Academic Regulations

Program structure & Detailed Syllabus

For

Under Graduate Programme (B.Tech.)

ELECTRICAL &ELECTRONICS ENGINEERING

(Applicable For Batches Admitted From 2020 – 2021)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY

(AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTUK, Kakinada, AP)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY

(AUTONOMOUS)

INDEX

ACADEMIC REGULATIONS
(VR 20)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM

ACADEMIC REGULATIONS for B. Tech. (Regular)
(Applicable for the batches admitted 2020-21 onwards)

The Admission of students into B. Tech. course shall be as per the Govt. of Andhra Pradesh rules.

1. Award of B. Tech. Degree

A student will be declared eligible for the award of the B. Tech. degree if he/she fulfils the following academic regulations.

a. Pursue a program of study for not less than four academic years and not more than eight academic years.
b. For lateral entry scheme admission: Pursue a program of study for not less than three academic years and not more than six academic years.
c. For the award of a degree, regular candidate has to register for 160 credits and shall secure 160 credits.
d. Lateral entry candidate has to register for 121 credits from second year onwards and shall secure 121 credits

2. Courses of Study

The following courses of study are offered at present for specialization in the B. Tech. Course.

S. No.	Course Code	Programme & Abbreviation
01	01	Civil Engineering (CE)
02	02	Electrical and Electronics Engineering (EEE)
03	03	Mechanical Engineering (ME)
04	04	Electronics and Communication Engineering (ECE)
05	05	Computer Science and Engineering (CSE)
06	12	Information Technology (IT)
07	19	Electronics and Computer Engineering (E. Com E)
08	54	Artificial Intelligence and Data Science (AI&DS)

And any other Course as approved by the authorities of the Institute from time to time.

3. Registration: A student shall register for courses in each semester as per the courses offered by the concerned department.

4. Curricular Program:

The Curriculum of the four-year B. Tech course has been designed to achieve a healthy balance between theory & lab hours, industry orientated and to develop technical skills, Interdisciplinary skills etc.,

5. Distribution and Weightage of Marks

i. The performance of a student in each semester shall be evaluated course -wise with a maximum of 100 marks for theory courses and 50 marks for practical course. The project work shall be evaluated for 200 marks.

ii. For theory course the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Semester Examinations. Distribution of marks for theory course, practical course and Design/Drawing is detailed below:

5.1. Internal 30 marks for theory course shall be awarded as follows:

i) MID exams -18marks
ii) Continuous assessment - 10 marks
iii) Attendance –2 marks

MID marks shall be calculated with 80% Weightage for best of the two MIDs and 20% Weightage for other MID exam.

5.2. For practical courses (Laboratory): There shall be continuous evaluation during the semester. Each Lab exam is evaluated for 50 marks. 20 marks shall be awarded for internal examination and 30 marks shall be awarded for external examinations.

5.2.1. Internal marks shall be awarded as follows

i) Day to day assessment including record– 10 Marks
ii) Internal laboratory exam– 10 Marks

5.2.2. The semester end examinations shall be conducted by the faculty concerned and external examiner

5.3. For the courses having design and/or drawing, (Such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation.

5.3.1. Internal marks shall be awarded as follows:

i) 18 marks for Mid exams
    - Day-to-day assessment - 8 marks
    - Internal exam - 10 marks
ii) Continuous assessment - 10 marks
iii) Attendance - 2 marks

There shall be two internal examinations in a semester and the internal marks shall be calculated with 80% weightage for best of the two internals and 20% weightage for other internal exam.

5.3.2. External examination shall be conducted for 70 marks.

5.4. Special Courses:

5.1.1. **Engineering Exploration (EE) course:**

EE course is evaluated for 50 marks.

i) Internal 20 marks shall be awarded based on the day-to-day performance of the activities.

ii) External evaluation shall be conducted for 30 marks.

- Project submission – 20 marks
- Viva-Voce – 10 marks

5.1.2. **Games, Sports & Yoga:** Though this course has no credits, it is mandatory to satisfy minimum attendance of 80%.

5.5. Mini project (EPICS): It is to be carried out during the second year. Students have an option to choose their own area of interest related to problems impacting the society. It is evaluated for 50 marks.

i) Internal assessment - 20 marks ii) Project submission and Viva-Voce - 30 marks

5.6. Evaluation of the summer internships:

It shall be completed in collaboration with local industries, Govt. organizations, construction agencies, Industries, Hydal and thermal power projects and also in software MNCs in the area of concerned specialization of the UG programme.

The minimum duration of this course shall be at least 4-6 weeks.

A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship.

After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development centre shall be included in the report. It shall be evaluated for 50 external marks at the end of the semester. The technical report and the oral presentation shall carry 20 marks and 30 marks respectively. There shall be no internal marks for Summer Internship. In case, if a student fails, he/she shall reappear and when semester supplementary examinations are conducted.

5.7. Job – oriented skill courses

The job-oriented skill courses maybe registered at the college or at any accredited external agency. A student shall submit a record/report on the list skills learned. If the student completes job- oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50marks (record/report: 20 marks and viva-voce/exam: 30 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job-oriented skill courses.

5.8. Audit courses: All audit courses will be “Pass/Fail” type with no credit points allotted. The result of the student in the audit course will be notified in the marks memo. A student must pass all the audit courses registered to be eligible for the award of B. Tech. degree. Environmental Sciences shall be offered compulsorily as mandatory course for all branches.Aminimumof75%attendanceismandatoryinthesesubjects.

List of audit courses will be notified from time to time. An indicative list of courses is as shown below.

a) Professional ethics & Universal Human Values b) Constitution of India c) Life skills d) Environmental science e) Entrepreneurship development f) IPR & Patents g) Gender sensitization for women empowerment h) Game, sports and yoga

5.9. MOOCs: It is an online course (Minimum of 12 weeks) to promote advanced knowledge suitable for placement and research.

