College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra, Permanently Affiliated to S.P. Pune University)

Department of Civil Engineering

Curriculum Structure & Detailed Syllabus (UG Program)

Second Year B.Tech.

(Revision: A.Y. 2015-16, Effective from: A.Y. 2016-17)

INDEX

UG PROGRAMS
(FOR AWARD of B.TECH.DEGREE)

ACADEMIC RULES and REGULATIONS

1. Short Title and Commencement:

(a) These Regulations shall be called the "College of Engineering, Pune Regulations for the Award of B.Tech. Degree";

(b) They shall come into effect from the date of getting approval from the Board of Governors of the College.

(c) They shall be applicable for students enrolling for B. Tech. Degree programmes at the College from Academic Year 2015-16.

2. Definitions:

(a) "B. Tech." means Bachelor of Technology, an Under Graduate Degree awarded by and from the University;

(b) "Board" means Board of Governors of the college;

(c) "College" means College of Engineering, Pune;

(d) "Council" means All India Council for Technical Education;

(e) "Dean" means Dean of the College, with the specific functions also indicated along with the title;

(f) "Deputy Director" means Deputy Director of the College;

(g) "Director" means Director of the College;

(h) "Government" means Government of the Maharashtra;

(i) "Prescribed" means prescribed by these or any other Regulations of the College;

(j) "Regulations" means College of Engineering, Pune Regulations for the Award of B. Tech. Degree;

(k) "Senate" means Senate of the College;

(l) "University" means Savitribai Phule Pune University

3. Preamble:

The Regulations prescribed herein have been made by the College, an autonomous institution affiliated to the Savitribai Phule Pune University, to facilitate the smooth and orderly conduct of its academic programmes and activities at the B. Tech level. It is expected that the Regulations will enable the students to take advantage of the

various academic opportunities at the College and prepare themselves to face the challenges in their professional careers ahead. It may be noted that:

(a) The provisions made herein shall be applicable to all the B. Tech. Programmes offered at the College, at present;

(b) They shall also be applicable to all the new B. Tech. Programmes which may be started at the College in the future;

(c) Academic and non-academic requirements prescribed by the Senate have to be fulfilled by a student for eligibility to the Award of B.Tech. degree.

4. Academic Calendar:

Table 1: Suggested Breakdown of Academic Year into Semesters

1. No. of Semesters/ Year	Three; Two being Main Semesters (Odd and Even) and One being a Supplementary Semester; (Note: Supplementary Semester is primarily to assist weak and/or failed students through make up courses, wherever possible. However, the College may use this Semester to arrange Add-On Courses for other students and/or for deputing them for practical training elsewhere.)
2. Semester Durations:	Main Semesters: 19 Weeks each; Supplementary Semester: 8 Weeks;
3. Academic Activities (Weeks):	Main Semester (Odd or Even) Registration of Courses- 0.5; Course work- 15.5; Examination Preparation-1.0; Examinations- 1.0; Declaration of Results- 1.0; Total: 19; Supplementary Semester (only for make up Courses): Registration of Courses- 0.1; Course Work- 7.0; Examination Preparation-0.2; Examinations- 0.2; Declaration of Results- 0.5; Total: 8; Inter-Semester Recess: After each Main Semester- 2; After Supplementary Semester- 2; Total: 14 (for good students) and 6 (for weak students) *(Note: In each Semester, there shall be provision for students for Registration of Courses at the beginning, Dropping of Courses in the middle under the advice of Faculty Members and approved by Departmental Undergraduate Programme Committee (DUPC).*

4. Examinations:	Continuous Internal Evaluation (CIE) and Semester End Examination (ESE), both having equal weightage in the students' performance in Course Work/Laboratory Work and other activities; (Note: The CIE shall be conducted throughout the Semester on dates announced in advance by the subject teacher, and its results made known to the students from time to time. This would be of help to the students to decide on Dropping or Withdrawal from Courses in consultation with their Advisors. However, the dates for the Mid-Semester Examination (MSE) which is a part of the CIE and ESE shall be fixed at the College level.
5. Other Items:	• Care shall be taken to ensure that the total number of days for academic work are > 180/year; • Academic schedules prescribed shall be strictly adhered to by all the Departments; • Supplementary Semester shall be mainly for Make up Courses, to benefit weak or failed students to the extent possible; • Students failed in a course shall attend a Course fully when it is offered again, and appear for all components of evaluation; • Specified Min. /Max. Course load per Semester shall be followed at all times.

(a) Each academic year shall be divided into two main semesters, each of 19 weeks, viz., odd semester (Jul. – Dec.) and even semester (Dec. – Apr.), and an 8-week supplementary semester (Apr.-Jun.).

(b) The College shall arrange regular academic activities for the students during the two main semesters and makeup and other courses for the students during the supplementary semester;

(c) The academic activities in a semester shall normally include course registration, course work, continuous internal evaluation, dropping/withdrawal from courses, semester-end examination, and declaration of results.

(d) The College shall announce the schedule for all the academic activities well before the commencement of the academic year and take all the necessary steps to follow them scrupulously.

(e) The college shall also announce adequate intra-semester and inter-semester breaks for the students and ensure that a minimum of 180 academic working days are available during the academic year.

(f) A typical breakdown of the academic year for the B. Tech programme at the College shall be as suggested in Table 1:

5. Admissions:

(a) The intake capacity of each programme, including the number of seats to be reserved for students of different categories shall be decided by the Board by following the Government directives and Council approvals.

(b) Admissions to the first year of all the programmes shall be made before the start of each academic year, through the Maharashtra Combined Entrance Test (MHCET) conducted by the Government.

(c) The College shall also admit to first year of the programmes, a limited number of students of Non-Resident Indian (NRI), Persons of Indian Origin (PIO) and Foreign National categories, as per Government rules.

(d) There shall also be a merit-based, lateral admission of students having Diploma qualification to the second year of all the programmes at the College in accordance with the Government rules applicable for such admissions.

(e) The College reserves the right to revoke the admission made to a candidate, if it is found at any time after admission that he/she does not fulfill all the requirements stipulated in the offer of admission.

(f) The College also reserves the right to cancel the admission of any student and discontinue his/her studies at any stage of studentship for unsatisfactory academic performance and/or undisciplined conduct.

6. In-campus Residence:

(a) Interested students may apply for hostel accommodation at the time of admissions, as the College is partially residential and it can admit a limited number of men and women students in the hostels.

(b) The method of admission to students' hostels, rent payable per each seat allotted and the discipline to be followed by the residents shall be governed by "rules and regulations" framed by the College in this behalf.

(c) Each student selected for hostel admission shall be provided a seat in one of the hostel rooms identified for this purpose and there shall be no family accommodation available in the hostel for married students.

(d) Students residing in the hostels shall adhere to the prescribed hostel discipline and pay the hostel/mess charges regularly, as any failure to do so, may lead to withdrawal of hostel facilities to such students.

(e) Hostel residents shall apply for leave of absence and get the same approved before leaving the hostel even for a few days, as any failure to do so may lead to cancellation of hostel admission to such students.

(f) Students residing in the hostels shall be required to clear all the hostel dues and vacate their rooms at the end of each academic year, as they will be considered for hostel admission afresh for the New Year.

7. Attendance:

(a) Each student shall be required to attend at least 75 per cent of all the classes arranged like, lectures, tutorials, laboratories, studios and workshops for being permitted to attend the semester-end examination.

(b) Extra Academic Activities (EAC) like Yoga, NSS, Physical Training, NCC and, Boat Club shall be compulsory for students of the first year, with at least a minimum attendance of 75 percent in each of them.

(c) Students shall also be required to take part in any other academic and non-academic activities and attend the camps, as and when arranged by the College during the academic year.

(d) Students desirous of leave of absence for less than two weeks during a semester shall apply for it in advance to the Head of the Department giving reasons & supporting documents, if any and get it approved.

(e) Absence due to illness or any other reason for a period less than two weeks in a semester, for which a student could not make prior application, may be condoned by the Head of the Department after proper verification.

(f) The Dean, Academic Affairs shall be the Authority for sanctioning the leave of students outside clauses (4) and (5) above, after receiving their applications along with recommendations of the Heads of Departments.

(g) In the case of long absence of a student in a semester with prior approval or otherwise, the Dean, Academic Affairs shall decide whether the student be asked to withdraw from the programme for that particular semester.

(h) In all the cases of leave of absence as per Clauses (4)-(6) above, the period of leave taken shall not be condoned for the purposes of fulfilling the attendance requirements stipulated in the Clauses (1) and (2).

(i) It shall be the responsibility of a student residing in the hostel to intimate the Warden of his/her hostel and also the concerned course instructors regarding his/her absence before proceeding on leave.

8. Code of Conduct and Discipline:

(a) All students shall be required to conduct themselves in a manner befitting the students of a national institution of high reputation, within and outside the precincts of the College.

(b) Unsocial activities like ragging in any form shall not be permitted within or outside the precincts of the College and the students found indulging in them shall be dealt with severely and dismissed from the College.

(c) The following additional acts of omission and/or commission by the students within or outside the precincts of the College shall constitute gross violation of code of conduct punishable as indiscipline:

i. Lack of courtesy and decorum, as well as indecent behaviour;
ii. Willful damage of property of the College/Hostel or of fellow students;
iii. Possession/consumption/distribution of alcoholic drinks and banned drugs;

iv. Mutilation or unauthorized possession of library material, like. books;

v. Noisy and unseemly behaviour, disturbing peace in the College/Hostel;

vi. Hacking in computer systems, either hardware or software or both;

vii. vii. Any other act considered by the College as of gross indiscipline.

(d) In each case above, the punishment shall be based on the gravity of offence, covering from reprimand, levy of fine, expulsion from Hostel, debar from examination, rustication for a period, to outright expulsion.

(e) The reprimanding Authority for an offence committed by students in the Hostels and in the Department or the classroom shall be respectively, the Rector of the Hostels and the Head of the concerned Department.

(f) In all the cases of offence committed by students in jurisdictions outside the purview of Clause (5), the Dean, Students Affairs shall be the Authority to reprimand them.

(g) All major acts of indiscipline involving punishment other than mere reprimand, shall be considered and decided by the Chairman, Students Disciplinary Committee appointed by the Senate.

(h) All other cases of indiscipline of students, like adoption of unfair means in the examinations shall be reported to the Dean, Academic Affairs, for taking appropriate action and deciding on the punishment to be levied.

(i) In all the cases of punishment levied on the students for any offence committed, the aggrieved party shall have the right to appeal to the Director, who shall constitute appropriate Committees to review the case.

9. Change of Branch:

(a) Change of branch shall be permissible for a limited number of special cases in the third semester as per following regulations.

(b) Only those students who have completed the common credits required in the first two semesters in their first attempt with a minimum CGPA of 8.5 shall only be eligible for making application for a change of branch.

(c) There shall be a maximum number of only two students admitted in any discipline in the third semester through the branch change rule.

(d) Intending students eligible for change of branch shall apply for the same to the Office of Academic Affairs of the College before the closing date notified at the beginning of odd semester of each academic year.

(e) Such students shall be required to indicate up to three branches, in order of preference to which they wish to change over, as the change shall be strictly based on their merit, subject to availability of vacancies.

(f) The change of branch shall be permitted purely on inter-se merit of all the eligible applicants. The CGPA of students at the end of the second semester shall be considered for rank ordering of the applicants seeking change of branch and in the case of a tie, the MHCET ranks shall also be considered.

(g) All the changes of branch permitted for intending students as per the above clauses

shall be effective from their third semester only and no further change of branch shall be permitted after this.

(h) All the changes of branch permitted at this stage shall be final and binding on the applicants and no student shall be permitted, under any circumstances, to refuse the change of branch offered.

(i) The candidates who have sought admission under Tuition Fee Waiver Scheme are not eligible for the branch change.

10. Course Structure:

a) Each course offered in the B. Tech. curriculum at the College shall be listed by using a total of five/six digits, the first two being letters and the remaining being numerals, as follows:

   i. The first two letters to represent the Department offering the Course in abbreviated form, e.g., CE for Civil Engineering;

   ii. The first numeral that follows to represent the year of the programme, such as 1, 2, 3 and 4, leading to 100,- 400 series;

   iii. The next two numerals to represent the Course Number allotted for the subject by the Department, i.e., 01, 02, 03, up to 99;

   iv. Thus, as an example, courses offered at the Department of Civil Engineering could be listed from CE 101 up to CE 499;

b) All the courses in the B. Tech. Curriculum shall be unitized, with one credit being assigned to each unit of course work, after the student completes its teaching-learning process successfully.

c) The assignment of credits to course work shall follow the well accepted practice at leading institutions, with one credit being defined to mean:

   1. Lecture course conducted for one hour per week in a semester;

   2. Tutorial conducted for one hour per week in a semester;

   3. Laboratory/Practical conducted for two/three hours per week in a semester;

   4. Project work conducted for two hours per week in a semester;

d) Each student for the B. Tech, Degree award shall be required to earn a total of 180 credits during his/her studentship at the College. While a student can register for more than 180 credits at the College, only 180 credits shall be reckoned for the Degree award. On the other hand, a student having less than 180 credits shall have to earn the remaining credits to make up the total to 180 credits so as to qualify for the Degree award. The total number of credits earned to complete the course depends on the academic schema for which the student has enrolled for.

e) In addition to the credit requirement prescribed above for the Degree award, each student shall have to complete the requirements of Extra Academic Activities (EAA) as referred to earlier in Clause 2 of Section 7, during the first two semesters of the programme. All the students shall receive certification as PP (for Passed), and NP (for not passed) in EAA, in the Grade Card. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this shall not be taken

into account for computing the final Grade Point Average.

