based and component-based software testing
4. To understand software test automation problems and solutions
5. To learn how to write software test documents and communicate with engineers in various forms

COURSEOUTCOMES:

By the end of the course, the student should have the ability to:

CO1: Identify and understand various software testing problems, apply software testing knowledge and engineering methods and solve these problems by designing and selecting software test models, criteria, strategies, and methods

CO2: Design and conduct a software test process for a software project

CO3: Analyze the needs of software test automation

CO4: Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects

CO5: Basic understanding and knowledge of contemporary issues in software testing, such as component- based, web based and object oriented software testing problems

CO6: Write test cases for given software to test it before delivery to the customer and write test scripts for both desktop and web based applications

UNIT-I:

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology.

Verification and Validation: Verification &Validation Activities, Verification, Verification of Requirements, High level and low level designs, verifying code, Validation.

UNIT-II:

Dynamic Testing- Black-Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table based testing, Cause-Effect Graphing based testing, Error guessing.

White-Box Testing: need, Logic Coverage criteria, Basis Path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

UNIT-III:

Static Testing: Inspections, Structured Walk through, Technical Reviews. Validation activities-Unit Testing, Integration Testing, Function Testing, System Testing, acceptance testing.

Regression testing: Progressives Vs regressive testing, Regression test ability, Objectives of regression testing, Regression testing types, Regression testing techniques.

UNIT-IV:

Efficient Test Suite Management: growing nature of test suite, Minimizing the test suite and its benefits, test suite prioritization, Types of test case prioritization, prioritization techniques, measuring

the effectiveness of a prioritized test suite, Software Quality Management- Software Quality metrics, SQA models.

Debugging: Process, techniques correcting bugs.

UNIT-V

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools such as Win Runner, Load Runner, Jmeter and JUnit . Test Automation using Selenium tool.

Testing Object Oriented Software: Basics, Object oriented testing, Testing Web based Systems, Challenges in testing for web based software, quality aspects, web engineering, testing of web based systems.

Text Books:

1) Naresh Chauhan, Software Testing, Principles and Practices, Second Edition, Oxford-2016
2) Yogesh Singh, Software Testing, First Edition, CAMBRIDGE -2012

Reference Books:

1) Aditya P Mathur ,Foundations of Software testing, Second edition, Pearson-2013
2) Baris Beizer, Software testing techniques Second edition ,Dream-tech-2002
3) MG Limaye, Software Testing, Principles, techniques and Tools, First Edition ,TMH,-2017
4) Willian E Perry,Effective Methods for Software testing, Third edition, Wiley-2006

E-Resources:

1) https://www.tutorialspoint.com/software_testing_dictionary/test_tools.htm

VII SEMESTER : OPEN ELECTIVE – IV	L	T	P	C
	3	-	-	3
20IT7O01 :: INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT				

Course Outcomes:

Upon the completion of the course students will be able to:-

1. Apply the process to be followed in the software development life-cycle models.
2. Apply the concepts of project management & planning.
3. Implement the project plans through managing people, communications and change
4. Conduct activities necessary to successfully complete and close the Software projects
5. Implement communication, modeling, and construction & deployment practices in software development.

UNIT – I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

UNIT – II:

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of The Process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT – III:

Model Based Software Architectures: A Management perspective and technical perspective.

Work Flows of the Process: Software process workflows, Iteration workflows.

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

UNIT – IV:

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

UNIT – V:

Process Automation: Automation Building blocks, The Project Environment.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Project Estimation and Management: COCOMO model, Critical Path Analysis, PERT technique, Monte Carlo approach (Text book 2)

Text Books:

1. Software Project Management, Walker Royce, Pearson Education, 2005.
2. Software Project Management, Bob Hughes, 4th edition, Mike Cotterell, TMH.

Reference Books:

1. Software Project Management, Joel Henry, Pearson Education.
2. Software Project Management in practice, Pankaj Jalote, Pearson Education, 2005.
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006.

