College of Engineering, Pune

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

Curriculum Structure & Detailed Syllabus (UG Program)

First Year B.Tech. [M-Group]

[Civil, Mechanical, Metallurgy, Production Engineering]

(Revised & Effective from: A.Y. 2015-16)

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.

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List of Abbreviations

BSC: Basic Science Course

DEC: Department Elective Course

EFC: Engineering Foundation Course

HSMC: Humanities/Social Sciences/Management Course

LC: Laboratory Course

LLC: Liberal Learning Course

MLC: Mandatory Learning Course

OEC: Open Elective Course

PCC: Program Core Course

SBC: Skill Based Course

SLC: Self Learning Course

Semester I [M-Group]

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	BSC		Linear Algebra	2	1	0	3
2	BSC		Optics and Modern Physics	3	0	0	3
3	EFC		Basic Electrical Engineering	3	0	0	3
4	EFC		Computer Aided Engineering Drawing	2	0	2	3
5	EFC		Engineering Mechanics	3	0	0	3
6	SBC		Mechanical Fab Shop	0	0	3	2
7	LC		Optics and Modern Physics Laboratory	0	0	2	1
8	LC		Basic Electrical Engineering Laboratory	0	0	2	1
9	LC		Engineering Mechanics Laboratory	0	0	2	1
10	HSMC		Professional Communication	1	1	0	2
				14	2	11	22
			Total Academic Engagement and Credits	**27**			**22**

(BSC) Linear Algebra

Teaching Scheme
Lectures : 2 hrs / week
Tutorial: 1 hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
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.)

Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.

Contents:

Unit I : 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. **[10 Hrs]**

Unit II : Linear mappings, representation by matrices, rank-nullity theorem, Eigen values, Eigenvectors and their basic properties. **[10 Hrs]**

Unit III : Inner product spaces, orthogonality, Gram-Schmidt process, Diagonalization of special matrices, Jordan Canonical form, Geometric applications of Linear transformation, quadratic forms: positive definiteness. **[08 Hrs]**

Text Books :

- Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer

Reference Books :

- Linear Algebra (3rd edition) by Serge Lang, Springer.
- Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons.
- Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi.
- Linear Algebra by Hoffman and Kunze, (2nd edition) Prentice Hall Publication, New Delhi.
- Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.

(BSC) Optics and Modern Physics

Teaching Scheme
Lectures : 3 hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Understand the different phenomenon of light (electromagnetic wave)
- Understand applications of optics using basic fundamentals of Physics
- Understand working principle of a LASER, components and working of different laser system and their engineering applications
- Understand dual nature of wave, significance and normalization of wave function, Applications of Schrodinger wave equation
- Understand and explain nuclear reactions, controlled chain reactions
- Understand the principle and working of particle detectors

Contents:

Unit I: Polarisation

Polarised light, Types of polarization and their representation, Brewster's law, Polarization by double refraction, Law of Malus, Optical Activity, Specific rotation, Fresenel's theory of Optical Rotation, Elliptical and Circular polarization, quarter and half wave plates.

Unit II: Interference and Diffraction

Interference due to thin films of uniform thickness and non-uniform thickness (with derivation), Newton's rings, Applications of interference. Fraunhoffer diffraction at a single

slit; condition of maxima and minima, Plane Diffraction grating (Diffraction at multiple slits

Unit III: Laser Physics

Spontaneous and stimulated emission of radiation, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical Resonator, Laser Beam Characteristics, Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser, Engineering applications of Laser (Fiber optics, Laser material interaction).

Unit IV: Wave Mechanics

Matter waves, De-Broglie's concept of matter waves, Properties of matter waves, , Heisenberg's uncertainty principle, Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Physical significance of wave function.

Unit V: Electrons in Potential Well

Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box), concept of quantum tunneling, Linear Harmonic oscillator,

Unit VI: Nuclear Physics

Nuclear reaction, Q-value of nuclear reaction, Nuclear fission in natural Uranium,Chain reaction, Particle detectors; Geiger Muller Counter, Scintillation counter, Circular accelerators; cyclotron

Reference Books:

- Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", Mc-Graw Hill International Edition.
- N. Subramanyam , Brijlal, "A Text Book of Optics", Vikas Publishing House Pvt. Ltd
- K. Thyagarajan, A. K. Ghatak, "LASERS Theory and Applications", Macmillan India Limited.
- Arthur Beiser, "Concepts of Modern Physics", Tata McGraw – Hill Edition
- Jeremy Bernstein, Paul M. Fishbane, Stephen Gasiorowics, "Modern Physics", Pearson Education
- L. J. Schiff, "Quantum Mechanics", Mc-Graw Hill International Edition.
- Resnick Halliday, Krane, "PHYSICS", (Volume I & II), Willey India 5th Edition

(EFC) Basic Electrical Engineering

Teaching Scheme
Lectures : 3 hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Predict the behaviour of simple electric and magnetic circuits.
- Analyze DC and AC electric circuits.
- Apply the knowledge of relevant laws and principles for solving circuit problems.
- Familiarize with different theorems and analytical approaches for solving a given electric circuit.
- Develop a clear understanding of operation and application of single phase transformer.
- Acquire the knowledge of basic principles, working and applications of various electric machines such as dc machines, induction and synchronous machines.
- Develop the knowledge about various lamps and lighting schemes, commonly used protecting devices in day-to-day electric installations.