1. Each student shall register for an average of 22 credits per semester during his/her studentship at the College, with the minimum and maximum credits being fixed as 16 and 28 credits per semester respectively. The exact number of credits to be registered by a student in a semester in a particular Department shall be decided by his/her Faculty Advisor based on the student's academic performance in the preceding semester and approval by the Departmental Undergraduate Programme Committee (DUPC).
2. The medium of instruction for course work and examinations at the College shall be English. The course work for the Programme shall be broadly divided into SEVEN main subject groups, as follows:
    - Humanities, Social Sciences and Management Courses;
    - Engineering Foundation Courses
    - Basic Sciences including Mathematics;
    - Mandatory Learning & Liberal Learning Courses;
    - Professional Core and Elective Subjects;
    - Skill based Laboratory Courses
    - Mini and Major Project
3. The total course package for the Programme at a Department shall have the following components:
    - Institutional Core subjects
    - Departmental Core subjects
    - Departmental Elective subjects
    - Other Elective subjects

f) The DUPC shall be responsible for planning the curriculum and syllabi for all the courses included for the Programme for approval by the Senate However, the Institutional Undergraduate Programme Committee (IUPC) shall be in charge for College wide implementation of course work, time tables and related requirements for the Programme.

g) Each Department shall have the flexibility to include industrial training and/or field work of 8 weeks for all its students as a compulsory requirement for the Degree award and this can be assigned credits, as approved by the Senate. However, these shall be arranged during the supplementary semester period following the sixth semester of studies at the College.

h) Each Department shall assign Faculty Advisors for all its students in consultation with the Dean, Academic Affairs and Dean, Students Affairs. It shall be the responsibility of the Faculty Advisors to help the students in planning their course work and other academic activities at the Department and also to regularly monitor and advise them on their academic and other performance at the College. For students of the first two semesters in any Department, the Dean, Students Affairs may assign Faculty Advisors from among the faculty of Basic Science including Mathematics and HSS Departments.

11. Course Registration for the Semester:

(a) Each student shall be required to register for course work by following the advice of the Faculty Advisor at the commencement of each semester on the day fixed for such registration and notified in the Academic Calendar.

(b) Students who fail to register for course work on the notified day may be permitted by the Department for late registration on another day announced in the Academic Calendar after payment of an additional fee fixed by the College.

(c) Only those students shall be permitted to register for course work who have:

i. Cleared all dues of the College, Hostel and Library including fines (if any) of the previous semester,

ii. Made all the required advance payments towards the College and Hostel dues for the current semester before the closing date, and

iii. Not been debarred from registration of courses on any other specific ground.

(d) Each student shall fulfill the following conditions at the time of registration of course work in any semester:

i. Each student of the first year shall register for all the courses in the first two semesters, with flexibility to drop one/two courses up to the minimum permissible limit of 18 credits in each case. Similarly Direct Diploma students will also register for all courses in third and fourth semester.

ii. A student shall be permitted to register for more than the average course load, i.e., up to a maximum of 28 credits, if he/she has shown outstanding performance in course work in the previous semesters, i.e., CGPA>=8.0.

iii. On the other hand, a student whose performance is not so good in the preceding semesters, i. e., =<5.0, shall be permitted to register 18 credits, the students who have secured CGPA in between 5 and 6 are allowed for normal credits (i.e. The credits offered by the department in that semester) and the students who have secured more than 6 CGPA are allowed to register for one additional course. The students are mandatorily required to register for backlog subjects first. The faculty advisor is required to check for the pre-requisites if any at the time of registration.

(e) All the students shall note the following special features of the credit system, which shall be strictly followed at the College:

i. There shall be no re-examination facility as in the conventional academic system and ESE shall be conducted for the course once in a semester, except to meet the needs of students specially permitted by the College.

ii. A student shall have to re-register in all the failed courses (i.e., Getting Grade FF) at any further semester when they are offered again, freedom being given to the student to change the course only if it is an elective.

iii. Also, a student getting certification as NP in the Extra Academic Activities

(EAC), shall re- register for them in a following semester/s until he/she obtains certification as PP.

(f) A student shall have the possibility to drop a course in the middle of a semester as per the Academic Calendar, without mention in the Grade Card, with the concurrence of the Faculty Advisor, and after intimating the concerned course instructor/s and the academic section. However, it shall not be possible for a student to register for an alternative course in that semester.

12. Supplementary Semester:

(a) Departments shall have the flexibility to conduct supplementary semesters during summer months for FY B.Tech backlog subjects, as per the Academic Calendar. Such a semester shall be offered on the recommendation of DUPC and with the approval of the Dean, Academic Affairs. A student shall be allowed to register for a maximum of three subjects in a supplementary semester.

(b) The supplementary semester shall be utilized primarily to facilitate the failed students to attend **the FY courses in which they have failed and not for launching any new courses for credit.** However, a Department shall be free to arrange any Add-On courses for its students during this semester.

(c) The academic activity in the supplementary semester shall be at double the rate as compared to a normal semester; e.g., 1 credit of course work shall require two hours/week in the class room, so that the contact hours are maintained the same as in a normal semester. It shall also be necessary to fulfill the requirements of CIE and ESE for all the courses like in a normal semester.

(d) Courses planned for the supplementary semester shall be announced by the Dean, Academic Affairs in each year, well before the conclusion of the even semester. Students intending to avail of this facility shall have to register for the courses offered by paying the prescribed fees within the stipulated time.

(e) It shall be the responsibility of the Department to plan in advance the faculty and non-teaching staff requirements to conduct the supplementary semester and take necessary steps including the institutional approvals for organizing the same.

(f) The student who are either dropped or detained in the course/s during regular semester is not allowed to register for that course/s in summer.

(g) Re-exam (ONLY for 60 marks equivalent to end semester exam) shall be conducted for all other classes three weeks after grade approval by DUPC/DPPC. The re exam shall be conducted after every semester, for the subjects offered in that semester. For final grading, T1, T2 scores of respective semester shall be used. Grade ranges shall be same as that of regular semester for that subject

13. Programme Duration:

(a) The Programme duration for a student to complete the academic and other requirements at the College and qualify for the award of Degree by the University shall be normally 8 semesters.

(b) However, it shall be possible for an outstanding student to qualify for the Degree award in less than eight semesters, by registering for more number of credits i.e., up to the maximum permissible limit of 28 credits per semester from the third semester onwards to complete the Programme requirements of 180 credits. In such

a case, the College shall issue a Provisional Certificate to the student who shall await the completion of eight semesters for the Degree award by the University.

(c) This flexibility shall also enable academically weaker students to conduct their studies at a slower pace and complete their Degree requirements in more than eight semesters. The maximum duration for the course completion will be 12 semesters.

(d) Clause (3) above shall be applicable to two types of students at the College:

i. Those wishing to complete the Degree requirements comfortably without encountering failure in any course;

(e) In both the above cases, a student shall have to complete the Programme requirements for the Degree of 170 credits within 12 semesters. Failure to complete the Programme requirements by any student in this period shall lead to the cancellation of his/her admission to the College forthwith. The Senate on case to case basis on the recommendations of the Director and Dean-Academics can extend the term.

(f) A student will not be awarded degree if his/her CGPA at the end of the course is less than 5. For such students the performance improvement scheme is recommended wherein he/she is eligible to take any three subjects for the improvement.

14. Temporary Withdrawal:

(a) Student shall be permitted to withdraw temporarily from the College on the grounds like prolonged illness, grave calamity in the family or any other serious happening. The withdrawal shall be for periods which are integral multiples of a semester, provided that

i. He/She applies to the College within at least 6 weeks of the commencement of the semester or from the date he/she last attended the classes, whichever is later, stating fully the reasons for such withdrawal together with supporting documents and endorsement of his/her guardian.

ii. The College is satisfied that, even by taking into account the expected period of withdrawal, the student has the possibility to complete the Programme requirements of 170 credits within the time limits specified earlier.

iii. The student shall have settled all the dues or demands at the College including those of Hostel, Department, Library and other units.

(b) A student availing of temporary withdrawal from the College under the above provision shall be required to pay such fees and/or charges as may be fixed by the College until such time as the students name appears on the Roll List. However, it shall be noted that the fees/charges once paid shall not be refunded.

(c) Normally, a student shall be entitled to avail of the temporary withdrawal facility only once during his/her studentship of the Programme at the College.

15. Termination from the Programme:

A student shall be required to leave the College on the following grounds

i. Absence from classes for more than six weeks at a time in a semester

without leave of absence being approved by the competent authorities, shall result in the student's name being struck off the College rolls.

ii. Failure to meet the standards of discipline as prescribed by the College from time to time shall also result in the student being recommended by the Students Disciplinary Committee to leave the College.

16. Performance Assessment:

(a) There shall be achievement testing of all the students attending a course, like lecture course, laboratory/design/drawing course or a combination of the two. This shall be in two parts, as follows, both of them being important in assessing the students performance and achievement in the particular course:

1. Sessional, involving Continuous Internal Evaluation (CIE), to be normally conducted by the subject teacher all through the semester; This shall include mid-term tests, weekly/fortnightly class tests, home work assignments, problem solving, group discussions, quiz, seminar, mini-project and other means. The subject teacher shall announce the detailed methodology for conducting the various segments of CIE together with their weightages at the beginning of the semester.
2. Terminal, often designated as End Semester- Examination (ESE), to be conducted by the subject teacher, preferably jointly with an external examiner; This shall include a written examination for theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.
3. CIE and ESE shall have 40:60 weightage. A student's performance in a subject shall be judged by taking into account the results of CIE and ESE together.
4. The evaluation of the project work shall be based on Sessional Work assigned by the project supervisor, seminar presentation, project report and assessment by Project Evaluation Committee, as covered in Clause(7) later in this Section.
5. In the case of other requirements, such as, seminar, comprehensive viva voce and EAA the assessment shall be made as determined by the Grade Awarding Authority of the College.
6. While the conduct of CIE for a course shall be the responsibility of the subject teacher and the Department concerned, MSE and ESE shall be conducted centrally by the Examination Section of the College. The records of both CIE and ESE shall be maintained by the Examination Section.
7. The performance of students at every stage of the CIE shall be announced by the concerned subject teacher within a fortnight of the date of the particular assessment. The subject teacher shall also show the assessed answer books to the students before submission of the final marks to the Controller of Examinations.
8. The concerned subject teacher shall also be responsible to award letter grades to the students after the ESE is completed and to submit the final results of the course within one week of the last date of ESE to the Controller of Examinations through the Head of his/her Department.

(b) Question Papers: For being able to conduct achievement testing of the students in an effective manner, good question papers shall be used as the principal tool, making it necessary for the question papers at CIE and ESE to:

i. Cover all sections of the course syllabus uniformly;
ii. Be unambiguous and free from any defects/errors;
iii. Emphasize knowledge testing, problem solving & quantitative methods;
iv. Contain adequate data/ other information on the problems assigned;
v. Have clear and complete instructions to the candidates.

(c) Therefore, the question papers, particularly at ESE, shall be set covering the entire syllabus and the students given opportunity to answer questions from the full syllabus of the course by restricting their choice out of each unit in the syllabus. For this to be realized,

(d) Besides, the course syllabi shall be well drafted, be defect-free and properly unitized (or modularized) to enable the distribution of questions in the question papers to cover the whole syllabus. These aspects shall have to be taken into account, in particular, by the concerned DUPCs.

(e) There shall be two types of questions to be set by the subject teacher for the question papers at both CIE and ESE, viz.,

i. Multiple Choice Questions, having each question to be answered by tick marking the correct answer from the choices (commonly four) given against it. Such a question paper shall be useful in the testing of knowledge, skills, comprehension, application, analysis, synthesis, evaluation and understanding of the students. Usually, no more than 15- 20% of the questions in a paper for CIE or ESE shall be of this type.
ii. Comprehensive Questions, having all questions of the regular type to be answered in detail. Such a question paper shall be useful in the testing of overall achievement and maturity of the students in a subject, through long questions relating to theoretical/practical knowledge, derivations, problem solving and quantitative evaluation.

(f) Examinations: The College shall maintain a high standard in both CIE and ESE and ensure the declaration of final results including SGPA and CGPA of the courses attended by a student in a semester before the end of the semester as per the Academic Calendar. For meeting these requirements, the College shall take the following steps:

i. CIE shall be conducted exclusively by the subject teacher, who shall spell out the components of CIE in advance, maintain transparency in its operation, declare the evaluation results in time and return the answer scripts and assignment sheets to the students on a regular basis after the evaluation is completed. The teacher shall also solve the questions asked in the tests at the tutorial sessions for the benefit of weak students.
ii. ESE shall be preferably conducted jointly by the subject teacher and an external examiner appointed for this purpose by the College. In this case, considering the tight time schedule for the various tasks connected with ESE, the external examiner shall be associated with the teacher only in the setting of the question paper.

iii. The answer scripts of ESE shall be evaluated by the subject teacher only; but, an external review of the entire ESE shall be conducted under the aegis of the Board of Examiners of the College before declaring the results. This step shall be useful to the College to gain the confidence of the University on the fairness and transparency in the system.

iv. Suggested passing standard for each of the courses shall be 50marks from the CIE and ESE taken together.

v. Attendance at all examinations, both CIE and ESE of each course shall be compulsory for the students. Students having the following deficiencies shall not be permitted to attend the ESE:

A. Disciplinary action by the College pending against him/her;
B. Irregular in attendance at lecture/laboratory and other classes;
C. Failure to meet the standards of attendance prescribed;
D. CIE Performance far below the passing standard

(g) In the event of a final year student failing in a Laboratory course or scoring very low marks in the CIE of a subject or falling seriously ill during ESE, the subject teacher concerned shall have the discretion to grant the student extra time, not exceeding 12 weeks for satisfactorily completing the concerned course after awarding an I grade. If no such extra time is sought/granted, the concerned student shall have to re-register for the same in a succeeding semester and take steps to fulfill the requirements for the Degree award. The I grade shall be required to be converted into a regular grade within stipulated period indicated in the academic calendar.