VII SEMESTER : HUMANITIES AND SOCIAL SCIENCE ELECTIVE	L	T	P	C
	3	-	-	3
20HS7T01 :: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY				

COURSE OUTCOMES:

Students are able to

- CO1: Recognize the need, basic guidelines, content and process of value education; explore the meaning of happiness and prosperity. (K1)
- CO2: Examine the difference between the Self and the Body; understand the meaning of Harmony in the Self the Co-existence of Self and Body. (K1)
- CO3: Associate the value of harmonious relationship based on trust and respect in life and profession. (K2)
- CO4: Identify the role of a human being in ensuring harmony in society and nature. (K2)
- CO5: Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession. (K3)

SYLLABUS

Unit 1: Introduction-Basic Human Aspiration

Understanding the need, basic guidelines, content and process for Value Education-Self-Exploration, its content and process - 'Natural Acceptance' and 'Experiential Validation' as the mechanism for self exploration-Continuous Happiness and Prosperity the basic requirements for fulfillment of aspirations of every human being with their correct priority- Understanding Happiness and Prosperity correctly-Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Harmony in the Human Being

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'- Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha - Understanding the Body as an instrument of 'I'-Understanding the characteristics and activities of 'I' and harmony in 'I'.

Unit 3: Human-Human relationships

Understanding values in human-human relationship-Meaning of justice-Nine universal values in relationship-Meaning of trust and respect-Difference between respect and differentiation-Harmony in society-undivided society from family to world family.

Unit 4: Nature and existence

Self exploration – self awareness and self evaluation- Self realization-Understanding and contemplation in the Self - Realization of Co-existence- Understanding of harmony in Nature and contemplation of participation of Human in development of harmony.

Unit 5: Implications of Harmony on professional ethics

Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order- Competence in professional ethics - Case studies of typical holistic technologies-management models-Production systems-Strategy for transition from the present state to universal human order.

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria. "Teachers' Manual for *A Foundation Course in Human Values and Professional Ethics"*, 2nd revised edition, Excel Books, New Delhi, 2019.
2. R R Gaur, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2010.

REFERENCES:

1. J. C. Kumarappa, “Economy of Permanence – (a quest for social order based on non-violence)”, Sarva-Seva-Sangh-Prakashan, Varansi, India-2010.
2. A.N. Tripathi,“Human Values”, New Age Intl. Publishers, New Delhi, 2004.
3. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. P. L. Dhar& R. R. Gaur, “Science & Humanism – towards a unified worldview”, Commonwealth Publishers, New Delhi-1990.
5. Mahadev Desai, Shriman Narayan, “The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi”, Navajivan Mudranalaya, Ahemadabad, India, 1925.

VII SEMESTER	L	T	P	C
	0	0	3	1.5
20CE7S01: Q-SURVEYING				

COURSE OUTCOMES

Students are able to

1. acquire knowledge of quantity surveying and will become familiar with modes of measurement and utility of various types of estimates. (K2)
2. use of current schedule of rates and quantitative resource allocation for the rate analysis. (K2)
3. familiarize the steps involved in the analysis of rates. (K2)
4. extend the knowledge of detailed estimate preparation for various civil engineering works. (K2)

LIST OF EXPERIMENTS

1. Estimation for building works by center line method, long wall and short wall method.
2. Calculation of slab steel quantity from the given drawing.
3. Calculation of stair case quantity (Concrete, Bar bending schedule and Reinforcement details).
4. Estimation of earthwork excavation in excel sheet.
5. Building quantity estimation step by step in excel sheet.
6. House construction cost calculator excel sheet for single storey.
7. House construction cost calculator excel sheet for Ground floor, Ground floor+1, Ground floor+2, Ground floor +3.

Reference Books

1. B.N. Dutta , 'Estimating and Costing', UBS publishers, 2000.
2. M. Chakraborthi , 'Estimation, Costing and Specifications', Laxmi publications, 2018.
3. G.S. Birdie, 'Estimating and Costing, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
4. 'Standard Schedule of rates and standard data book' by public works department.
5. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works – B.I.S.)