Contents:

Unit I: D.C. CIRCUITS

Basic electrical quantities -Electrical energy and power-Introduction to Resistance, Inductance and capacitance. Types of sources Ohm's Law-Fundamental circuit laws: KCL and KVL-D.C. circuits and network simplification (series, parallel, star/delta) - Mesh and Nodal Analysis. Principle of superposition-Thevenin's and Norton's Theorems. Step response of R-L, R-C circuits. [08 hrs]

Unit II: MAGNETIC CIRCUITS

Magnetic circuits' concepts-BH curves-characteristics of magnetic materials-practical magnetic circuits with d.c. excitation-magnetically induced voltages-self inductance-magnetic circuits with ac excitation-hysteresis and eddy current losses-exciting current [07 hrs]

Unit III: A.C. FUNDAMENTALS

Generation of alternating voltages-sinusoidal voltages and currents Different terminologies associated with AC circuit. Behavior of AC circuit containing pure R, L, and C. Phasor

representation in rectangular, polar and exponential forms Impedance and admittance concept. Power in single phase circuit: - Concepts of active, reactive and apparent power, power factor. [07 hrs]

Unit IV: A.C. CIRCUIT ANALYSIS

Series RL, RC and RLC circuits-application of complex notation- series-parallel circuits, series resonance. Three phase voltages, current and power-Star connected and delta connected balanced circuits-delta/Star equivalence-analysis of balanced three phase circuits Power measurement in Three phase circuit. [06 hrs]

Unit V: TRANSFORMER

Single-phase transformer construction-action in an ideal transformer, inrush current phenomenon. - departure from ideal-equivalent circuit and determination of parameters-efficiency and regulation. Behavior of Practical transformer on loaded condition, working of auto-transformer. [06 hrs]

Unit VI: ELECTRICAL MACHINES, MEASUREMENTS & INSTALLATION

Construction, principle of working, types, characteristics and applications of DC generator, DC motor, Induction motor Electrical instruments such as wattmeter, energy meter, tong tester, megger and power analyzer. Miniature Circuit Breaker - Earth Leakage Circuit Breaker - Ceiling fan - Electronic fan regulator - Storage type Water Heater. Illumination: Fluorescent Tube, Compact Fluorescent Lamp, LED Lights, Earthing and Lightning protection (Introduction, need, types). [06 hrs]

Text-books:

- D.P. Kothari, I.J. Nagrath, “Basic Electrical Engineering”, TMH Publishing Co. Ltd., New Delhi, 3rd edition
- Leonard S. Bobrow, “Fundamentals of Electrical Engineering”, 2nd Edition, Oxford Press.

Reference Books:

- A.E. Fitzgerald, D.E. Higginbotham, “Basic Electrical Engineering”, McGraw Hill Book Co., New York, 2nd edition
- Dr.S.L.Uppal, “Electrical Wiring, Estimating and Costing”, Khanna Publishers.

Tutorials:

- Assignments, problems, quizzes may be given from the following books
- S. Parker Smith, “Problems in Electrical Engineering”, Asia Publishing House, Bombay, 7th Edition
- D.P. Kothari, I.J. Nagrath, “Problems and Solutions in Basic Electrical Engineering”, TMH Publishing Co. Ltd., New Delhi, 3rd edition.

(EFC) Computer Aided Engineering Drawing

Teaching Scheme

Lectures : 2 hrs / week

Examination Scheme

Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Read and write the language of Engineering Graphics: to study its basic theory and to be familiar with its accepted conventions and abbreviations.
- Develop the ability to visualize and communicate three dimensional shapes.
- Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views
- Plan and prepare neat isometric drawings of regular planes and solids
- Dimension and annotate two-dimensional engineering drawings.
- Freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.
- Plan and prepare neat orthographic drawings of points, straight lines, and regular planes and solids.
- Knowledge of basics of CAD software

Contents:

Unit I:
Introduction to methods of projections. Projections of points. Projections of lines. [6hrs]

Unit II:
Projections of planes, Orthographic Projections: Drawing orthographic projections from pictorial Projectionsby using first angle projection method. [8hrs]

Unit III:
Isometric Projections: Difference between isometric view and projection. Drawing isometric views from given orthographic views. [6 hrs]

Unit IV :
Interpretation of given views, Missing views [4hrs]

Text Books

- N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishing House, Anand(India)
- M.L.Dabhade, “Engineering Graphics I”, Vision Publications, Pune

Reference book

- Warren Luzzader, "Fundamentals of Engineering Drawing", Prentice Hall of India, New Delhi.

(EFC) Engineering Mechanics

Teaching Scheme

Lectures : 3 hrs / week

Examination Scheme

Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Identify principles of mechanics to be used for the real life engineering problems.
- Solve simple engineering problems

Contents:

Unit I:

Resultant and Equilibrium of 2 D force system: concept of resultant, equivalent force systems, resultant of 2D force systems. Concept of equilibrium, Newton's first law, engineering applications like beams, trusses, frames and cables. **[7 hrs]**

Unit II:

Resultant and Equilibrium of 3 D force system: resultant of general force system, moment about a point, moment about a line. Equilibrium of 3D force system, applications to concurrent and parallel force system. **[7 hrs]**

Unit III:

2D equilibrium problems considering friction: Applications to simple contact friction, wedges and belt friction. Principle of virtual work: applications to beams and mechanisms with single degree of freedom. **[7hrs]**

Unit IV:

Kinematics of particles: motion related to Cartesian coordinates, path coordinates and polar coordinates, motion curves, relative motion and dependent motion. **[7 hrs]**