(h) Re-Examination: There shall be no re-examination for any course at the College to take care of the failed students. Hence, the failed students shall re-register for the course (the same course, if it is hard core, or an alternative course, if it is a soft core or an elective) when it is offered again (either in a main or supplementary semester) and fulfill the passing standards laid down to earn the specified credits. However, there shall be make- up examination for a course to take care of students with the I or X grades in ESE.

(i) Make Up Examination: This facility shall be available to students who may have missed to attend the ESE of one or more courses in a semester for valid reasons and given the I grade; also, students having the X grade shall also be eligible to take advantage of this facility. The make up examination shall be held as per dates notified in the Academic Calendar. However, it shall be possible to hold a make up examination at any other time in the semester with the permission of the Dean, Academic Affairs. The standard of conducting this examination shall be the same as the normal ESE.

(j) Evaluation of Project work The project work shall be normally conducted in two stages, spread over one or two sequential semesters.

i. At the end of first stage, the student shall be required to submit for evaluation, a preliminary report of the work done before a prescribed date to the Project Coordinator, DUPC and present the same before an Internal Project Evaluation Committee. This shall be followed by taking up the second stage of work either in the same or the following semester.

ii. The Controller of Examinations shall receive a panel of names from the Chairman, DUPC for identifying the project examiners for the student, at least two weeks before the submission of the second stage of project work. This shall comprise of three unbound, typed copies of the project report (one for each examiner), prepared according to the prescribed format to be submitted to the Department at least one week before the date of oral examination.

iii. The Department shall record the date of submission of the project report and arrange to send copies of the same to the examiners a few days before the date fixed for the oral examination. The project coordinator shall notify the date of the oral examination to the examiners and also the student, with a copy marked to the Controller of Examinations. Then the project report shall be evaluated by the Project Evaluation Committee and the result submitted to the Project Coordinator, who in turn shall forward it to the Controller of Examinations.

iv. On successful completion of the oral examination, the student shall be required to submit two bound copies of the final, corrected project report, one being for the Department and the other for the project supervisor(s).

v. A student desirous of extension of time, up to a maximum of 3 months from the prescribed date for submission of the project report, shall seek permission for the same from the Project supervisor(s) and Head of the Department. The DUPC shall consider such requests, case by case, before giving the permission.

vi. If the DUPC is convinced that the progress of a student in project work is insufficient, the concerned students shall be temporarily awarded the I grade. Further, if the project report of the student is not submitted within the extended time period, the I grade shall be automatically converted to the FF grade.

vii. Such of the students who fail in the first stage assessment of project work shall be required to re-register for the first stage in the following semester. Likewise, those who obtain the FF grade in the second stage assessment shall be required to re-register for the same in the subsequent semester(s).

(k) The evaluation of performance in EAAc shall be done by the concerned faculty members, who shall communicate the student's performance to the Examination Section, soon thereafter.

17. Grading System:

(a) The College shall follow the award of letter grades and the corresponding grade points to the students based on their performance at the end of every semester, as given in Table 2, In addition to the grades given in the Table 2, the instructors shall use two transitional grades I and X as described in Clause (3) in this Section.

Table 2: Letter Grades and Grade Points

Grade	Grade Points
AA	10
AB	9
BB	8
BC	7

CC	6
CD	5
DD	4
FF	0
PP (Only for Compulsory Non Credit Subjects)	0
AU (Audit Subject)	0
NP (Only for Non Credit Subjects)	Not Passed

(b) A student is considered to have completed a course successfully and earned the credits if he/she secures a letter grade other than I, 'X' or FF in that course. Letter grade FF in any course implies failure in that course.

(c) The Transitional Grades I and 'X' shall be awarded by the teachers in the following cases:

i. Grade I to a student only on satisfactory attendance at classes and performance in other components of assessment, but absence from ESE in a semester for valid and convincing reasons acceptable to the Department, such as,
   A. Illness or accident, which disabled him/her from appearing at the examination;
   B. A calamity in the family at the time of the examination, which required the student to be away from the College;

ii. Grades X to a student on his/her overall performance in the course during the semester, highly satisfactory, i.e., high CIE rating, but a very low ESE performance resulting in an overall F Grade in the course.

iii. All the I and X grades awarded to the students shall be converted by the teachers to appropriate letter grades and communicated to the Academic Section (through Head of the Department) within two days of the respective make-up ESEs. Any outstanding I and X grades two days after the last scheduled make-up ESEs shall be automatically converted to FF grade.

(d) A *Semester Grade Point Average* (SGPA) shall be computed for all the students in a Department for each semester, as follows:

$$SGPA = (C_1 * G_1 + C_2 * G_2 + C_3 * G_3 + \ldots + C_n * G_n) / (C_1 + C_2 + C_3 + \ldots + C_n)$$

where, n is the number of courses registered during the semester, C_i is the number of credits allotted to a particular course, and G_i is the grade points corresponding to the grade awarded for the course.

(e) A *Cumulative Grade Point Average* (CGPA) shall be computed for all the students

in a Department at the end of each semester by taking into consideration their performance in the present and the past semesters as follows:

$CGPA = (C_1 * G_1 + C_2 * G_2 + C_3 * G_3 + \ldots + C_m * G_m) / (C_1 + C_2 + C_3 + \ldots + C_m)$

where, m is the number of courses registered upto that semester, C_i is the number of credits allotted to a particular course, and G_i is the grade points corresponding to the grade awarded for the course.

(f) Whenever, a student repeats or substitutes a course in any semester, the lower of the two grades obtained by him/her in the course shall be ignored in the computation of CGPA from that semester onwards and the students shall be given the benefit of a higher grade.

(g) Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such for ease of presentation. Whenever the CGPAs are to be used for the purpose of determining the merit ranking in a group of students, only the rounded off values shall be made use of.

(h) When a student gets the grade I or X for any course during a semester, the SGPA for that semester and the CGPA at the end of that semester shall be tentatively calculated ignoring the I and X graded course(s). The SGPA and CGPA for that semester shall be finally recalculated after conversion of I and X grade(s) to appropriate grade(s), taking into account the converted grade(s).

(i) Other academic requirements for the Programme include the following two certifications as indicated earlier in clause (5) of Section 10, viz., PP (Passed) and NP (Not Passed) for EAA. However, there shall be no grade points are associated with these certifications and they do not figure in the calculation of SGPA or CGPA. But, obtaining a PP shall be a mandatory requirement to qualify for, the Degree award.

(j) It shall be open to each student to take additional courses for audit from the fifth semester onwards, with the concurrence of the Faculty Advisor. Students having CGPA ¿= 8.0 shall be normally encouraged to take such courses. While the performance of the student in audited courses shall be included in the Grade Card, they do not contribute to SGPA or CGPA of the concerned student.

18. Method of Awarding Letter Grades:

(a) The subject teacher(s) shall award the letter grade(s) to students based on the marks secured by them in both CIE and ESE together in the course(s) registered. This shall be done by following a relative grading system based on the use of statistics, for which the IUPC shall make available an appropriate software package.

(b) The subject teacher(s) shall submit two copies of the result sheet for each course, giving both the marks and the grades awarded to the Head of the Department, before the due date specified in the Academic Calendar. This shall be forwarded to the Controller of Examinations soon thereafter by the Head of the Department, after preliminary scrutiny and moderation (if necessary) at the DUPC level.

(c) All the evaluated answer scripts of CIE in a subject shall be returned to the students

from time to time during the semester. However, the answer scripts of ESE shall only be shown to the students during the specified period after the evaluation and the detailed marks sheets together with ESE answer scripts and any other relevant papers connected with ESE shall be submitted by the subject teacher(s) to the Controller of Examinations who shall hold it for a period of at least one semester. Steps shall be taken to destroy the same only after obtaining permission from the Dean of Academic Affairs at the end of the prescribed period.

(d) Appeal: A student shall have the possibility to appeal to the Director against a subject teacher for awarding lower grade in a course than that expected by him/her, on payment of prescribed fees, before the commencement of the next semester. In such a case, the DUPC shall arrange a meeting of the aggrieved student together with a Committee comprising of the subject teacher, another subject expert from the College and the Head of the Department, who shall reconsider the evaluation done, show the answer script to the student. If the student is satisfied, the matter shall be closed at this stage. On the other hand, if a revision of marks allotted is called for, the same shall be carried out and all the records, including the Grade Card, corrected soon thereafter. In the latter case, the prescribed fee paid by the student shall be returned.

(e) Withholding of Grades: The Grades of a student in a semester shall be withheld and not declared if the student fails to pay the dues to the College or has disciplinary action pending against him/her.

19. **Eligibility for the Award of Degree**:

(a) A student shall be eligible for the award of B. Tech. Degree from the College and the University provided, he/she has:

(b) The Senate shall be the Recommending Authority for the award of B. Tech. Degree to students fulfilling the requirements specified under Clause (1) above and the Board shall be the Approving Authority.

(c) The Degree award shall then be granted by the University.

i. Completed all the prescribed credit requirements for the award of Degree with grade DD or higher, in each of the courses, like Theory, Laboratory, Studio, Workshop, Seminar and Project Work;
ii. Satisfactorily completed all the non-credit requirements with PP certification, covering EAA and Industrial Training, Field work, (if any);
iii. Obtained a CGPA of >= 5.00 at the end of the semester in which he/she completes all the requirements for the award of Degree;
iv. Paid all the dues to the College including the Department, Hostels, Library and other units; and,
v. No case or disciplinary action pending against him/her.

20. Eligibility for the CGPA improvement after completion of pre-requisite credits for the award of Degree:

Students who secure CGPA between 5 and 6.75 after completing the pre-requisite

credits for the award of degree, and wish to improve their CGPA are permitted for CGPA improvement. Such students be permitted to withdraw their grade in a given course with poor grade and permitted to reappear for the examinations for improving the grade and in turn CGPA.

a) Student can appear for grade improvement examination within one year from the date of passing his/her PG or UG Examination. He should not have taken (i) Leaving Certificate from the Institute and ii) Degree from University of Pune through convocation. He/she will submit a written application to dean academics seeking his/her permission to register for class improvement within one month from the date of declaration of result or one week before the date of convocation of University of Pune whichever is earlier. This application will be forwarded to dean academics through the Head of the Department from where he/she has graduated. No student will be admitted once the subject registration process of that semester ends.
b) For grade improvement student will have to take maximum 3 subjects in which he/she has secured DD or CD grades from the same semester in one stretch.
c) Student can choose maximum three theory courses from a particular semester offered for T.Y and B. Tech (either odd or even) in which he/she has secured DD or CD grade. Student will have to register for these courses in a particular semester in which those subjects are offered.
d) At the time of registration student will surrender all the original mark lists given to him by the institute He will have to give an affidavit on 100 Rs. judicial stamp paper that he/she will not do any use of surrendered mark lists till he/she gets official result of the subjects for which he/she wishes to appear for grade improvement. No change of subjects or drop of subjects will be allowed after registration.
e) Student wishing to improve his/her grade will have to pay appropriate fees as laid down by the institute time to time.
f) Student wishing to appear for grade improvement is exempted from attending regular classes as he/she has already undergone the course instructions but he/she will have to appear for all the evaluation tests conducted for the particular subjects. No re-exam or retest will be allowed for the class improvement, in case of such students misses any of the tests or examinations. Absentee for End-semester examination will automatically lead to award of FF grade in that subject.
g) The grading process as used for the regular students appearing for that subject will be applicable and no concession of any sort will be granted on account of absentee for any of the examinations.
h) Student wishing to use the facility of grade improvement will have to pass in all the three subjects at a time for which he/she has registered for. He/she will not be entitled for the summer term or re-examination in such cases.
i) Only one attempt will be permissible for any candidate wishing to use the facility of grade improvement. If the student fails to secure higher grades resulting in reduction in overall CGPA then the original resul t of the student before registering for grade improvement will be retained.
j) Student who improves his/her CGPA will be issued fresh mark lists by the institute. These mark lists will have star against the subjects for which he/she has appeared for grade improvement and will state *"Grade Improvement".* The date on the new

mark lists will be that as issued for other students appearing in those subjects. Name of the student will be communicated to Pune University and he/she will have to apply for degree certificate from University of Pune thereafter.

21. Honors and Minor Certification Schemes at the Institute (To be implemented w.e.f A.Y. 2017-18 for Third Year Students:

- Aspiring student has to register for additional FOUR THEORY courses and acquire a additional (minimum) 12 credits (3 credits/course) for any ONE of BOTH the Schemes.
- Honors Certificate for Vertical in his/her OWN Branch for Research orientation; Minor in any OTHER Branch for Improving Employability.

- **For MINOR scheme:**
  - Every Department to develop and submit 'Minor-Courses-List' of 5-6 Theory courses with Titles and detailed syllabi, separately.
    - e.g. E & TC dept.: Linear & Digital ICs, DSP, Embedded Processors, Digital Communication, Communication Networks.
  - Student from ANY department is ELIGIBLE to apply for Minor from ANY OTHER DEPARTMENT.
  - The Scheme would start from 5th Semester of UG program and applicant must have a minimum CGPA of 6.0 (up to 4th Sem).
  - Host Department to float a SINGLE course from Minor-List, ONE in EVERY Semester starting from 5th Semester (Four courses in Four Semesters viz. 5, 6, 7, 8).
  - NO Lab course/Internship/Mini-project/MOOC permitted in Minor Scheme.
  - All Minor Courses to be designed and delivered by Departments only.

- **For HONORS Scheme:**
  - Every Department to develop and submit a 'Honors-Courses-List' of 5-6 Theory courses with Titles and detailed syllabi. MOOCs are permitted to be part of the list, so also a few PG courses. Multiple Verticals are encouraged. (e.g. Digital Communication/Signal Processing/Communication Networks/VLSI Design/Embedded Systems/ etc.)
  - Student from Host Department to undertake the Honors scheme for his/her own branch.
  - Scheme would begin from 5th Semester of UG program.
  - Applicant should have CGPA score of 6.0 (up to 4th Semester)
  - Host Department to float the courses from Honors-List as ONE in each Semester (viz. 5th, 6th, 7th, 8th Sem, of which preferably the SECOND course could be a MOOC from NPTEL/edX/Coursera/Udacity//PurdueNext/Khan Academy/QEEE etc. with examination given by the Department.