E-Resources

https://nptel.ac.in/courses/105103093

MINOR TRACKS SYLLABUS

IV SEMESTER (MINOR COURSES)	L	T	P	C
	3	1	-	4
20CE4N01: CONCRETE TECHNOLOGY				

COURSE OUTCOMES

Students are able to

1. Identify the characteristics of basic ingredients and properties of concrete. (K2)
2. Distinguish the properties of fresh and hardened concrete. (K2)
3. Assess the quality of Hardened Concrete. (K3)
4. Discriminate Concepts Proportioning of concrete mixes by various methods -BIS method of mix design. (K3)
5. Justify the significance of special concretes. (K2)

SYLLABUS

UNIT-I

INGREDIENTS OF CONCRETE & ADMIXTURES: - Concrete ingredients- Admixtures-Mineral and chemical admixtures - accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silica fume.

AGGREGATES: Classification of aggregate - Particle shape & texture - Bond, strength & other mechanical properties of aggregates - Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate -Bulking of sand -Deleterious substance in aggregate - Soundness of aggregate – Alkali aggregate reaction - Thermal properties - Sieve analysis - Fineness modulus - Grading curves - Grading of fine & coarse Aggregates -Gap graded and well graded aggregate as per relevant IS code - Maximum aggregate size. Quality of mixing water.

UNIT - II

FRESH CONCRETE: Steps in Manufacture of Concrete-proportion, mixing, placing, compaction, finishing, curing - including various types in each stage. Properties of fresh concrete-Workability - Factors affecting workability - Measurement of workability by different tests, Setting times of concrete, Effect of time and temperature on workability - Segregation &bleeding - Mixing and vibration of concrete, Ready mixed concrete, Shotcrete.

UNIT - III

HARDENED CONCRETE: Water / Cement ratio - Abram's Law –Gel space ratio - Nature of strength of concrete -Maturity concept - Strength in tension & compression - Factors affecting strength – Relation between compression & tensile strength - Curing, Testing of Hardened Concrete: Compression tests – Tension tests - Factors affecting strength -Flexure tests -Splitting tests - Non-destructive testing methods – codal provisions for NDT.

UNIT - IV

ELASTICITY, CREEP & SHRINKAGE: Modulus of elasticity -Dynamic modulus of elasticity - Poisson's ratio - Creep of concrete -Factors influencing creep - Relation between creep & time - Nature of creep – Effects of creep - Shrinkage -types of shrinkage.

MIX DESIGN: Factors in the choice of mix proportions - Durability of concrete - Quality Control of concrete - Statistical methods - Acceptance criteria - Concepts Proportioning of concrete mixes by various methods -BIS method of mix design.

UNIT – V

SPECIAL CONCRETES: Ready mixed concrete -Light weight aggregate concrete – Cellular concrete -No-fines concrete, High density concrete, Fibre reinforced concrete – Different types of fibres- Factors affecting properties of FRC, polymer Concrete- Types of polymer concrete- properties of polymer concrete-High performance concrete-Self consolidating concrete, SIFCON, Self-healing concrete.

Text Books:

1. M.L. Gambhir, Concrete Technology- Tata Mc. Graw Hill Publishers, New Delhi, 2014.
2. M.S.Shetty , Concrete Technology, S.Chand& Co. , 2004.

Reference Books

1. A.R. Santha Kumar, Concrete Technology, Oxford University Press, New Delhi, 2018.
2. A.M.Neville, Properties of Concrete, PEARSON - 4th edition, 2016.