Unit V:

Kinetics of particles: Newton's second law; Energy principles; Impulse momentum

principle; direct central impact. **[7 hrs]**

Unit VI:

Kinematics of rigid bodies: general plane motion, ICR. Kinetics of Rigid Bodies: applications to Newton's Second law. **[7 hrs]**

Reference Books:

- Meriam J. L., Kraige L. G., "Engineering Mechanics – Statics", Wiley Student Edition, (Sixth Edition) reprint 2011.
- Meriam J. L., Kraige L. G., "Engineering Mechanics – Dynamics", Wiley Student Edition, (Sixth Edition) reprint 2011.
- Beer F. P. , Johnston E. R., "Vector Mechanics for Engineers Statics and Dynamics", Tata McGraw Hill Publishing company Ltd., New Delhi (Eighth Edition) reprint 2009
- Shames Irving H., "Engineering Mechanics", Prentice Hall, New Delhi (Fourth edition) reprint 2009.

(SBC) Mechanical FAB Shop

Teaching Scheme
Practical : 3 hrs / week

Examination Scheme
Term work: 100 marks

Course Outcomes:

Students will be able to:

- Understand different manufacturing processes.
- Practice/use these manufacturing processes for their final year project activities and different competitions across different disciplines.
- Enhances the practical aspects of engineering through understanding of workshop practices as well as safety practices followed in industry.
- Enhance their knowledge skill sets with hand-on experience and teamwork inculcating analysis and lifelong learning.

Content:

Carpentry - 1 job

Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns, contraction, draft & machining allowances

Term work includes one job involving joint and woodturning

Joining – 1 job

Includes making temporary and permanent joints between similar and dissimilar material by processes of chemical bonding, mechanical fasteners and fusion technologies.

Term work includes one job involving various joining processes like riveting, joining of plastics, welding, brazing, etc

Fitting- 1 Job

Types of Fits, concepts of interchangeability, datum selection, location layout, marking, cutting, shearing, chipping, sizing of metals, drilling and tapping.

Term work to include one job involving fitting to size, male-female fitting with drilling and tapping

Sheet Metal Practice– 1 Job

Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints.

Term work to include an utility job in sheet metal

Assembly and Inspection:

Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments

Safety in Workshop (Demonstration)

Fire hazards, electric short circuit –causes and remedies, Machine protection, Human protection, Accident prevention methods, developing ability to observe safe working habits. Introduction to measuring equipments used in Quality Control

Forging (Demonstration)

Hot working, cold working processes, forging materials, hand tools & appliances, Hand forging, Power Forging

Moulding (Demonstration)

Principles of moulding, methods, core & core boxes, preparation of foundry sand, casting, Plastic moulding

Surface Coating Processes (Demonstration)

Cleaning of metals, chemical cleaning, mechanical cleaning, metallic coatings, plastic coating, organic finishes, Inorganic coating

Plumbing (Demonstration for Civil/Mech/Prod/Met.Engg.)
Types of pipe joints, threading dies, Pipe fittings

FabLab (Demonstration)
Overview of digital fabrication techniques, tools used, laser cutting, engraving, CNC wood router, electronic work bench

CNC (Demonstration)
Define Numerical Control its advantages and disadvantages, coordinate systems adopted for CNC programming, major types of motion control strategies, major classifications of CNC machines, Part Programming

(LC) Optics & Modern Physics Laboratory

Teaching Scheme
Practical : 2 hrs / week

Examination Scheme
End sem: 100 marks

Course Outcomes:

Students will be able:

- To understand the different phenomenon of light (electromagnetic wave)
- To understand applications of optics using basic fundamentals of Physics
- To understand working principle of a LASER, components and working of different laser system and their engineering applications
- To understand dual nature of wave, significance and normalization of wave function, Applications of Schrodinger wave equation
- To understand and explain nuclear reactions, controlled chain reactions
- To understand the principle and working of particle detectors

Contents:

Experiment No. 1 : Newton's Rings
Experiment No. 2: Wavelength by diffraction grating
Experiment No. 3: Measurement of Divergence of Laser Beam
Experiment No. 4: Experiment of Laser
Experiment No. 5: Verification of Cosine Square Law of Malus
Experiment No. 6: Determination of Brewster's Angle and refractive index of glass
Experiment No. 7: Frank – Hertz Experiment

Experiment No. 8: Polarimeter
Experiment No. 9: Electron Diffraction

(LC) Basic Electrical Engineering Laboratory

Teaching Scheme
Practical : 2 hrs / week

Examination Scheme
Term Work: 100 marks

Course Outcomes:

Students will be able to:

- Comprehend the basic Electrical circuit components and their behavior.
- Practically verify the theorems applied to the Electrical circuits
- Receive Knowledge of single-phase and three-phase circuits and power measurement
- Evaluate magnetic circuit parameters
- Analyze of errors in the experiments
- Work in a methodical and organized manner
- Demonstrate improved communication ability as a result of careful experiment report writing.

Contents:

Minimum eight practical's are to be conducted out of the following.

List of Experiments:

- To verify KVL and KCL and current and voltage division.
- To experimentally verify the effect of temperature on resistance of a conducting Material.
- To verify Norton and Thevenin theorems.
- To verify Superposition theorem.
- Experimental Evaluation of Unknown Multi-Port, 4-node resistive Circuit.
- To determine the charging and discharging of a capacitor as a function of time.
- To analyze RLC circuit and to plot its locus diagram.
- To verify relationships between line and phase values for both star and delta connections.
- To evaluate the relative permeability and magnetic reluctance of a 3-Limb core using an exciting coil of unknown number of turns.
- To conduct load test on single phase transformer and pre-determine its efficiency and regulation.