- **Implementation:**
  - 01 Minor & 01 Honors each = 02 Courses in every Semester beginning from 5th Sem. upto 8th Sem. Total: 08 Courses.
  - A Student opting for 'Honors' will NOT be ENTITLED to register for 'Minor'.
  - Allotment of SLOT in Time table on the line of ILOE (e.g. Mon-Wed: 9 to 10 am).
  - Department to identify and appoint a faculty member as 'Honors/Minor Coordinator' for guiding the aspirants.

- **Specific Remarks:**
  - Normal UG program for B.Tech. degree is therefore of **reduced credits in comparison to previous iterations of Curriculum revision, (170 credits across Eight semesters).**
  - Mediocre learner would find it bit easier to complete the program with good scores, with such reduced credits.
  - So, for Brighter Students opting Honors/Minor scheme, the UG program would be of **170 + 12 = 182 credits**.
  - Average learners can receive B.Tech degree with normal 170 credits.
  - The remedial assessment schemes such as Re-examination or Summer term will NOT be applicable for Minor or Honors schemes. Student failing in any of the Minor or Honors courses, at any stage will be discontinued from the Scheme.
  - The schemes shall also be open for Second Year Direct Admitted Diploma Students, with CGPA of Second Year at COEP exceeding 6.0.

******

Program Education Objectives (PEOs):

The Graduates will be able to

I. Have successful career in the diversified sectors of the engineering Industry and / or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals.

II. Analyze and design Civil engineering systems with social awareness and responsibility.

III. Exhibit professionalism, ethical approach, communication skills, team work in their profession and adapt to modern trends by engaging in lifelong learning.

Program Outcomes (POs):

The Undergraduate Students will be able to..

(a) apply knowledge of mathematics, science and engineering to civil engineering problems.

(b) identify, formulate, research literature and solve complex civil engineering problems.

(c) design various structures or particular system that meets desired specifications and requirements.

(d) design and conduct experiments, interpret and analyze data, synthesize the information to provide conclusion.

(e) select and use appropriate engineering techniques and software tools to analyze civil engineering problems with understanding of limitations.

(f) assess local and global impact of societal issues on civil engineering profession.

(g) able to understand the impact of engineering solutions on society and demonstrate the knowledge of, and need for sustainable development.

(h) demonstrate their professional and ethical responsibilities.

(i) able to function as a member or a leader on engineering and science laboratory teams, as well as on multidisciplinary teams.

(j) communicate effectively in both verbal and written forms.

(k) understand engineering and management principles and apply to their work as a member and/ or leader in a team to manage projects.

(l) adapt transform in industry by understanding the need of independent and lifelong learning.

Correlation between the PEOs and the POs

Program Educational Objectives	Program Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
I	√	√			√						√	
II		√	√	√	√				√			
III						√	√	√	√	√	√	√

Note: The cells filled in with ✓ indicate the fulfilment/correlation of the concerned PEO with the PO.

List of Abbreviations

Abbreviation	Title
S.P. P.U.	Savitribai Phule Pune University
A.Y.	Academic Year
BSC	Basic Science Course
EFC	Engineering Foundation Course
MLC	Mandatory Learning Course
ILOE	Institute Level Open Elective Course
SLC	Self Learning Course
HSMC	Humanities/Social Sciences/Management Course
LLC	Liberal Learning Course
SBC	Skill Based Course
PCC	Program Core Course
DEC	Department Elective Course
LC	Laboratory Course

Semester III [Odd Term]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Ordinary Differential Equations and Multivariate Calculus	2	1	0	3
2	BSC	Science of Living Systems	3	0	0	3
3	PCC1	Building Planning, Design and Construction	4	0	0	4
4	PCC2	Strength of Materials	2	1	0	3
5	PCC3	Fluid Mechanics	3	1	0	4
6	SBC	Building Planning, Design and Drawing Lab	0	0	4	2
7	LC1	Strength of Materials Lab	0	0	2	1
8	LC2	Fluid Mechanics Lab	0	0	4	2
		Total	14	3	10	22
		Total Academic Engagement and Credits	**27**			**22**

Semester IV [Even Term]

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Vector Calculus and Partial Differential Equations	2	1	0	3
2	MLC	Professional Ethics & Values	1	0	0	0
3	HSMC	Innovation	1	0	0	1
4	ILOE	Basic Civil Engineering [For other Departments]	3	0	0	3
5	PCC1	Surveying	3	1	0	4
6	PCC 2	Concrete technology	3	0	0	3
7	PCC3	Structural Mechanics	3	0	0	3
8	PCC4	Environmental Engineering	3	0	0	3
9	SBC1	Surveying Laboratory	0	0	4	2
10	SBC2	Concrete technology Lab	0	0	2	1
11	LC	Environmental Engineering Lab	0	0	2	1
		Total	19	2	8	24
		Total Academic Engagement and Credits	**29**			**24**

Semester III (For Direct Second Year Admitted Diploma Students)

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Linear Algebra and Univariate Calculus	4	1	0	5
2	BSC	Science of Living Systems	3	0	0	3
3	BSC	Foundations of Physics	3	0	0	3
3	PCC1	Building Planning, Design and Construction	4	0	0	4
4	PCC2	Strength of Materials	2	1	0	3
5	PCC3	Fluid Mechanics	3	1	0	4
6	SBC	Building Planning, Design and Drawing Lab	0	0	4	2
7	LC1	Strength of Materials Lab	0	0	2	1
8	LC2	Fluid Mechanics Lab	0	0	4	2
		Total	16	3	10	24
		Total Academic Engagement and Credits	**29**			**24**

Semester IV (For Direct Second Year Admitted Diploma Students)

Sr. No.	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	BSC	Multivariate Calculus and Differential Equations	4	1	0	5
2	MLC	Professional Ethics & Values	1	0	0	0
3	HSMC	Innovation	1	0	0	1
4	ILOE	Basic Civil Engineering [For other Departments]	3	0	0	3
5	PCC1	Surveying	3	1	0	4
6	PCC 2	Concrete technology	3	0	0	3
7	PCC3	Structural Mechanics	3	0	0	3
8	PCC4	Environmental Engineering	3	0	0	3
9	SBC1	Surveying Laboratory	0	0	4	2
10	SBC2	Concrete technology Lab	0	0	2	1
11	LC	Environmental Engineering Lab	0	0	2	1
		Total	21	2	8	26
		Total Academic Engagement and Credits	**31**			**26**

Semester-III

(MA 16001) Ordinary Differential Equations and Multivariate Calculus

Teaching Scheme:
Lectures : 2 Hrs/week
Tutorial: 1Hr/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Outcomes:

Students will be able to:

1. know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)
6. organize and present thoughts. (To measure this outcome, questions may asked to write summaries and short notes on a given topic.)

Unit I **[10hrs)**

Review of first order differential equations, Reduction of order, linear differential equations, homogeneous higher order linear differential equations, non-homogeneous higher order linear differential equations with constant coefficients and reducible to differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters), systems of differential equations, applications to orthogonal trajectories, mass spring systems and electrical circuits.

Unit II **[05hrs)**

Functions of several variables, level curves and level surfaces, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points, constrained optimization.

Unit III **[11hrs)**

Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates, substitutions in multiple integrals, Applications to Area, Volume, Moments and Center of Mass.

Text Books:

- Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, 12th Edition.
- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley eastern Ltd., 10th Edition.

Reference Books:

- K.D. Joshi, "Calculus for Scientists and Engineers", CRC Press.
- Sudhir Ghorpade and Balmohan Limaye, "A Course in Multivariate Calculus and Analysis", Springer Science and Business Media.
- George Simmons, "Differential Equations with Applications and Historical notes", Tata Mc-Graw Hill publishing company Ltd, New Delhi.
- C.R. Wylie, "Advanced Engineering Mathematics", McGraw Hill Publications, New Delhi.
- Peter V. O' Neil, "Advanced Engineering Mathematics", Thomson Brooks / Cole, Singapore, 7th edition.

(AS 16001) Science of Living System

Teaching Scheme
Lectures : 3 lectures/week

Examination Scheme
T1-**20** (Classroom activity),
T2-**20** (Assignment/s)
Semester End Examination-**60**

Objectives: To make students conversant with basic Biology regarding the life processes. To impart knowledge about the common corridors of biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, bioimaging, bioinformatics, bioinstrumentation etc. To introduce recent trends in biology viz. genetic & tissue engineering, stem cell engineering, bio and nanotechnology etc. with the objective of appreciating engineering principles in biological systems.

Unit 1: Understanding Basics (6L)

1. Engineering perspectives of biological sciences: Where engineering meets biology and where biology meets engineering. Biology as an integrated Science; Case studies on integrating biology with engineering.
2. Biopolymers and macromolecules – Structure and Function: Organic and inorganic molecules; Unique Properties of Carbon; Carbohydrates, Amino Acids and proteins, Lipids, Nucleic Acids, Vitamins and Minerals; The Rise of Living Systems.

3. Levels of organization of life : Cell as basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Levels of organization of life - tissues, organs, systems and organism.

Unit 2: Biological Processes and Bioenergetics (6L)

1. **Energy Dynamics in Biology –**
    a) Photosynthesis and energy assimilation: aerobic and anaerobic systems. Applications
    b) Respiration and Electron Transport Chain: Mitochondria and respiration, ATP generation.
2. **Bioenergetics:** Thermodynamic principles applied to biology, negative entropy changes in biological systems, Free Energy, Chemical Equilibrium;
3. **Optimization of biological functions**: Metabolic networks; anabolism and catabolism; flux analysis (MATLAB).

Unit 3: Living Systems (6L)

1. **Transport Phenomena in Biological Systems:** Membrane channels and ion channels; Fluid flow and mass transfer
    a. In plants: Xylem and Phloem
    b. In animals: Blood and Lymph
    c. Transport of molecules and gases (Oxygen and Carbon dioxide); Heat Transport - Body temperature regulation.

2. **Communication:** Cell junctions, Cell-cell communications – cell signaling, Hormones, Pheromones; Chemotaxis. Communication in living systems by photo, bio, chemotactic methods.
3. **Defense mechanisms in plants and animals:**
    a. In plants: Herbivory, secondary metabolites.
    b. In animals: Innate and Adaptive immune systems.

Unit 4: Techniques and Devices (6L)

1. **Genetic Code** - Expression and Transmission of Genetic Information, The concept of DNA cloning; Mechanisms of Enzyme Action.
2. **Techniques for optimization:**
    a. At molecular level: Genetic Code and protein synthesis, DNA replication, RDT, DNA hybridization, Colony Hybrids, PCR, DNA microarray,
    b. At cell level: Hybridoma technology,
    c. At tissue level: Plant Tissue Culture, Animal Tissue Culture and Microbial Culture techniques; Tissue Engineering.
3. **Instrumental Methods of analysis** – A case study of protein purification and characterization: Principles and types of microscopy and spectroscopy, Chromatography, electrophoresis, diffusion, centrifugation, light scattering.

Unit 5: Discovery and Innovation (6L)

1. **Current trends and advances** in cell and molecular biology
2. **Landmark Discoveries**: Landmark discoveries in the field of Molecular Biology, Cell Biology and Genetics.
3. **Nanobiotechnology:** Micro-/Nanotechnologies for Interfacing Live Cells; Nanotechnology in Medicine – Diagnostics and Therapy; Biosensors; Nanotechnology in Agriculture; Biomemetics.
4. **Biomemetics:** Nature inspired processes applicable to the field of Engineering.

Unit 6: Branch-wise

Branch: Electronics and Telecommunication Engineering

Biosensors – Introduction to Biosensors, transducers, amplifiers; **Bioimaging**-Introduction to medical imaging and different medical Imaging modalities; Review of Signals and system; Electro Physiological Signal Analysis. Bio-telemetry Communication in living systems by photo, bio, chemo, tactic methods; **Diagnostic Devices**- Radiography, X-ray Computed Tomography Nuclear Medical Imaging, Ultrasound Imaging, Magnetic Resonance Imaging. **Therapeutic Devices**-Cardiac Pacemakers, Cardiac defibrillators, Surgical Diathermy, Diagnostic application of LASERs, High frequency heat therapy, Hemodialysis, Ventilators, Anesthesia machines, Automatic Drug delivery Systems, Electro Surgical units and safety.

Branch: Instrumentation and Control Engineering

Basic concepts of **Medical Instrumentation**: Generalized medical Instrumentation System, Medical Measurement constraints, Classification of Biomedical Instruments, Generalized static and dynamic characteristics, Design criteria, Commercial Medical Instrumentation Development process, Regulation of Medical Devices. **Biomedical transducers:** optical, photo- electric, electrochemical, electrical, mechanical, electromechanical and thermoelectric. **Specialty areas in Bioinstrumentation**—Confocal, Tunneling, Sequencing, FACS, PCR, MRI, CT,USG, Endoscopy, ECG; Introduction to biosensors and tissue engineering.

Branch: Mechanical Engineering

Biomechanics, Human body motion, Prosthetics; Introduction to Ergonomics; Elements of Anthropometry; Physiology, Anatomy; Mechanical Properties of Bone and Soft Tissues Rehabilitation engineering, Biomimetics; Bio Material Handling; Hand Tool Design; Human Information Processing; Applications of Principles of Biomechanics in two and three dimensional kinematics; Fundamentals of Fluid Mechanics; Introduction to bio sensors and tissue engineering.