E-Resources

1. https://nptel.ac.in/courses/105102012
2. https://archive.nptel.ac.in/courses/105/106/105106176/

V SEMESTER (MINOR COURSES)	L	T	P	C
	3	1	-	4
20CE5N01: STRUCTURAL ANALYSIS				

COURSE OUTCOMES:

Upon successful completion of this course,

1. Solve the Propped Cantilever and the fixed beam under different loading conditions. (K3)
2. Deduce the Continuous Beams by Clapeyron's theorem of three moments and slope-deflection method. (K3)
3. Apply moment distribution and kani's method to continuous beam. (K3)
4. Determine support reactions, normal thrust and radial shear for three hinged and two hinged arches. (K3)
5. Analyze cable structures and suspension bridges. (K3)

SYLLABUS

UNIT-I

PROPPED CANTILEVERS: Analysis of propped cantilevers-shear force and Bending moment diagrams-Deflection of propped cantilevers.

FIXED BEAMS: Introduction to statically indeterminate beams with U. D. load central point load, eccentric point load. Number of point loads, uniformly varying load, couple and combination of loads shear force and Bending moment diagrams-Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

UNIT-II

CONTINUOUSBEAMS: Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed-continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

SLOPE-DEFLECTION METHOD: Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

UNIT III

MOMENT DISTRIBUTION METHOD: Stiffness and carry over factors – Distribution factors – Analysis of continuous beams with and without sinking of supports – Portal frames – including Sway-Substitute frame analysis by two cycles.

Kani's Method: Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway.

UNIT IV

THREE HINGED AND TWO HINGED ARCHES

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear –Rib shortening and temperature stresses, tied arches – fixed arches – (No analytical question).

UNIT V

LATERAL LOAD ANALYSIS USING APPROXIMATE METHODS: Application to building frames. (i) Portal method (ii) Cantilever method.

CABLE STRUCTURES AND SUSPENSION BRIDGES: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

Text Books

1. Gupta, Pandit & Gupta; Theory of Structures, 1st Edition , Tata McGraw Hill, New Delhi, 2017.
2. V.D. Prasad, Structural Analysis, 3rd Edition,Galgotia publications, 2011.
3. T.S. Thandavamoorthy, Analysis of Structures, 1st Edition, Oxford University Press, New Delhi, 2011.

Reference Books

1. R.C. Hibbeler , Structural analysis, 6th edition, Pearson, New Delhi, 2017.
2. R.S. Khurmi , Theory of Structures, 1st Edition, S. Chand Publishers.2005.
3. Devdas menon , "Structural analysis" - Alpha Science International Ltd, 2nd Edition, 2017.
4. B.C.Punmia, Jain & Jain, 'Theory of Structures – II', Laxmi Publications, India.
5. C.S. Reddy , Structural Analysis', Tata Mc-Graw hill, New Delhi, 3rd edition, 2009.

E-Resources

1. https://nptel.ac.in/courses/105105166
2. https://nptel.ac.in/courses/105101085
3. https://nptel.ac.in/courses/105101086

VI SEMESTER (MINOR COURSES)	L	T	P	C
	3	1	-	4
20CE6N01: SURVEYING				

COURSE OUTCOMES

Students are able to

1. describe the principles and classification of surveying, Calculate horizontal and angular measurements. (K2)
2. identify to use various surveying instruments for Measure distances and bearings. (K2)
3. use different methods of surveying to Measure levels and draw contours. (K2)
4. demonstrate the various components of Theodolite. Prepare theodolite traversing including closing error and trigonometric leveling. (K2)
5. compute various data required for various methods of surveying for setting out of curves. (K3)

SYLLABUS

UNIT – I

INTRODUCTION: definition - Uses of surveying-overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications- Errors in survey measurements.

UNIT - II

DISTANCES AND DIRECTION: Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements (EDM) -principles of electro optical EDM- errors and corrections to linear measurements-compass survey -Meridians, Azimuths and Bearings, declination, computation of angle. Traversing – Purpose-types of traverse-traverse computation -traverse adjustments -omitted measurements.

UNIT - III

LEVELING AND CONTOURING: Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments - method of levelling. Characteristics and Uses of contours- methods of conducting.

UNIT - IV

THEODOLITE: Theodolite, description, principles - uses and adjustments -temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite - Trigonometrical leveling..