(LC) Engineering Mechanics Lab

Teaching Scheme
Lab : 2 hrs / week

Examination Scheme
Mid sem: 40 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Verify principles of mechanics through experiments.
- Apply concepts of simple engineering problems using computer programs.
- Identify when theory applies and when theory is limited by simplifying assumptions.
- Identify reasons why actual measurements differ from theoretical calculations.
- Use the laboratory equipment correctly and safely to perform all experiments.

Contents:

1. Verification of law of polygon of forces
2. Determination of beam reactions
3. Determination of coefficient of friction between different surfaces
4. Belt friction
5. Determination of coefficient of restitution
6. Experiment of curvilinear motion and Projectile motion
7. Graphical method to find forces in truss members
8. Study of Space forces system

(HSMC) Professional Communication

Teaching Scheme
Lectures : 2 hrs / week
Practical: 1 hr / week

Examination Scheme
Internal Test 1: 30 marks
Internal Test 2: 30 marks
End Sem. Exam: 40 marks

Course Outcomes:

- The learning outcome of students is assessed through assignments, tests, mid-term and final exams and most importantly through practical performances.
- Through these tests, students would be able to reproduce their understanding of concepts/principles of communication in English language.
- Students would be able to present themselves well in front of large audience on a variety of topics. Moreover they would get the knack for structured conversation to make their point of views clear to the listeners.

Contents:

Unit I :

Communication as a skill: types of communication, barriers to communication, effective communication

Unit II :

Foundation of language: grammaticality and acceptability, word power, accuracy and appropriateness

Unit III :

Listening: nature of listening, stages of listening (pre, while and post)

Unit IV :

Speaking: pronunciation, stress, intonation and pauses, formal and informal expressions, conversation skills, general discussions, presentation skills, business etiquette

Unit V :

Reading: silent reading, reading aloud, reading for details, reading for gist, reading for pleasure, reading for study, reading between and beyond the lines

Unit VI :

Writing: nature of writing, stages of writing (pre, while and post), qualities of effective writing, what makes writing poor, the what, how and why of writing, drafting, summarizing, letter writing, writing reports

Reference Books:

- S. Mishra & C. Muralikrishna, "Communication Skills for Engineers", Pearson
- T.M. Farhathullah , "Communication Skills for Technical Students", Orient Longman
- Saran Freeman, "Written Communication in English", Orient Longman
- Raymond Murphy, "Essential English Grammar (Elementary & Intermediate)", CUP
- Shirley Tailor, "Communication for Business: A Practical Approach", Longman Developing
- Krishna Mohan & Meera Banerji, " Communication Skills", Macmillan
- R. C. Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill

Websites:

- http://www.englishpage.com; http://www.english-4u.de/
- http://www.nonstopenglish.com/; http://www.business-english.com
- http://www.breakingnewsenglish.com/; http://www.elllo.org/
- http://www.fonetiks.org

Semester II [M-Group]

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	BSC		Univariate Calculus	2	1	0	3
2	BSC		Solid State Physics and Statistical Thermodynamics	3	0	0	3
3	BSC		Applied Chemistry	3	0	0	3
4	EFC		Basic Electronics Engineering	3	0	0	3
5	SBC		Computer Programming	3	0	0	3
6	LC		Solid State Physics Laboratory	0	0	2	1
7	LC		Computer Programming Laboratory	0	0	4	2
8	LC		Applied Chemistry Laboratory	0	0	2	1
9	SBC		Electronics and Computer Workshop	0	0	2	1
				14	1	10	20
			Total Academic Engagement and Credits	**22**			**20**

(BSC) Univariate Calculus

Teaching Scheme
Lectures : 2 hrs / week
Tutorial: 1 hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to

- Know and recall the core knowledge of the syllabus.
- Understand the concept.
- Analyze the problem and apply the appropriate concept.
- Apply core concepts to new situations.
- Give reasoning.

Contents:

Unit I :

Review of limits, continuity and differentiability of univariate functions, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection, Jensen's inequality. **[10 Hrs]**

Unit II :

Integrals as limits of Riemann sums, fundamental theorem of calculus, logarithm and exponential functions through integrals, integrals by special techniques: reduction formulae, arc length, solids of revolution, surface area, improper integrals, Gamma and Beta functions, tests for convergence. **[10 Hrs]**

Unit III :

Sequences, recursively defined sequences, limits, subsequences, monotone sequences, infinite series, tests for convergence (Geometric series, p-series test, Ratio test, Root test, Comparison test, Leibnitz's test for alternating series), absolute convergence, power series and its convergence. Fourier series: definition, full and half range expansions of functions of arbitrary period. **[8 Hrs]**

Text Book:

- Thomas' Calculus (12^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.

- Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd

Reference Books:

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1st edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7th edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Calculus by Shanti Narayan, S. Chand and company, New Delhi.
- Applied Mathematics Vol. I (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan Pune.