Branch: Metallurgy and Material Science

Classification of biomaterials –Comparison of properties of some common biomaterials; Effects of physiological fluid on the properties of biomaterials; Biological responses (extra and intra vascular system) to Metallic, Ceramic and Polymeric implant materials; Introduction to bio sensors and tissue engineering. Metals & alloys, composites and their advantages used in bio-industries; Materials in bio-printing. **Tissue Engineering and cloning:** Engineering cells, tissues and organs; Stem cells and translational medicine; Introduction to Gene Therapy; Bioengineering at molecular, cell and systems level; 3D bio-printing; Engineering Materials for Biomedical Applications.

Branch: Production Engineering and Industrial Management

Bio chemical engineering; Fermentation Technology, Bioreactors; Bio process Engineering; Use of living organisms (mostly microbes) to produce useful products. Biomechanics and ergonomics–production innovations.

Branch: Electrical Engineering
Alternative energy sources; Electrical signaling in biological system; Bioluminescence, bioelectricity, ECG.

Branch: Civil Engineering
Environmental engineering, Understanding ancient engineering. Designs in Nature; Bio radars.

Branch: Computer and Information Technology –
Principles of Bioinformatics, Computational Biology: Role of Computational Biology in Bioengineering; Genomics, Proteomics, Bioinformatics. Computational solutions to Biological Problems, Virtual systems Artificial Intelligence in Biomedical Engineering: Basics of Artificial Neural Networks.

References:

1. Lodish H, Berk A, Zipursky SL, et al. (2000) Molecular Cell Biology. W. H. Freeman.
2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). *Lehninger principles of biochemistry*. New York: Worth Publishers.
3. Lewin B. (2000) Genes VII. Oxford University Press..
4. Rao CNR, et.al. Chemistry of Nanomaterials: Synthesis, Properties and Applications.
5. Eggins BR. (1006) Biosensors: An Introduction. John Wiley & Sons Publishers.
6. Palsson B.O. and Bhatia S.N. (2009) Tissue Engineering. Pearson.

(CE16001) Building Planning, Design and Construction

Teaching Scheme:
Lectures : 4 hrs/week
Tutorial : ----

Examination Scheme:
Assignments /Quiz- 40 Marks,
End - Sem Exam – 60 Marks

Course Outcomes:
Students will be able to

1. Identify and analyze different building components, their properties, and their applications in construction.
2. Design various building services.
3. Apply D.C. rules, Develop basic planning skills, and design residential /public buildings/commercial buildings

Unit 1 **(9hrs)**
Introduction to building construction:
Super structure and Substructure,
(A) Footings and foundation

Bearing capacity of soil and rock, necessity and concept of site investigation, Foundation types – shallow and deep and their suitability, setting out and layout of foundation plan, Damp proof course, basement construction, plinth filling and soling, under pinning

(B)Masonry Construction

(a) Stones and stone masonry:

Stones – Requirements of good building stones, IS specification and tests on stones ; Stone masonry – principal terms, Detailing of constructions – procedure for UCR and CR masonry, Mortar preparation, types of mortar, Pointing – Purpose and types.

(b) Brick and block masonry:

Characteristics of good building bricks, IS specifications and test; Classification of bricks¬ silica, refractory, fire etc; Brick work – terms, types of bonds – English, Flemish, Stretcher, Header; Construction procedure, supervision, Openings in walls, mortar preparation; Block masonry – Hollow, solid, cavity wall construction; Scaffolding – types.

Unit 2 **(8hrs)**

Building materials

A) **Materials of doors and windows,** types, glazing, method of fixing doors and windows, fixtures and fastenings.

(B) Flooring materials tests and IS specifications:

Ground and upper floors; Flooring- functional requirements of flooring material, varieties of floor finishes and their suitability, construction details for concrete, tiles and stone flooring.

Unit 3 **(8 hrs)**

(A) Roofing materials:

GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability, method of construction, types of trusses, types of shell structures, space and frame structures.

(B)Protective coatings:

Plastering types and application, mortar; Painting and varnishing, types and application ; White washing, distempering, oil paints ; Wall cladding – materials, methods of fixing, wall papering and glazing work

Unit 4 **(9 hrs)**

Principles of Building planning and Development Control Rules, Principle of planning of Buildings, Principles of Architectural design – form, function, utility, aesthetics. Integrated approach in Built Environment, Building Rules and Byelaws.

Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distances, building line control line, height regulation, room sizes, types of area calculations – built-up area, floor area, carpet area, Rules for ventilation, lighting, drainage, sanitation and parking of vehicles ; Landscape elements and elements of interior decoration.

Unit 5 **(8 hrs)**

(A) Noise and acoustics: Effect of noise, comfort standards, noise control, sound insulation. Acoustics – reverberation, Sabine's formula, acoustical defects, conditions of good acoustics, sound absorbents, and acoustics for various types of buildings.

(B) Building Types and layout details

Planning of residential buildings – Load bearing / Framed Structure – (a) Bungalows (b) Row houses, (c) Ownership flats, (d) Apartments. Layout details , Elevation , sectional details

Unit 6 **(8 hrs)**

Planning of public buildings

Functional requirements of public buildings. Following types of public buildings may be considered for planning. Educational Buildings, Hostel building with Rector's and servants' quarters, Lodge/Hotel building, Primary Health center with Hospital-staff quarters, factory building-Administrative block and factory, Bus Stand, Library building, Shopping complex, Health club, Marriage hall, auditorium, multiplex, sports complex, restaurant, vegetable market, post office, bank and any other.

Text Books:

- Shah M.G., Kale C.M. and Patki S.Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition).
- Mentt, "Building Design and Constructions", Tata McGraw Hill (Second edition)
- Punmia B C " Building Construction

Reference Books:

- Schild E, Casselmann H.F., Dahmen G., Pohlenz R. "Environmental Physics in Construction", Granada Publishing, London.
- National Building Code of India 2005, Bureau of Indian Standard, New Delhi
- Jain V.K. "Fire safety in Buildings" new Age International Publisher
- Barrid, "Building Construction" Tata McGraw Hill, New Delhi
- Ghosh,"Materials of Construction" Tata McGraw Hill
- CBRI, Roorkee , "Building Construction manual '.
- TTTI Chandigrah, "Civil Engineering Materials", Tata McGraw Publication
- Callender," Times Savers Standards of Architectural Design Data", Tata McGraw Hill

(CE 16002) Strength of Materials

Teaching Scheme	**Examination Scheme**
Lectures : 2 hrs/week	T1 and T2: 20 Marks each
Tutorial : 1 hr/week	End-Sem Exam: 60 Marks

Course outcomes:

Students will be able to:

- Analyze isotropic structural members subjected to axial forces and temperature variations.
- Analyze statically determinate beams and circular shafts (determinate and indeterminate)
- Find principal stresses and strains in structural members.

Unit 1 **(5hrs)**

Simple stresses and strains

a)Stress and strain (linear, lateral, shear and volumetric), Generalized Hooke's law. Elastic constants and their relationship for isotropic materials

b) Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self weight and temperature changes.

Unit 2 **(5hrs)**

a) Shear force and bending moment diagrams for determinate beams

Concept and definition of shear force and Bending Moment. Beams under various kinds of loading

b) Stresses in beams due to bending

Theory of pure bending, Flexure formula. Bending stress distribution diagram, Moment of resistance and section modulus.

Unit 3 **(5 hrs)**

a) Stresses in beams due to Shear

Shear stress distribution diagram for common symmetrical sections (with at least one axis of symmetry), maximum and average shear stress, Flitched beams.

b) Torsion of circular shaft

Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solids ections of homogenous and composite materials subjected to torsion

Unit 4 **(5 hrs)**

Principal planes and stresses

Normal and shear stresses on any oblique plane and concept of principal planes and principal stresses by analytical and graphical methods (Mohr's circle of stress 2-D). Combined Effects of axial force, bending moment, shear force and Torsional moment. Theories of failure: Maximum normal stress, Maximum shear stress and Maximum strain energy theory.

Unit 5 **(5 hrs)**

a) Axially loaded columns.

Critical load and buckling, Euler's formulae for column with hinged ends, equivalent length for various end conditions. Rankine's formula

b) Direct and Bending Stresses:

Eccentrically loaded short columns including biaxial cases, retaining walls, dams, chimneys. Core of section for standard symmetrical sections.

Unit 6 **(5 hrs)**

Slope and Deflection of Determinate Beams

a) Double integration method (McCauley's method).

b) Moment Area method

c) Conjugate beam method

Text Books:

- Beer and Johnston, “Mechanics of Material”, Tata Mc Graw Hill publication.
- F. L. Singer and Pytel, “Strength of Material”, Harper and Row publication.

Reference Books:

- Gere and Timoshenko, “Mechanics of Materials”, CBS publishers.
- J.B. Popov, “Introduction to Mechanics of Solids”, Prentice Hall publication
- James M.Gere, “Mechanics of Materials”, Brooks/Cole Thomson Learning,(Fifth edition)
- Andrew Pytel and Jaan Kiusalaas, “Mechanics of Materials” , Thomson Learning, 511, Fo rest Lodge Road, Pacific Grove, USA

(CE 16003) Fluid Mechanics

Teaching Scheme:
Lectures : 3 hrs/week
Tutorial : 1 hr/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course outcomes:

Students will be able to:

1. understand fluid mechanics fundamentals, including concepts of mass and momentum conservation.
2. apply the Bernoulli equation to solve problems in fluid mechanics.
3. apply control volume analysis to problems in fluid mechanics.
4. use potential flow theory to solve problems in fluid mechanics.
5. perform dimensional analysis for problems in fluid mechanics.
6. Understand laminar and turbulent boundary layer fundamentals.

Unit 1 **(6hrs)**

A) Properties of Fluid:

Physical properties of fluids: density, specific weight, specific volume, relative density, Newton's Law of Viscosity, dynamic and kinematic viscosity, Classification of fluids, Reheological diagram, Newtonian and Non Newtonian fluids, ideal and real fluids, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure.

B) Dimensional Analysis and Model studies:

Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Bukingham's Pai theorem, important dimensionless parameters and their significance. Geometric; Kinematic and Dynamic similitude; Model laws, Type of models, Applications of dimensional analysis and studies to fluid flow problems.

Unit 2 **(6hrs)**

A) Fluid Statics:

The basic equation of hydrostatics, concept of pressure head, Measurement of pressure datum (absolute, gauge), Application of the basic equation of hydrostatics. Piezometers, Simple and differential manometers, inclined manometers, Introduction to pressure transducers. Total pressure, Center of pressure for plane and curved surfaces, Pressure Diagrams, Practical applications (gate, dams, lock gates)

B) Buoyancy and Floatation:

Principle of floatation and Buoyancy, Equilibrium of floating bodies, Stability of Floating bodies, metacentre, metacentric height and its determination (experimental and analytical), Stability of submerged bodies . Relative Equilibrium of liquids: Fluid masses subjected to uniform linear acceleration and rotational.

Unit 3 **(8 hrs)**

A) Fluid Kinematics:

Methods for describing the motion of fluid; Velocity and acceleration of fluids, Type of flow: Steady and unsteady, uniform and nonuniform, Laminar and Turbulent, one, two and three dimensional flows in Cartesian co-ordinate, Equation for one dimensional flow along a streamline, Rotational and irrotational motions, Circulation and vorticity, Derivation of Cauchy's Riemann equation, Velocity potential, stream function and flow net, Method of drawing flow net, use and limitation of flow net,

B) Fluid Dynamics

Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, Assumptions of Bernoulli's equation, Kinetic energy correction factor, Hydraulic Grade line and total energy line, Linear momentum equation and momentum correction factor, angular momentum, Application of continuity, Bernoulli and momentum equations.

Flow through orifices and mouthpieces under free and submerged condition, venturi meter, orifice meter, Nozzle meter, rotameter and pitot tube

C) Flow over Notches and Weirs:

Classification of notches and weirs, Discharges over a sharp crested rectangular notch, velocity approach, end contractions, discharges over a triangular notch, trapezoidal notch, Cippoletti notch, Ventilation of weir, time required to empty a tank.

Unit 4 **(7 hrs)**

A) Laminar Flow:

Reynolds Experiment, Laminar flow through a circular pipe, Flow between tow fixed parallel plates, Stoke’s law, Methods of measurement of viscosity, Flow through porous media, Darcy's law, Transition from laminar to turbulent flow.

B) Boundary Layer Theory:

Development of boundary layer on a flat plate, Nominal, displacement, momentum and Energy thicknesses. Laminar, turbulent and transitional boundary layer, Application of momentum equation for boundary layer development, Local and mean drag coefficient, Hydro dynamically smooth and rough boundaries, Boundary layer separation and its control.

Unit 5 **(7 hrs)**

A) Flow through Pipes:

Energy losses in pipe flow (major and minor losses) , Flow through pipes such as simple, compound, parallel, branched pipes and siphons, Dupit's equation, Hydraulic transmission of power through pipes, introduction to three reservoir problem and pipe network.

B) Turbulent Flow:

Characteristics of turbulent flow, instantaneous velocity, temporal velocity, scale of turbulence and intensity of turbulence , semi-empirical theories to estimates shear stress in turbulent flows using Boussinesq's theory, Prandtl's mixing length theory, velocity distribution in turbulent flow, Prandtl's velocity distribution equation, Karman Prandtl velocity distribution equations for smooth and rough boundaries, Equation for mean velocity for pipes, Darcy flow; Nikuradse's experiments on artificially roughened pipe, Friction factor for commercial pipes. Moody's diagram, explicit equation for friction factor.

Unit 6 **(6 hrs)**

A) Fundamentals of Open Channel Flow:

Difference between pipe flow and open channel flow. Types of open channel flow. Uniform and Nonuniform flow. Concept of specific energy and specific force. Sub-critical, critical and super-critical flow, type of channel transition, Continuity Equation and Momentum Equation for open channel flow.

B) Introduction to Hydraulic Machinery:

Concept of impact of jet. Jet impinging on a stationary plate, jet impinging on a moving plate (straight and inclined). Jet striking the plates mounted on a circular wheel. Types of Turbines (Pelton Wheel and Reaction Turbine). Types of Pumps.