TACHEOMETRIC SURVEYING: Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position.

UNIT - V

CURVES: Types of curves, design and setting out - simple and compound curves - transition curves. Introduction to geodetic surveying, Total Station and Global positioning system.

COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

Text Books

1. SatishGopi, R. Sathi Kumar and N. Madhu, Advance Surveying,2nd edition Pearson Publications,2016.
2. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain , Surveying (Vol No.1, 2 &3),16th edition, Laxmi Publications (P) ltd, New Delhi, 2015.

Reference Books

1. C. Venkataramaiah, Text book of Surveying, 2nd edition, University press, India (P) limited,2014.
2. S.K. Roy, Fundamentals of surveying, 2nd edition - PHI learning (P) Ltd, 2010.
3. S.K. Duggal, Text book of Surveying (Vol No.1&2), 3rd Edition, Tata McGraw Hill Publishing Co. Ltd. NewDelhi, 2008.
4. R. Subramanian, Surveying and levelling , 2nd edition, Oxford University press,2007.

E-Resources

1. https://nptel.ac.in/courses/105107122
2. https://nptel.ac.in/courses/105104101

VII SEMESTER (MINOR COURSES)	L	T	P	C
	3	1	-	4
20CE7N01: SOIL MECHANICS				

COURSE OUTCOMES

Students are able to

1. develop different methods of index properties of the soils and classify the soils. (K2)
2. compute different engineering properties of the soil such as compaction, permeability, consolidation and shear strength and determine them in the laboratory. (K3)
3. relate stress distribution in soils in day-to-day civil engineering practice. (K3)
4. estimate compressibility of soils. (K3)
5. develop stress-strain behavior of different sands. (K3)

SYLLABUS

UNIT - I

Introduction: Soil formation- soil structure and clay mineralogy -Adsorbed water – Mass-volume relationship - Grain size analysis - Sieve and Hydrometer methods -consistency limits and indices.

Index Properties of Soils: Various Types of soil Classifications - Unified soil classification and I.S. Soil classification-Relative density - Mechanism of compaction - factors affecting - effects of compaction on soil properties -compaction control.

UNIT -II

Permeability: Soil water - capillary rise - One dimensioned flow of water through soils - Darcy's lawpermeability - Factors affecting -laboratory determination of coefficient of permeability - Permeability of layered systems. Total, neutral and effective stresses -quick sand condition - 2-D flow and Laplace's equation - Seepage through soils -Flow nets: Characteristics and Uses.

UNIT - III

Stress Distribution In Soils: Stresses induced by applied loads -Boussinesq's and Westergaard's theories for point loads and areas of different shapes- Newmark's influence chart - 2:1 stress distribution method.

UNIT - IV

Consolidation: Compressibility of soils - e-σ and e-log σ curves - Stress history - Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation - Determination of coefficient of consolidation (C_v) - Over consolidated and normally consolidated clays.

UNIT - V

Shear Strength of Soils: Basic mechanism of shear strength - Mohr -Coulomb Failure theories - Stress-Strain behavior of Sands - Critical Void Ratio - Stress-Strain behavior of clays - Shear Strength determination various drainage conditions.

Text Books

1. Gopal Ranjan and A.S.R.Rao, 'Basic and Applied Soil Mechanics', New Age International Publishers, 2018.
2. R.F.Craig, "Soil mechanics", spon press, Talyor & Francis Group, London**,** Seventh edition, 2017.

Reference Books

1. Braja M. Das and Khaled Sobhan, "Principles of Geotechnical Engineering, Cengage Learning-USA, Eight edition, 2015.
2. Holtz and Kovacs, An introduction to Geotechnical Engineering', Prentice Hall, 2014.
3. B.C.Punmia, Ashok Kumar Jain & Arun kumar Jain , 'Soil Mechanics and Foundations', Laxmi Publications, 16th edition,2013.

E-Resources

1. https://nptel.ac.in/courses/105103097