(BSC) Solid State Physics and Statistical Thermodynamics

Teaching Scheme
Lectures : 3 hrs / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Understand the different types of structure of solids and analysis of crystal structure by X-ray diffraction technique.
- Understand the band structure of solids, categorization of solids based on the basis of band structure.
- Understand the significance of Fermi-Dirac probability function, position of Fermi level in intrinsic and extrinsic semiconductors, Semiconductor Conductivity.
- Understand basics of statistical mechanics, Fermi Dirac, Bose Einstein and Maxwell Boltzmann statistics.
- Understand the statistical interpretation of basic thermodynamic variables; energy, work, pressure, entropy, Helmholtz free energy.
- Understand the thermal properties of solids, specifically, specific heat and some models for specific heat calculation.
- Understand the origin and types of magnetism, significance of hysteresis loop in different magnetic materials and Principles of superconductivity, their uses in modern technology

Contents:

Unit I: Structure of Solids and its Characterization

Crystalline state, space lattice, lattice, basis and crystal structure, Unit cell and primitive cell, lattice parameters ,crystal systems in brief (7 Systems), atomic radius (simple cubic, fcc, bcc), iv), No. of atoms in unit cell, coordination number, packing fraction, Miller indices, inter planer distance of lattice plane, X-ray diffraction: Bragg spectrometer (Principle, construction and working), Analysis of XRD spectra for cubic system

Unit II: Solid State Physics

Sommerfeld's free electron theory, Density of states (1D, 2D, 3D), Nearly free electron theory, origin of band gap, magnitude of band gap, Classification of solids on the basis of band theory, Fermi energy level, Fermi-Dirac probability function, position of Fermi level in intrinsic (with derivation),Carrier concentration: (intrinsic and Extrinsic), Semiconductor conductivity:(intrinsic and Extrinsic)

Unit III: Statistical Mechanics

Micro and macro states, basic postulate of statistical mechanics, Concept and types of ensembles, partition function, Maxwell -Boltzmann statistics (MBS), Bose- Einstein (BES), Fermi -Dirac statistics (FDS)

Unit IV: Statistical Thermodynamics

Laws of thermodynamics; zeroth, first, second and third, Statistical interpretation of basis thermodynamic variables; pressure, work, energy, entropy, Helmholtz free energy, Gibb's free energy

Unit V: Thermal properties of solids

Thermal vibrations, specific heat of solids, Dulong Petit law, Einstein's theory of specific heat, Debye's theory of specific heat: Vibrational modes, density of vibrational mode, Debye's approximation

Unit VI: Magnetism and Superconductivity

Origin of magnetic moment, magnetization, Types of magnetism: Dia, para, ferro and antiferromagnetism, Curie Law for Paramagnetism (Statistical approach), Curie Weiss law, Antiferromagnetism and Ferrimagnetism, Introduction to superconductivity, Meissner effect, concepts of Cooper pair, Type-I and Type-II superconductors

Reference Books:

- B. D. Cullity, “Elements of X-ray Diffraction”, Addison-Wesley Publishing Company, Inc.
- Charles Kittel, “Introduction to Solid State Physics”, Wiley
- S. O. Pillai, “Solid State Physics”, New Age International Publishers.
- Ben G. Streetman, Sanjay Banerjee, “Solid state electronic devices”, Pearson Prentice-Hall
- B. B. Laud, “Fundamentals of statistical Mechanics”, New Age International Publishers
- F. Reif, “Fundamentals of Statistical and Thermal Physics”, Levant Pub
- Avadhanulu, Kshirsagar, “Text Book of Engineering Physics”, S. Chand Pub.
- B. D. Cullity, “Introduction to Magnetic Materials”, Wiley

(BSC) Applied Chemistry

Teaching Scheme
Lectures : 3 hrs / week

Examination Scheme
Assignment / quiz: 40 marks
End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Strengthen their understanding on the related core subjects in their respective branches
- Apply the acquired knowledge to engineering systems
- Receive Hands on experience / Analysis using relevant techniques.

Contents:

Unit 1: Water

Sources and quality of drinking water, Water quality parameters- heavy metal, microbial impurities, dissolved salts and their consequences (BIS and WHO standards), Determination of hardness by EDTA method, chloride content, Alkalinity of water and its significance, Water treatment for civic applications, Problems associated with use of hard water in Boiler and its treatment. [6 Hrs]

Unit 2: Spectroscopy techniques

An overview of various analytical techniques, Fundamentals of Spectroscopy, Principles and applications of UV-visible, IR, Flame photometry & Atomic absorption Spectroscopy [8 hrs]

Unit3: Fuels and combustion

Fuels: Definition, classification of fuels, calorific value and its units, Determination of calorific value -Bomb calorimeter, Boy’s colorimeter – numerical, Solid fuels : Coal, classification of coal, proximate and ultimate analysis of coal, numericals based on analysis of coal - Dulong and Goutel formula. Liquid fuels: Origin of petroleum, composition of petroleum, refining of petroleum, Chemical treatment for fuel upgradation , Knocking,

Octane number of petrol, cetane number of diesel ,Combustion :Chemical reactions, Calculation on air requirement for combustion – numericals. [7 Hrs]

Unit 4: Polymers

Classification of Polymers, Characteristics and Properties of polymers, Methods of polymerization, Copolymerization, addition polymerization, condensation polymerisation with suitable examples, Commercial important polymers e.g. viton, teflon, kevlar, Advanced polymeric materials; Conducting polymers, plastics, silicon base polymers Biodegradation and Recycling of polymers. [7Hrs]