Note: More emphasis would be given on numericals in the course

Tutorials/Assignments

i. Assignment based on the properties of fluid and dimensional analysis.
ii. Assignment based on the fluid statics and buoyancy and floatation
iii. Assignment based on the fluid kinematics and fluid dynamics
iv. Assignment based on the Application of Bernoulli's equation
v. Assignment based on the notches and weirs
vi. Assignment based on the laminar flow theory
vii. Assignment based on the boundary layer theory
viii. Assignment based on the turbulent flow
ix. Assignment based on flow through pipes
x. Assignments based on the flow through pipes
xi. Assignment based on the open channel flow

Text Books:

- Modi, P. N. and S. N. Seth " Hydraulics and Fluid Mechanics", Standard book house, New Delhi, ISBN: 978-81-89401-26-9

- Bernard Massey and John Ward Smith, " Mechanics of Fluids", Taylor and Francis, 8 Edition (2006) London and New York.
- Douglas J. F. Gaisorek J. M. , Swaffield J. A., "Fluid Mechanics" Addison-Weisley Harlow 1999.
- Shames I. H., " Mehcanics of Fluids", Mc Graw-Hill, New York 1992.

Reference Books:

- R. J. Garde and Mirajgaonkar, " Fluid Mechanics Through Problems", New Age International
- Streeter V.L. Wylie E. Benjamin, “Fluid Mechanics ", Mc Graw Hil, London, 1998.

(CE 16004) Building Planning, Design and Drawing Laboratory

Teaching Scheme:
Studio: 4 hrs/week

Examination Scheme:
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes:

Students will be able to

1. Prepare freehand sketches/ drawings for different components of buildings.
2. Design and Prepare set of multi-layer architectural and working drawing for various types of buildings.
3. Draw various types of building drawing using AUTOCAD

SECTION I

Term Work

It shall consist of the following

(A) Free hand sketches: (Minimum Two from each)

Types of Stone masonry 2 plate

Types of Brick masonry 2 plates

Types of foundation – 1 plate

Types of door – detailed plan, elevation and section – 1 plate

Types of window – 1 plate

Types of stairs – 2 plates

Types of arch – 1 plate

B) Measured Drawing of any one building

SECTION II

(C)Students will prepare working drawings of any one residential, commercial or public building

Working drawing: Scale 1: 50 or suitable

Layout plan

Plan/typical floor plan(by hand as well as by Auto CAD)

Elevation (by hand as well as by Auto CAD)
Foundation plan
Sectional Elevation
Parking plan
Axonometric view/perspective view
Water supply and drainage layout

(D) Report file: It shall consist of
Data given for the project
Analysis of the program
Planning considerations and line plans
Approximate cost of the building.

(CE 16005) Strength of Materials Laboratory

Teaching Scheme:
Practical : 2 hrs/week

Examination Scheme:
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Test different materials using IS codes.
2. Interpret the test results according to IS requirements.
3. Decide whether the materials are fit or otherwise for use.

The laboratory consists of any 8 experiments from PART A. PART B is compulsory.

PART – A: List of Experiments

Experiment 1: Tension test on Mild Steel, Torsteel, and Aluminum
Experiment 2: Shear test on Mild Steel and Aluminum
Experiment 3: Torsion test on Mild Steel & Cast iron
Experiment 4: Impact test on Mild Steel, Aluminum, Copper, Brass, Cast iron
Experiment 5: Hardness test on Mild Steel, Copper, Aluminum, Brass & Cast iron
Experiment 6: Bending test on Timber and plywood
Experiment 7: Bend- re-bend test on mild steel and Torsteel
Experiment 8: Flexure test on Mild Steel.
Experiment 9: Tests on bricks:
a) Compressive strength test
b) Water absorption test
c) Efflorescence Test
Experiment 10: Tests on tiles:
a) Flexural strength of flooring and roofing tiles
b) Abrasion test of flooring tiles-cement and marble mosaic

PART – B: List of Assignments

At least four assignments based on any four units of theory.

(CE 16006) Fluid Mechanics Laboratory

Teaching Scheme:
Practical : 4 hrs/week

Examination Scheme:
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Identify, name, and characterize flow patterns and regims.
2. Understand basic units of measurement, convert units and utilize basic measurement techniques of fluid mechanics.
3. Demonstrate practical understanding of various equation of Bernoulli,
4. Demonstrate practical understanding of friction losses in internal flow and boundary layers.
5. Demonstrate the ability to write clear lab reports.

List of Experiments

1. Measurement of viscosity
2. Study of laminar flow in Heleshaws apparatus
3. Study of pressure measuring devices
4. Study of stability of floating bodies
5. Study of laminar flow in Reynolds apparatus
6. Verification of Bernoulli's theorem
7. Calibration of Venturimeter
8. Calibration of Orifice meter
9. Calibration of Orifice
10. Calibration of rectangular notch
11. Calibration of triangular notch
12. study of major losses in pipe
13. study of minor losses in pipe
14. Study of uniform flow formula of open channel flow
15. Study of hydraulic jump

Assignments for Practical Work

1. Flow net graphical method
2. Assignment on use of computer Program / spread sheet/ solver for trial and error solution of three reservoir problem
3. Assignment for solution of pipe network by Hardy Cross Method

4. Study of specific energy diagram
5. Study of depth discharge diagram
6. Study of Impulse turbine
7. Study of Reaction turbine
8. Study of centrifugal pump

(MA) Linear Algebra and Univariate Calculus

(For Direct Second Year Admitted Diploma Students)

Teaching Scheme:
Lectures : 4 Hrs/week
Tutorial: 1Hr/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Outcomes:

Students will be able to:

1. know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit I **[14hrs)**

Matrices and linear equations: basic properties of matrices, row operations and Gauss elimination, Determinants and their basic properties. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations.

Unit II **[12hrs)**

Linear mappings, representation by matrices, rank-nullity theorem, Eigen values, Eigen vectors and their basic properties, diagonalization.

Unit III **[10hrs)**

Review of limits, continuity and differentiability, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection.

Unit IV **[12hrs)**

Integrals as limits of Riemann sums, fundamental theorem of calculus, surface area, integrals by special techniques: reduction formulae, arc length, solids of revolution, improper integrals, tests for convergence, Gamma and Beta functions.

Text Books:

- Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, 12^{th} Edition.
- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley eastern Ltd., 10^{th} Edition.

Reference Books:

- Serge Lang, "Introduction to Linear Algebra (2^{nd} edition)", Springer.
- Howard Anton and Chris Rorres, "Elementary Linear Algebra (10^{th} edition)", John Wiley and sons.
- K.D. Joshi, "Calculus for Scientists and Engineers", CRC Press.
- Sudhir Ghorpade and Balmohan Limaye, "A Course in Multivariate Calculus and Analysis", Springer Science and Business Media.
- C.R. Wylie, "Advanced Engineering Mathematics" , McGraw Hill Publications, New Delhi.
- Peter V. O' Neil, "Advanced Engineering Mathematics", Thomson Brooks / Cole, Singapore, 7^{th} edition.
- Shanti Narayan, "Differential Calculus", S. Chand and company, New Delhi.
- P.N. Wartikar and J.N. Wartikar, "Applied Mathematics Vol. I (Reprint July 2014)", Pune Vidyarthi Griha Prakashan Pune.

Semester-IV

(MA 16002) Vector Calculus and Partial Differential Equations

Teaching Scheme:
Lectures : 2 Hrs/week
Tutorial: 1Hr/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Outcomes:

Students will be able to:

1. know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)
6. organize and present thoughts. (To measure this outcome, questions may asked to write summaries and short notes on a given topic.)

Unit I: **[09 Hrs]**

Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications.

Unit II: [**10 Hrs]**

Partial differential equations with separation of variables, boundary value problems: vibrations of a string, heat equation, potential equation, vibrations of circular membranes.

Unit III: **[07 Hrs]**

Laplace Transforms, its properties, Unit step function, Dirac delta functions, Convolution Theorem, periodic functions, solving differential equations using Laplace transform.

Text Books:

- Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, 12th Edition.

- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley eastern Ltd., 10th Edition.

Reference Books:

- C.R. Wylie, “Advanced Engineering Mathematics” , McGraw Hill Publications, New Delhi.
- Peter V. O’ Neil, “Advanced Engineering Mathematics”, Thomson Brooks / Cole, Singapore, 7th edition.
- Wendell Fleming, “Functions of several variables”, Springer-Verlag, New York.
- Fritz John, “Partial Differential Equations” (4th edition), Springer.
- Michael D. Greenberg, “Advanced Engineering Mathematics (2nd edition)”, Pearson Education.

(ML 16001) Professional Ethics and Human Values

Teaching Scheme	**Examination Scheme**
Lectures: 1 hour per week	To be announced by the Teacher, preferably in the form of team assignments

OBJECTIVE

Engineers, being a special group of professionals, need to be conscious of their duties, responsibilities and actions because these affect the society and environment in which they work. Therefore, ethics and human values become as central, if not more, to the practice of engineering as to any other profession. The objective of this course could be summarized as:

• To create a general awareness about Professional Ethics and Human Values.
• To enable future professional engineers to contribute to Society and human well-being.
• To inculcate professional behavior and a sound work / workplace ethic in young minds
• To understand social responsibility at the personal, professional and corporate levels.
• To appreciate the concept of gender diversity and related issues from an ethical viewpoint
• To appreciate ethical dilemma while discharging duties in professional life.

Course Outcomes

a. Understand the need, basic guidelines, content and process for value education.
b. Understand the need of self and body, harmony of self with body.
c. Understand the harmony in the family, difference between respect and differentiation.
d. Understand the harmony in nature, interconnectedness and mutual fulfillment in nature, holistic perception of harmony.
e. Understand natural acceptance of human values, competence in professional ethics.

Unit 1: HUMAN VALUES [3 hours]

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Commitment – Courage –Empathy – Self-Confidence – Character – Caring and Sharing – Empathy and Leadership.

Unit 2: PROFESSIONAL ETHICS [3 hours]

Introduction to and history of Ethics – profession and professionalism – professional roles played by an engineer – engineering ethics – senses of 'Engineering Ethics' – variety of moral issues supported by case studies, e.g. moral / ethical dilemma, moral autonomy, consensus and controversy, etc. – models of professional roles – codes of conduct and codes of ethics – valuing time – co-operation – commitment – ethics at the workplace – gender diversity – diversity at the workplace – women's empowerment – sexual harassment at work, etc..

Unit 3: GLOBAL ISSUES [2 hours]

Types of technology (e.g. simple, high, intermediate, and appropriate technologies) and their ethical application – transfer of technology, its benefits and drawbacks – role of multinational corporations in technology transfer – environmental ethics – need for sustainable development, environmental hazards due to irresponsible technological development e.g. global warming, acid rain, etc., with case studies – computer ethics, prevention of IPR infringement, computer crime, social problems resulting from computerization, ethical social networking, etc.

Unit 4: ENGINEERING AS SOCIAL EXPERIMENTATION [2 hours]

Meaning of experimentation – engineering as experimentation – engineers as responsible social experimenters to benefit society – R&D efforts towards ethically and environmentally sustainable design of products and systems – codes of ethics and a balanced view towards legal, ethical and business aspects of technology use

Unit 5: SAFETY, RESPONSIBILITIES AND RIGHTS [2 hours]

Knowledge of safety and risk – uncertainty of design – ethical need to reduce safety and risk – need for testing product and system designs for safety – concept of risk benefit analysis – ethical issues in cost-benefit analysis – difference between gifts and bribes – protecting employee rights – human rights and human responsibilities – case studies involving natural and manmade disasters, e.g. Chernobyl, Bhopal Gas Tragedy, floods in Uttarakhand, Mumbai, etc.

6. WHISTLE BLOWING [1 hour]

Meaning and brief history of whistle blowing – internal and external whistle blowing – Ethical and legal issues involved – Managing whistle blowing – case studies involving whistle blowers like Manjunath, Satyendra Dubey, etc.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger - "Ethics in Engineering", McGraw-Hill, New York (1996).
2. Govindarajan M, Natarajan S, Senthil Kumar V. S - "Engineering Ethics", Prentice Hall of India, New Delhi, (2004).
3. Alavudeen A, KalilRahman R., Jayakumaran M. – "Professional Ethics and Human Values", University Science Press (an imprint of Laxmi Publications Pvt. Ltd.), New Delhi (2011)
4. Naagarazan, R.S. "A Textbook on Professional Ethics and Human Values" (As per Anna University Syllabus) (2009)

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.

(HS 16001) Innovation

Teaching Scheme:
Lectures : 1 Hr/week

Examination Scheme:
"To be declared by the Instructor"

Course Outcomes:

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

1. Discover the creative / innovative side within herself/himself.
2. Hone entrepreneurial and leadership skills within his/her personality.
3. Develop new ways of thinking and Learn the entire innovation cycle from Ideation to Go-To-Market.
4. Study frameworks, strategies, techniques and business models for conceived ideas.
5. Develop skills for evaluating, articulating, refining, and pitching a new product or service.

Syllabus:

Introduction to Innovation, Personal thinking preferences, ‘Innovation’ mind set, Everyday creativity and eliminating mental blocks, Introduction to Innovation, Creative thinking techniques, Innovation types, Idea management and approaches, Teaming techniques for creativity, Idea Conception, Idea Scoping, Self Evaluation, Idea Brainstorming sessions, Idea Verification, Market Evaluation, Concept Evaluation, Idea Verification, Prototype Evaluation, Protection/Patent review, Innovation Case Study, Idea Presentations, Idea Incubation, Product and Market Plan, Product and Market Development, Innovation Case Studies, Idea Incubation and Product Launch, Marketing and selling, Post Launch Review

Reference Books:

- Jeff Dyer, Hal Gregersen, Clayton M. Christensen, " The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators, Harvard Business Review Press, 2011.
- Paddy Miller, Thomas Wedell-Wedellsborg, "Innovation as Usual: How to Help Your People Bring Great Ideas to Life , Harvard Business Review Press, Kindle Edition.

(ILOE)- Basic Civil Engineering [For other Departments]

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	T1 and T2: 20 Marks each
Tutorial : ---	End-Sem Exam: 60 Marks

Course outcomes:

Students will be able to

1) understand basic principles related to various civil engineering systems.
2) identify the various areas in his discipline to utilize his knowledge related to civil engineering.

Unit 1 **(7 hrs)**

Introduction and scope of Civil Engineering. Role of Engineers in the infrastructure development.

Surveying: Principles of surveying and leveling, Various types of maps such as contour map, index map, etc. and their uses; Introduction to digital mapping, Introduction to various survey instruments such as EDM, Total Station, and digital planimeter.

Modern survey methods:-Introduction to GIS, GPS and their applications.

General concepts related to building. Selection of site, basic functions of buildings, types of buildings – Residential, Public, Commercial, and Industrial. Principles of planning, orientation of buildings, introduction to bye-laws regarding building line, Height of building, open space requirement, F.S.I., Carpet area, built up area, setbacks, ventilation.

Unit 2 **(7 hrs)**

Components of Buildings - Types of loads on buildings. Substructure – Types of soils; rocks and foundation strata, concept of bearing capacity, Types of foundation and their suitability.

Superstructure –Types of construction: Load Bearing, Framed, and Composite.

Building Materials

Introduction to basic construction materials; cement, bricks, stone, aggregates, reinforcing steel, Structural glazing, structural steel; Concrete types: PCC, RCC, Prestressed, Precast and Ready Mix Concrete. Use of various eco- friendly materials in construction.

Unit 3 **(6 hrs)**

Building Services: Vertical transportation, acoustics, ventilation and air conditioning, plumbing services,

Construction management: Principles, function of various agencies related to construction activities, tenders and contracts

Sustainable Development: Role of Engineers in Sustainable Development. Concept of green buildings and Certification.

Unit 4 **(7 hrs)**

Transportation Engineering

Role of transportation in national development; various modes of Transportation. Classification of Highways: - Expressways, NH, SH, MDR, ODR, VR; Types of Pavements, Road maintenance, PPP/BOT Projects; Road safety:-Traffic Signs, signals, Parking system, and Causes of Accidents.

Unit 5 **(7 hrs)**

Environmental Engineering

Water supply - Sources, drinking water requirements, impurities in water and their effects; Purification of water, modern purification processes; Standards of purified water. Solid Waste: Classification, Collection, treatment and Disposal methods; Waste water: Classification, Collection, treatment and reuse.

Unit 6 **(6 hrs)**

Water Resources Engineering

Introduction to Hydrology, Hydrologic cycle, precipitation, losses, Runoff , Sources of water, Hydraulic structures of storage; Water requirements, water conservation, water conveyance systems. Watershed management: Definition, Necessity and methods; Roof top rain water harvesting and Ground water recharge: relevance and methods.

Text Books:

- B. C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Basic Civil Engineering, Firewall Media, 2003.
- S.S. Bhavikatti, Elements of Civil Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.

Reference Books:

- Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain., "Soil Mechanics and foundations", Laxmi Publications (P) LTD, March 2005.
- M. S. Shetty, "Concrete Technology", S. CHAND & COMPANY LTD**.** & Co., 1992, New Delhi.
- T. P. Kanetkar, S. V. Kulkarni, "Surveying and Levelling" Pune Vidyarthi Griha Prakashan, 1988
- Santosh Kumar Garg, "Irrigation Engineering And Hydraulic Structures" Khanna Publications, 23rd Edition, 2009
- G. S. Birdie, J. S. Birdie "Water Supply and Sanitary Engineering: Including Environmental Engineering" Dhanpat Rai and Sons, 5th Edition, 1996.
- Sushil Kumar,"Building Construction" Standard Publishers Distributors, 6th Edition, 2006.
- Khanna&Justo, "Highway Engineering" Nem Chand and Bros, Roorkee(U.A), 8th Edition,2001
- M. G. Shah, C. M. Kale, S. Y. Pakti, "Building Drawing Design" Tata McGraw Hill Publication, 4th Edition, 2007.
- "Building Construction manual" CBRI, Roorkee

- "Civil Engineering Materials" Tata McGraw Publication, TTTI Chandigarh.
- "National Building Code of India 2005", Bureau of Indian Standard, New Delhi

(CE 16007) Surveying

Teaching Scheme
Lectures : 3 hrs/week
Tutorial : 1 hr/week

Examination Scheme
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course outcomes:

Students will be able to:

1) Determine linear, angular and height measurements.
2) Analyse surveying data of different types.
3) Use different surveying techniques for construction

Unit 1 **(7 hrs)**

a) Chain and compass Traversing

Introduction, Principles of surveying, chain survey, errors in chaining, ranging, chaining, offsetting, plotting chain survey data, instruments for measuring right angles, use of prismatic compass, bearing of lines, Local attraction, traversing with chain and compass, plotting and adjusting a traverse, Magnetic Declination etc.

b) Plane Table Survey

Equipment required for plane table Survey, uses, advantages, disadvantages and errors in plane table surveying; Methods of plane table Survey Radiation, intersection, traversing and resection; Two point and Three point problems and their solutions by different methods, Strength of fix, Lehman's Rules

Unit 2 **(7 hrs)**

a) Study of Dumpy Level and Theodolite

Principle axes of Dumpy Level: study of Dumpy Level, testing and adjustment of axis of bubble tube and line of collimation, reciprocal leveling, curvature and refraction corrections, distance to the visible horizon. Study of Vernier and Micro Optic Theodolite: introduction to 20" Vernier Theodolite. Principle axes of Theodolite: Testing and Permanent adjustments of Transit Theodolite.

b) Tacheometry

Principle of stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of Tacheometry in Surveying, Tacheometric Contour Survey. Ontouringuse of contour maps, direct and indirect methods of contouring. Profile Levelling Longitudinal Section and Crosssections Study and use of Toposheets.

Unit 3 **(6 hrs)**

Theodolite Traversing

Uses of Theodolite: Measurement of Horizontal angles, horizontal angles by repetition and by reiteration (errors eliminated) ,vertical angles, magnetic bearings, prolonging a line, lining in, setting out angles. Theodolite Traversing: Computation of Consecutive and independent Coordinates, adjustment of closed traverse, by transit rule and Bowditch's rule, Gales Traverse table, omitted measurements, area calculation by independent coordinates. Open Traverse – Its uses, measurement of deflection angles using transit Theodolite, open traverse survey, checks in open traverse.

Unit 4 **(7 hrs)**

Geodetic Surveying

Objects, Methods in Geodetic surveying, Trilateration, Classification of triangulation systems, Triangulation figures, Strength of figure & derivation for well conditioned triangle, Selection of stations, intervisibility & height of stations, Towers signals & their classifications, Phase of signals & their corrections. Satellite stations, Reduction to center, Reduction to mean sea level and extension of base.

Unit 5 **(7 hrs)**

Photogrammetry

Objects, applications to various fields, aerial camera, comparison of map & vertical photograph, vertical tilted and oblique photographs, scale of vertical photograph, Mirror Stereoscope, photo interpretation, etc. Geographic Information System (GIS): definition and meaning, data modes for GIS, components of GIS, and application to Civil Engineering, etc.

Unit 6 **(6 hrs)**

Advance Surveying Techniques

Global Positioning System(GPS): Applications to Civil Engineering, concept of Global Positioning Systems [GPS] and differential GPS, Electromagnetic waves and their properties, Electromagnetic Distance Meters (E.D.M.), measurement principle of EDM instruments, Total Station and its uses, fundamental parameters of Total Station, etc., Optical Theodolite, etc.

Remote Sensing: basic principles, electromagnetic spectrum, classification of remote sensing systems, etc.

Text Books:

- Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part1", Pune Vidyarthi Griha Prakashan, Pune.
- Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part2", Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

- Duggal S. K. "Surveying Volume I", Tata McGraw-Hill Publishing Company Limited.
- Duggal S. K. "Surveying Volume II", Tata McGraw-Hill Publishing Company Limited.
- Bannister A, Raymond S & Baker R. "Surveying", Pearson Education Ltd.
- Subramanium R., "Surveying & Levelling", Oxford University Press.

- Clark David, “Plane and Geodetic Surveying for Engineers Volume–I”, CBS, 6/E.
- Clark David, “ Plane and Geodetic Surveying for Engineers Volume –II”, CBS, 6/E
- Clendinning J. “Principles of Surveying”, Blackie
- Punmia B. C. “Surveying-I”, Laxmi Publications (P) Ltd. New Delhi
- Punmia B. C., Jain A, Jain A., “Surveying-II”, Laxmi Publications (P) Ltd. New Delhi

(CE 16008) Concrete Technology

Teaching Scheme
Lectures : 3 hrs/week
Tutorial : --

Examination Scheme
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course outcomes:

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

1) Apply measures to check the quality of ingredients of concrete at field as well in laboratory.

2) Understand various factors those will affect quality of fresh as well as hardened concrete

3) Design a concrete mix as per the requirement at the field.

Unit 1 **(6 hrs)**

Ingredients of Concrete

Cement :-Manufactureof Portland cement, Chemical composition, Hydration of cement, Classification and types of cement, Tests on cement.

Aggregate :-Classification,Mechanical and Physical properties, Deleterious Materials, Soundness, Alkaliaggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial and Recycled aggregate.

Water :-Mixing Water, Curing water, Tests on water.

Unit 2 **(6 hrs)**

Fresh Concrete

Workability: Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete Curing, Methods of curing, Influence of temperature, Maturity rule, Steam curing.

Unit 3 **(7hrs)**

Hardened concrete

1) Strength of concrete – General, Factors affecting strength, Micro cracking and stress strain relation, other strength properties, Relation between tensile and compression strengths, impact strength, Resistance to abrasion.

2) Elasticity , Creep, and Shrinkage

3) Non Destructive Testing Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test.

Unit 4 **(7 hrs)**

Concrete Mix Design

Factors to be considered, Statistical quality control, Methods of Mix Design IS(10262), and DOE, High strength concrete, Acceptance criteria for concrete as per IS specifications.

Unit 5 **(7 hrs)**

Admixtures in concrete

Functions, Classification, Types ,Mineral and Chemical.

a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS Specifications (9103), Compatibility of Admixtures, Marsh Cone test.

b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash.

Unit 6 **(7 hrs)**

Special Concretes and Durability of concrete

Special Concretes: Light weight concrete, Polymer concrete, Fibre reinforced concrete, High performance concrete, Pumped concrete, Ready mixed concrete, Roller compacted concrete, Ferrocement.

b) Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination,

Text Books:

- M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications,
- M. S. Shetty, "Concrete Technology", S. Chand Publications

Reference Books:

- A. M. Neville, J. J. Brooks, "Concrete Technology" Pearson Education India
- A. M. Neville, "Properties of Concrete", Pearson Education India .
- R.S. Varshney, "Concrete Technology", Oxford and IBH.
- P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall.SP-26

(CE 16009) Structural Mechanics

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	T1 and T2: 20 Marks each
Tutorial : --	End-Sem Exam: 60 Marks

Course outcomes:

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

1. convert given practical problem into the structural model by applying the knowledge of various types of structures and supports
2. understand clearly the difference between statically and kinematically determinate and indeterminate structures
3. analyse indeterminate structures by using various force and displacement methods for

primary effects as well as secondary effects such as temperature change and support movements etc.

4. analyse the structures subjected to moving loads.

Unit 1 **(4 hrs)**

a) Basic concepts of Structural Analysis – Types and Classification of structures based on structural forms. Skeletal Structures, Surface Structures, 3D Structures.

b) Concept of indeterminacy and degrees of freedom - Static and Kinematic degree of Indeterminacy.

Unit 2 **(7 hrs)**

a)concept of strain energy, strain energy due to axial, due to shear, bending moment and torsional moment

b) Energy Methods in Structural analysis Unit Load Method, Castigliano's theorems, Deflection of determinate structures – beams, and rectangular portals

Unit 3 **(7hrs)**

a)analysis of indeterminate structures by application of Castigliano's Theorem, Beams and Rec tangular portal frames

b) Analysis of Indeterminate Beams by Compatibility Methods

c) Maxwell's theorem of reciprocal displacements and Betti's law.

Unit 4 **(7 hrs)**

a) Deflections of Determinate Trusses by Castigliano's Theorem and virtual work principle.

b) Analysis of Redundant Trusses by Castigliano's Theorem and virtual work principle. Lack of fit and temperature changes in members, sinking of supports

Unit 5 **(6 hrs)**

Analysis of continuous beams (with indeterminacy up to 3 degrees) including sinking and rotational yielding at supports by

a) Slope deflection method

b) Moment distribution method

Unit 6 **(9 hrs)**

a) Influence lines

Basic Concept of Influence lines. Application of MullerBreslau's principle.

b) Rolling loads

Use of Influence line diagram for determination of SF and BM in beams due to UDL, series of concentrated loads and conditions for maximum SF and maximum BM values. Condition for maximum

BM under a chosen load, determination of absolute maximum SF and BM. Absolute maximum B M diagram, Concept of Equivalent UDL.

c) Influence line diagram for the truss reactions and member forces for Plane Determinate trusses

Text Books:

- Junnarkar, S. B. and Shah,H. J., "Mechanics of Structures Vol. II", Charotar Publishing house
- Reddy, C. S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company Limited.
- C. K. Wang, "Intermediate structural analysis", McgrawHill Book Comp.