Unit 5: Nanomaterials

Introduction, classes of nano materials, nano devices Synthesis of nanomaterials -Top down & bottom up approach, Fullerenes, Carbon nanotubes, Nanowires Synthesis of nanomaterials-Top down & bottom up approach ,Electronic and mechanical properties, Applications of nanomaterials–Catalysis, Electronics & Telecommunication, Medicines, Composites, Energy sciences. [6Hrs]

Unit 6: Corrosion and corrosion control

Corrosion- Atmospheric corrosion-mechanism, Wet corrosion-mechanism, Electrochemical and galvanic Series, Typical Electrochemical corrosion like (Pitting, Inter-granular, Soil, Waterline) ,Factors affecting corrosion-nature of metal, nature of environment, Kinetics of corrosion, Methods of prevention of corrosion-cathodic and anodic protection ,Metallic coatings, hard coatings. [6Hrs]

Reference Books:

- "A textbook of Engineering Chemistry", Jain and Jain, Dhanpatrai Publication.
- Willard Dean, Merrittee, "Instrumental Methods of Chemical analysis", Tata MacGrow Hill Limited.
- S. S. Dara, "A textbook of Engineering Chemistry", S. Chand Publication 2010 edn.
- Shashi Chawla, "A textbook of Engineering Chemistry", Dhanpatrai Publication.
- V.R.Gowariker, "Polymer Science", New Age International Publication
- S.K.Kulkarni, "Introduction to Nanotechnology"

(EFC) Basic Electronics Engineering

Teaching Scheme

Lectures : 3 hrs / week

Examination Scheme

Internal Test 1: 20 marks

Internal Test 2: 20 marks

End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Learn terminology, concepts and fundamentals in the field of Electronics, Communication, Mobile Technologies, Data networks and Internet.
- Learn how to develop and employ circuits using elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistors, Op-Amp and Timer IC.
- Learn how operational amplifiers are modeled, analyzed and study applications using Op-Amp.
- Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator;
- Acquire experience in building and trouble-shooting simple electronic analog and digital circuits.

Content:

Unit I: Semiconductor Devices and Applications

Introduction to P-N junction Diode and V-I characteristics .Full-wave bridge rectifier, capacitor filter. Zener diode and characteristics, Zener diode as voltage regulator, Regulated power supply IC based on 78XX and 79XX series. Introduction to BJT I/O characteristics, transfer characteristics BJT as a Single stage CE amplifier, Frequency response and bandwidth.

Unit II: Feedback and OPAMP

Principle of feedback, block schematic of feedback amplifier, Effect of negative feedback on amplifier parameters Ri, Ro, Av, Bandwidth Op-Amp as black box,, Ideal Op-Amp, Study of practical op-amp IC 741 Linear applications: Inverting and Non-inverting, Summing, Difference amplifier, unity gain buffer.

Unit III: Digital Electronics Fundamentals

Difference between analog & digital signals, Boolean algebra Basic & Universal Gates, Symbols, Truth tables, Expressions, Logic simplification, Logic ICs (Kmap---4 variable) Adder/Subtractor, Multiplexers/de-multiplexers, Flip-Flops as box, Asynchronous counter (3/4 Bit)

Unit IV: Timing Circuits and Signal Generators

RC-timing circuits, IC 555 and its applications as Astable and Mono-stable multi vibrators, Positive feedback, Barkhausen's criteria for Oscillations, R-C oscillators, IC 8038 as function generator IC.

Unit V: Introduction to Microprocessors

Shift registers, Memory (RAM, ROM, PROM, EPROM), Architecture and instruction set of 8085 microprocessor.

Unit VI: Introduction to Electronic Communication Systems

Block schematics, modulation schemes, Wired and wireless channels,, Broadcast radio Principle of Systems such as cellular telephony and its generations up to 4G, Data networks and Internet, Convergence.

Text Books:

- Malvino ,"Electronic Principles", PHI
- R.P. Jain , "Modern Digital Electronics", Tata Mc Graw Hill, Third Edition

Reference Books:

- Allen Mottershed, "Electronic Devices and circuits", Second Edition ,
- Frenzel, "Communication Electronics", WIE

(EFC) Computer Programming

Teaching Scheme	Examination Scheme
Lectures : 3 hrs / week	Internal Test 1: 20 marks
Tutorials : 2 hours / week (Conducted in	Internal Test 2: 20 marks
Laboratory, in 4 batches of 15-18 students)	End Sem. Exam: 60 marks

Course Outcomes:

Students will be able to:

- Understand the basic terminology used in computer programming
- Choose programming components that effectively solve computing problems in real-world
- Design programs involving decision structures, loops, pointers, functions and structures.
- Create/update basic data files

Contents:

Unit I: Introduction to Problem Solving

Understanding a problem, Framing a problem in simple terms – mathematical, graphical, other abstractions, Problem solving heuristics, Conveying the solution in a formal language (the foundation of programming) – using pseudo-code, unplugged exercises. Variables,

constants, decisions and loops in pseudo-code and flowcharts, Sub-program concept and its representation in pseudocode and flow-charts. An example of the kind of problems we expect to cover is found in the `Unplugged Exercises' Manual. [4 hr]

Unit II: Introduction to C programming

Basic program structure, variables, constants, I/O, Operators, decision control and blocks. Loop control. Application(Some problems of fundamental importance.) [10 hr]

Unit III: Arrays and Strings

Concept and requirement of arrays, defining arrays –one, two and multi-dimensional. Important problems that use arrays. Strings, Important string functions, important problems which use strings. [6 hr]