Reference Books:

- Gupta, S. P. and Pandit, G. S., "Theory of Structures, Vol. I", Tata McGraw Hill Publishing Company Limited.
- Timoshenko, S. P. and Young, D. H., "Theory of Structures", McGrawHill Publication, 2/e
- R.C. Hibbeler, " Structural Analysis", Pearson Education Asia Publication, 6/e
- Utku , S., Norris, C. H. and Wilbur, J. B., "Elementary Structural Analysis", McGrawHill Publication, 4/e
- T.G.H. Megson, "Structural and Stress Analysis", ButterworthHeinemann Publication

(CE 16010) Environmental Engineering

Teaching Scheme	**Examination Scheme**
Lectures : 3 hrs/week	T1 and T2-20Marks each
Tutorial : --	End -Sem Exam – 60 Marks

Course outcomes:

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

1. To demonstrate a firm understanding of various water distribution systems and their suitability.
2. To design water distribution layout for communities.
3. To visualize water quality parameters and their characteristics.
4. To understand relevant water treatment processes, their design criteria and applicability.
5. To make decisions regarding the treatment plant site selection, operation and maintenance and the need of advanced treatment.
6. To aware the cause and consequences of water pollution.

Unit 1 **(6 hrs)**

Air pollution- Definition, sources of air pollution, types and classification of air pollutants, Primary and Secondary air pollutants and their importance, Atmospheric stability, mixing heights, plume types and meteorological parameters.

Effects of air pollution on – Human, Animals, Materials and Vegetation.

Global Effects- Photochemical smog, heat island, ozone depletion, acid rain. Control of air pollution.

Unit 2 **(6hrs)**

Sources of water, Factors considered in selection of source of water for treatment plant,
Conveyance of raw water-, canals and pipelines, Hydraulics of conduits, Different types of pipes used and their suitability, designing of rising main., intake structure, different types of intake structures.
Quality- Characteristics, Indian standards, Testing of raw water for physical, chemical and bacteriological parameters and their significance.

Unit 3 **(8hrs)**

Quantity- Population forecasting, different methods of population forecasting, rate of water consumption for various purposes, factors affecting demand of water, calculation of fire demand.
Water Treatment: Necessity of water treatment processes. Different types of water treatment flow sheets.
Aeration: Principle and Concept, Necessity, Methods,

Unit 4 **(8hrs)**

Sedimentation- Theory of sedimentation, types of suspended solids, determination of Settling velocity, Types of sedimentation tanks. Surface Loading, detention time, and design of PST, inlets and outlets arrangements
Theory of chemical coagulation, Factors affecting coagulation, turbidity, rapid mixing, coagulant dosage, characteristics of water, optimum pH, Coagulant aids, choice of coagulants, common coagulants, coagulant aids like Bentonite clay, lime stone, silicates and poly electrolytes,
Rapid mixing-Necessity, gravitational, mechanical, pneumatic devices,
Slow mixing and flocculation, design of flocculation chamber, mean velocity gradient “G” and power consumption,
Concept of Plate settler and Tube settler.

Unit 5 **(8hrs)**

Filtration: Theory of filtration, Mechanism of filtration, filter materials, Types of filters- Rapid gravity filter, slow sand-filter and pressure filter. Components, materials, underdrainage system, working and cleaning of filters, operational troubles, Design of filters.
Theory of disinfection- Factors affecting efficiency of disinfection. Types of disinfectants, Mathematical relationship governing disinfections variables. Theory of chlorination, break point chlorination, bleaching powder estimation.
Water softening methods- lime-soda, ion exchange method and Demineralization.

Unit 6 **(4 hrs)**

System of water supply- Continuous and intermittent system.

Distribution of water- Different distribution systems and their components, layouts, Methods of supply like gravity, pumping and combination, Design of distribution system, determination of Balancing Capacity of ESR

Text Books:

- H. V. N. Rao and M. N. Rao, "Air Pollution", TMH Publications.
- S. K. Garg ,"Water Supply Engg.", Khanna Publishers - NewDelhi.
- Peavy and Rowe, "Environmental Engg.", McGraw Hill Publications

Reference Books:

- Stern,"Air Pollution Vol. I – IV", McGraw Hill.
- Sharma and Kaur, "Environmental Chemistry", Goyal Publisher.
- Water Supply and Treatment Manual: Govt. Of India Publication.
- Fair and Geyr, "Environmental Engineering", McGraw Hill Publications.
- Steel and McGhee, "Environmental Engineering", McGraw Hill Publications.

(CE 16011) Surveying Laboratory

Teaching Scheme:
Practical : 4 hrs/week

Examination Scheme:
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes:

Students will be able to

1) Practice linear, angular and height measurements.
2) Analyse surveying data of different types.
3) Use different surveying techniques for construction

Term work

It shall consist of List of practical exercises and projects for surveying as detailed below.

1) Study of chain and compass.
2) Chain and compass Traverse Survey
3) Study and use of dumpy level, auto level to determine elevation of various points.
4) Measurement of horizontal and vertical angles by transit Theodolite.
5) Measurement of horizontal angles by repetition method.
6) Project-I -Theodolite traverse Survey project of a closed traverse with at least four stations, computation of area of the traverse.
7) Computation of horizontal distances and elevations by Tacheometry
8) Project-II-Tacheometric contouring project with two instrument stations about 60 m apart.
9) Radiation & intersection methods in plane table survey.
10) Project-III -Plane table survey project of a closed traverse with at least four stations, with details such as buildings, roads, etc.

11) Setting out a given building from a given foundation plan.
12) Project-IV- Road project for a minimum length of 300 m including fixing of alignment, profile leveling, cross-sectioning, plotting of L section and cross section.
13) Study and use of one second Theodolite and measurement of horizontal angle.
14) Setting out a given horizontal angles and measurement of Vertical angles using one second Theodolite.
15) Finding out elevation of high object by Trigonometrical Leveling using one second Theodolite.
16) Study and use of Mirror Stereoscope and finding out Air base distance
17) Study and use of Total Station
18) Study and use of GPS.

Practical examination and oral will be based on above term work.

(CE 16012) Concrete Technology Laboratory

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme :
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes: Upon completion of the course the student will be able to

- Test different materials using IS codes.
- Decide whether the materials are fit or otherwise for use.
- check the quality of ingredients of concrete .

The laboratory consists of any 8 experiments from **PART A** whereas **PART B** is compulsory.

PART A: List of Experiments

1. **Test on Cement:** Fineness**,** Standard Consistency, and Setting time,
2. **Test on Cement** : Soundness and Compressive strength
3. **Test on Aggregate**: Sp. Gravity, porosity, bulk density and void ratio of CA and FA
4. **Test on Aggregate :** Sieve analysis of FA and CA, Flakiness Index of CA
5. **Test on Aggregate:** Aggregate Impact value and Aggregate crushing value.
6. **Test on fresh concrete:** Workability tests (slump, compaction factor, veebee, flow table)
7. **Test on fresh concrete:** Effect of Admixtures on workability and setting time of concrete (Super plasticizers and retarders)
8. **Concrete mix design:** Using IS code / DOE method.
9. **Test on hardened concrete:** Compressive strength, split Tensile strength and Modulus of Rupture, Young's modulus of concrete.

PART B: Site Visit

1. NDT Project (using rebound and ultrasonic pulse velocity tests) on any site under construction with a short report.
2. Site visit to study advances in Concrete Technology (like RMC, Pumped concrete

etc) with a short report.

(CE 16013) Environmental Engineering Laboratory

Teaching Scheme:
Practical: 2 Hrs/week

Examination Scheme :
Continuous evaluation : 40 Marks
End-Sem Exam: 60 Marks

Laboratory Outcomes:

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

1. Perform the analysis of water by following the standard methods of sampling and testing.
2. Perform the characterisation studies of water and determine the suitability of a water sample as drinking water source.
3. Understand the importance of the laboratory analysis as a controlling factor in the treatment of water.

List of Practicals:

(A) Determination of (Any Eight)

1. pH and Alkalinity
2. Hardness
3. Chlorides
4. Chlorine demand and residual chlorine
5. Turbidity and optimum dose of alum. ,
6. MPN
7. Sulphates
8. Fluorides
9. Iron

B) Site visit to water treatment plant.

A report based on the visit to water treatment plant would be submitted and would form a part of the term work.

C) Design of various components of water treatment plant

Design of various components of water treatment plant would be carried out based on the theory covered in CE- 301 Environmental Engineering-I.

OR

C) Study of Software or programming for analysis of water distribution system

Programmes available for the design of various water treatment plants would be used or Computer Programmes to Design various units of water treatment plant would be written in any suitable programming language.

OR

C) At least six assignments on the over all syllabus

Note: The term work shall consist of record of above Practical Journal B and D .
Oral /Practical examination will be based on above exercises.

(MA) Multivariate Calculus and Differential Equations

(For Direct Second Year Admitted Diploma Students)

Teaching Scheme:
Lectures : 4 Hrs/week
Tutorial: 1Hr/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Outcomes:

Students will be able to:

1. know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
2. understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
3. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
4. give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
5. apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit I: **[06 Hrs]**

Functions of several variables, level curves and level surfaces, partial and directional derivatives, differentiability, chain rule, local extreme values and saddle points.

Unit II: **[11Hrs]**

Double integrals in Cartesian and polar co-ordinates, iterated integrals, change of variables, triple integrals in Cartesian, spherical and cylindrical co-ordinates.

Unit III: **[10 Hrs]**

Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss.

Unit IV: **[09 Hrs]**

Review of first order differential equations, linear differential equations, homogeneous higher order linear differential equations, non-homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters).

Unit V: **[07 Hrs]**

Laplace Transforms, its properties, Unit step function, Dirac delta functions, Convolution Theorem, periodic functions, solving differential equations using Laplace transform.

Unit VI: **[07 Hrs]**

Partial differential equations with separation of variables, boundary value problems: vibrations of a string, one dimensional heat equation.

Text Books:

- Maurice D. Weir, Joel Hass, Frank R. Giordano, "Thomas' Calculus", Pearson Education, 12th Edition.
- Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley eastern Ltd., 10th Edition.

Reference Books:

- K.D. Joshi, "Calculus for Scientists and Engineers", CRC Press.
- Sudhir Ghorpade and Balmohan Limaye, "A Course in Multivariate Calculus and Analysis", Springer Science and Business Media.
- George Simmons, "Differential Equations with Applications and Historical notes", Tata Mc-Graw Hill publishing company Ltd, New Delhi.
- Wendell Fleming, "Functions of several variables", Springer-Verlag, New York.
- Fritz John, ""Partial Differential Equations (4th edition), Springer.
- C.R. Wylie, "Advanced Engineering Mathematics" , McGraw Hill Publications, New Delhi.
- Peter V. O' Neil, "Advanced Engineering Mathematics", Thomson Brooks / Cole, Singapore, 7th edition.
- Michael D. Greenberg, "Advanced Engineering Mathematics (2nd edition)", Pearson Education.

(PH 16001) Foundation of Physics

Teaching Scheme :
Lectures:3 hrs /week

Examination scheme:
Test 1 & 2: 20 marks each
End Sem exam: 60 Marks

Course Outcomes:

At the end of the course student should be able to

a) Develop the understanding of laws of thermodynamics and their application in various processes, optics and their applications.
b) Solve the basic problems in Classical Mechanics
c) Derive the Wave Mechanics of microscopic bodies.
d) Formulate and solve the engineering problems on Electromagnetism.

Unit 1 Thermodynamics **(6 hrs)**

i) Heat as a form of energy , mechanical equivalent of heat, thermodynamic systems,
ii) Zeroth law and concept of temperature, first law & its mathematical statement,
iii) Second law and concept of entropy, third law of thermodynamics,
v) Concept of free energy; Gibbs and Helmoltz free energy.

Unit 2 Waves motion & Optics **(6 hrs)**

i) Logitudinal and transeverse waves, Light as an EM wave and it's graphical representation,
ii) General equation of traveling wave,
iii) Superposition principle, formation of stationary waves (with derivation),
iv) Huygen's Principle, Young's double slit experiment,
v) Interference of light due to thin film of uniform thickness and conditions for darkness and brightness,
vi) Diffraction due to a single slit; conditions of maxima and minima.

Unit 3 General Mechanics **(6 hrs)**

i) Kinetic energy and potential energy,
ii) Work done (single particle system only); work energy theorem,
iii) Conservative and non conservative forces, concept of central force, properties of central force,
iv) Laws of planetary motion (with mathematical statement).

Unit 4 Introduction to Quantum Mechanics **(6 hrs)**

i) Drawbacks of classical mechanics, Plank's quantum hypothesis, Dual nature of matter,
ii) De Broglie's hypothesis, de Broglie's wavelength,
iii) Photoelectric effect, Davisson-Germer's experiment,
iv) Heisenberg's uncertainty principle
v) Illustrations of Heisenberg's uncertainty principle; electron diffraction at a single slit

Unit 5 Electrostatics **(6 hrs)**

i) Coulomb's law in integral form, the electric field intensity ,
ii) Continuous charge distribution (Line, Surface & Volume),
iii) Introduction to Gauss's law, integral form of Gauss's law,
iv) Applications of Gauss's Law to simple 2D-3D problems ,
v) Line integral of electric field, concept of electric potential (V),
vi) Potential (V) due to continuous charge distribution.

Unit 6 Magnetostatics **(6 hrs)**

i) Steady currents (line current ,surface current,volume current) & current densities,

ii) Magnetic field due to steady currents (Biot-Savert's law) and it's applications,
iii) Line integral of B over a closed loop,
iv) Ampere's Law and its applications to simple problems,
v) Closed surface integral of B (Non-existence of magnetic monopole).

References:

Unit 1: H. C. Verma & Halliday-Resnick (Sixth edition), B. B. Laud
Unit 2: Halliday-Resnick (Sixth edition)
Optics by Brij Lal (S. Chand Publication)
Unit 3: Classical Mechanics by P. V. Panat,
H. C. Verma, Halliday –Resnick (Sixth edition)
Unit 4: Halliday-Resnick (Sixth edition)
Unit 5 & 6: Classical Electrodynamics by David Griffith (Pearson India limited)

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