Unit IV: Functions and Recursion

Concept of subprogram applied to C, Declaration, Definition, Calling. Arguments, Local variables. Global and Static variables. Important problems using functions. Concept of recursion, essential components of a recursive program, recursion v/s iteration. Some important recursive algorithms. [6 hr]

Unit V: Pointers

Pointers and addresses, Use of pointers for passing variables, Pointers and arrays, Dynamic allocation and its application. [6 hr]

Unit VI: Structures and File Handling Structures, Pointers and structures, Structures and Functions, Self-referential structures Introduction to linked lists and data structures. What is a file, Basics of file handling (Text files). [6 hr]

Text books

- E. Balguruswamy, “Programming in ANSI C”, Tata Mc-Graw Hill
- “Programming With C”, Schaum Series

Reference Books

- Stephen G. Krantz, “Problem Solving Techniques” , Universities Press.
- Kernighan and Ritchie, “The ‘C’ programming language”, Prentice Hall
- V. Rajaraman, “Computer Programming in ‘C’”, Prentice Hall
- R.G. Dromey, “How to solve it by Computer”, Pearson Education

(LC) Solid State Physics Laboratory

Teaching Scheme
Practical: 2 hrs / week

Examination Scheme
End Sem. Exam: 100 marks

Course Outcomes:

Students will be able:

- To understand Fermi-Dirac probability function, Position of Fermi level in intrinsic and extrinsic semiconductors, Semiconductor conductivity
- To understand Fermi-Dirac probability function, position of Fermi level in intrinsic and extrinsic Semiconductors, Semiconductor Conductivity
- To understand Concept of gradient, operator, divergence and curl Line, surface and volume integrals,
- To understand magnetic fields and forces
- To understand the electric field in dielectric,
- To understand the basic equations of electromagnetism

Contents:

Experiment 1: Bandgap of a semiconductor by four probe method
Experiment 2: Hall Effect in a semiconductor
Experiment 3: Biot- Savart's law
Experiment 4: Determination of e/m by Thomson's method
Experiment 5: Magnetic susceptibility by Quinke's method
Experiment 6: Magnetoresistance of semiconductors
Experiment 7: Dielectric constant kit
Experiment 8: Study of P-N Junction
Experiment 9: Linear Absorption Coefficient by G. M. Counter

(SBC) Computer Programming Lab

Teaching Scheme
Tutorials : 2 hrs / week
Practicals: 2 hrs/ week

Examination Scheme
Internal Test 1: 40 marks
Internal Test 2: 40 marks
Term work: 20 marks

Course Outcomes:

Students will be able to:

- Receive understanding of basics commands in Linux
- Choose programming components that efficiently solve computing problems in real-world, write, compile, debug and execute programs in C

- Document and present the algorithms, flowcharts and programs in form of user-manuals

Contents:

Course Outline

The course involves writing code for solved, unsolved and practice programming problems given in the lab manual.

This lab manual will contain -

- One solved problem per concept
- Two unsolved problems with hints.
- Three unsolved problems without hints [Problems in category 2 and 3 will have to be done in the lab and submitted towards term work].
- A list of 10-20 unsolved problems grouped by difficulty. To be solved for practice but not towards term work.

The lab manual will contain experiments that involve at least (but not limited to) the following concepts (listed with examples) --

Basic problem solving – (Various ``unplugged'' exercises)

Basic C program -- (Using variables, constants and simple I/O statements)

Arithmetic operators and simple arithmetic expressions – (Unit Conversion, Simple Interest, Basic Physics and Mathematics Formulae)

Swapping two values, rotating three values.

Simple character handling – (Recognition, Case change, Counting)

Decision control and blocks – (Tests of Divisibility, Triangularity, Nature of Quadratic Roots, Leap year, Calculator)

Loop control – (Arithmetic and geometric progressions, Trigonometric ratios using power series, Power, Factorial, Fibonacci series, Pattern generation)

Arrays – (Declaration, Initialisation and Access, Generating value tables, Simple Data processing – Summation of array elements, Average of elements, Maximum and Minimum.)

Sorting -- (Bubble, Insertion and Selection sorting algorithms)

Searching -- (Linear and Binary search)

2-D Arrays – (Basic matrix operations, Matrix multiplication)

Strings – (Initialisation and usage, Important string functions, String matching, String reversal)

Basics of functions -- (Declaration, Definition and Usage – previously solved problems like unit conversion, trigonometric ratios, etc. can be re-done using functions)

Arrays and functions – (Sorting and Searching with functions)

Recursive Functions -- (Summation, Power, fibonacci series)

Use of Pointers for Indirect Access
Use of Pointers for passing variables
Use of Pointers for passing arrays and strings.
Dynamic memory allocation
Structures – (Basics of Structures -- definition, declaration and usage)
Arrays of Structures -- (Student Database, Telephone Directory)
Passing Structures to Functions
Pointer to Structure and Passing Structure using Pointers
Self-Referential Structure (Basics – definition, declaration and usage)
File Handling – (Reading and Writing into Text Files with standard functions)

(LC) Applied Chemistry Laboratory

Teaching Scheme
Practical: 2 hrs / week

Examination Scheme
CCE: 70 Marks
ESE: 30 Marks
Total: 100 Marks

Course Outcomes:

Students will be able to:

- strengthen their practical understanding on the related core subjects in their respective branches
- Successfully participate in both research, and development of innovative technology programs, both at the national and international levels.
- Handle different instruments which are used in various industrial laboratories.

LIST OF EXPERIMENTS

- Preparation and Standardization of Analytical Reagents
- Determination of temporary and permanent hardness of water sample by EDTA method.
- Determination of total alkalinity of water sample.
- Residual Chlorine in tap water
- Determination of molecular weight of a polymer using Ostwald's viscometer.
- pH-metric titration of Acid/Base
- Spectrophotometric/colorimetric determination of concentration of given inorganic sample.
- Demonstration of Flame-Photometry
- Determination of calorific value of a fuel using Bomb's calorimeter
- Proximate Analysis of coal

(SBC) Electronics and Computer Workshop

Teaching Scheme | **Examination Scheme**

Practical: 2 hrs/week | TW: 50 marks

Course Outcomes:

At the end of the lab course, students will demonstrate the ability to:

- Identify, handle and use various electronic components, devices and instruments with “What is it" and "How it works" insight, towards skill development.
- Build and test a hobby class electronic circuit, with flavor of small real life application, on printed circuit board.
- Get introduced to various computer system hardware components, peripherals and terminologies frequently used in software and hardware world and acquire proficiency in handling them.
- Build a dual boot machine by installing different operating systems on it and install software on various operating systems including GNU/Linux and Microsoft Windows.
- Create basic networking setup using 2-4 PCs and networking hardware.
- Troubleshoot day to day life problems on personal computers, including issues related to: Network connection, display, power-on, software configuration, software network setup

Contents:

Part A) Electronics

Activity I:

Introduction to various electrical passive components such as R, C, L, transformers, relays, switches, bread board, universal printed circuit board and electronic devices such as rectifying diode, Zener diode, light emitting diode, transistor, seven segment displays, LCD panel, Integrated circuit chip (with different packages and functionalities, both digital and analog) and Surface mount devices/chips. Acquaintance with ratings, specifications, packages of components and devices listed above, using data-sheets.

Activity II:

Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/ 1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester.

Activity III:

Circuit building practice on standard bread board using simple ICs, components and single strand wires, performing cold test and functionality verification wherever possible.

Soldering and de-soldering practice on universal PCBs using solder guns/stations/de-soldering pumps, for components/devices/ICs listed above.

Activity IV:

Build and Test for functionality, a hobby category electronic circuit towards a simple real life application, using off-the-shelf components/devices as listed above, in a TEAM of THREE Students. Following sub-activities be followed:

The single sided printed circuit board (PCB) should be designed using any available open source PCB-CAD software, towards deployable artwork.

The designed artwork should be transferred to copper clad laminate board any available PCB manufacturing/fabrication process.

After soldering the components and devices onto the PCB, the design should be tested and demonstrated for intended functionality, using above mentioned instruments.

Sample Examples of Circuits for BUILD and TEST projects:

1. IC 555 based timer and square wave generator
2. OP-amp IC 741 based analog computer (adder/subtractor/integrator/Differentiator)
3. FM remote lock for vehicle
4. Digital Clock
5. Temperature sensor and display

Part B) Computer

Activity I:

1) Name and identify various PC hardware components: USB Mouse, PS/2 Mouse, Keyboard, LCD/LED Monitor, VGA, HDMI, CAT5, CAT6, server, routers, fiber cable, Hard disk, RAM, CMOS battery, SMPS, cache, ROM, BIOS

2) Type using all your fingers and achieve a speed of 30 words per minute

Activity II:

Introduction to various important software: Ubuntu, Windows, Mac, Libreoffice and Microsoft Office; Firefox, Google Chrome, Tor; Linux Command Line (few basic commands); Photoshop, Gimp

Understand the broad structure and functioning of the Internet; Learn the following terms and concepts: LAN, DNS, Proxy, Router, Hub, Switch, Server, Client, Website, Web-server;

Understand basic networking commands, applications and services: ssh, telnet, ftp, winscp,

ping, http, https, various search services (google, startpage, aggregator search services)
Prepare a working LAN cable by using crimping tools.

Activity III:

Assemble a Desktop PC from it's components
Install any two operating systems on a PC making it dual boot, including latest version of Ubuntu Linux, Windows 7/8
Connect 2-4 computers together using a network hub to create a LAN

Activity IV:

Setup a working desktop system using a Raspberry Pi board. Download the OS image from web. Try installing one of the various operating systems on the board: Raspbian, Ubuntu Mate, Openelec, OSMC, Pidora, RISC OS, Arch Linux ARM, etc.

Resources:

Electronics Workshop

- Consumables such as passive components, devices, ICs, bread-boards, wires, solder metal, flux, displays, switches, relays, transformers, copper clad laminates, chemicals for PCB fabrications etc.
- Equipment such as Oscilloscope, function generators, power supplies, solder stations/guns, de-soldering pumps, PCB drilling and de-burring machines, Open source PCB design software hosted on Desktops.
- Data sheets, application notes, volumes of magazines such as Electronics For You etc.

Computer Workshop

- PC Hardware components: Motherboard, processor, SMPS, RAM, DVD-RW drive, Hard disk drives, power cables, VGA/HDMI connectors, Keyboard, Mouse (PS2/USB), Cabinet, LED displays
- Raspberry Pi Complete Kit: Raspberry Pi 2, Micro SD Card, Plastic case, Power adapter, HDMI cable, RCA Video/Audio cable, Cat5 cable
- Network Hub (4/8 ports), CAT5 cables network tool kit (Network crimper, Cable Tester, Wire stripper)