To award credits, the student should get certificate after they have registered for written exam and successfully passed

(Or)

College will conduct the written examination/Viva-voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

Note: The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.

5.10.Major Project *(*Project - Project work, seminar and internship in industry):

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated by external examiner.

Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15marks, Seminar: 15marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140marks.

5.11 Integrated theory lab:

a. The integrated course is in the ratio of 2:1 (total credit: 3).
b. Attendance shall be counted for both in theory as well as lab. Minimum attendance shall be required individually in theory and lab as per institute norms.
c. Student has to attend the internal examination and external examination conducted

by the institution as per the regulations.

d. Student has to pass individually both the external examinations (Theory for 100 marks and Lab for 50 marks).
e. If the student fails in either theory or laboratory, the final result is FAIL only.
f. The student has to pass separately both in the external theory examination and external lab examination.

6. Attendance Requirements:

a. It is desirable for a candidate to have 100% attendance in the class in all the courses. However, a candidate shall be permitted to appear for the end semester examination if he/she has a minimum of 75% aggregate attendance in the semester. Student will not be permitted to write Mid examination if the attendance percentage is less than 75 % during the stipulated instruction duration. However, Academic Committee shall review the situation and take appropriate decision.

Note: Special cases for students having extraordinary performance at National and International level will be considered by the Academic Committee.

b. Condonation of shortage of attendance may be considered on Medical grounds maximum up to 10%, if the student provides the medical certificate to the HOD immediately after he / she recovers from the illness. Medical Certificate submitted afterwards shall not be permitted. Shortage of attendance equal to or above 65% and below 75%will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study***.

c. Shortage of attendance may be considered for the students who participate in prestigious sports, co and extra-curricular activities if their attendance is in the minimum prescribed limit.
d. A student will be promoted to the next semester if satisfies attendance and credits requirement.

7. Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements.

For any course, student is considered to be passed upon securing minimum 40% marks in the external examination alone and minimum 50% marks from both internal and external examination put together.

8. Promotion Policy:

a. A student shall be promoted from first year to second year if he/she fulfills the minimum attendance requirements.
b. To promote to III year, a student has to secure minimum 40% of total credits from I & II-year courses.

c. To promote to IV year, a student has to secure minimum 40% of total credits from I, II & III-year courses.
d. In case of Lateral entry students, to promote to IV year, a student has to secure minimum 40% of total credits from II & III-year courses

9. GAP Year: Gap year concept is introduced after completion of the I/II/III year to give the opportunity to explore entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at Institute level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing Gap year.

10. Supplementary examinations: Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa. In case a student fails in online courses/ industrial lecture(s), he/she may be permitted to register for another course/lecture(s).

11. Examinations and Evaluation

a. General guidelines
   i. All the semester end examinations are conducted for duration of three hours.
   ii. External examination shall be conducted for 70 marks consist of five questions of internal choice carrying 14 marks each.
   iii. For laboratory examinations, the evaluation is done by internal examiner and an external examiner.
b. Revaluation: There is a provision for revaluation of theory courses if student fulfils the following norms.

The request for revaluation must be made in the prescribed format duly recommended by the Chief Superintendent of Examinations through Additional Controller along with the prescribed revaluation fee.

12. Grading System:

CGPA

Marks Range (in %)	Letter Grade	Level	Grade Point
≥ 90	O	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Satisfactory	6
<50	F	Fail	0
	AB	Absent	-1
	WH	Withheld	-2
	MP	Malpractice	-3

	CP	Completed	

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average. (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

SGPA (Si) = Σ (Ci x Gi) / ΣCi

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

Computation of CGPA

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA =Σ (Ci x Si) / Σ Ci

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

Conversion of CGPA to Percentage:

Equivalent Percentage = (CGPA – 0.75) X 10

13. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following three classes:

Regular:

Class Awarded	**CGPA to be secured**	**From the CGPA secured from160 Credits.**
First Class with Distinction	≥ 7.75 with no failures	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

Lateral- entry scheme:

Class Awarded	**CGPA to be secured**	**From the CGPA secured from121 Credits from II Year to IV Year**
First Class with Distinction	≥ 7.75 with no failures	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

14. General Instructions

i. Where the words ‘he’, ‘him’, ‘his’, occur, they imply ‘she’, ‘her’, ‘hers’, also.

ii. The academic regulations should be read as a whole for the purpose of any interpretation.

iii. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.

iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institution.

15. Transitory Regulations

i. The student has to continue the course work along with the regular students of the respective semester in which the student gets re-admission.
ii. The student has to register for Substitute / Compulsory courses offered in place of courses studied earlier.
iii. The mode of internal evaluation and end-semester examinations shall be on par with the regular students, i.e., the student has to follow the mode of internal evaluation and the then question paper model for the end-semester examinations along with the regular students of the respective semester in which the student gets re-admission. The marks secured in the internal and end-semester examinations will be pro-rated in accordance with the regulations under which the student was first admitted.
iv. For the courses studied under earlier regulations but failed, the student has to appear, pass and acquire credits from the supplementary examinations as and when conducted. The question paper model shall remain same as the one in which the student took examination during previous regulations.
v. The promotion criteria based on attendance as well as credits shall be in accordance with the regulations under which the student was first admitted.
vi. All other academic requirements shall be in accordance with the regulations under which the student was first admitted.
vii. The decision of the Principal is final on any other clarification in this regard.
viii. Transcripts: After successful completion of the entire program of study, a transcript containing performance of all academic years will be issued as a final record. Partial transcript will also be issued up to any point of study to a student on request, after payment of requisite fee.

16. Minimum Instruction Days

The minimum instruction days for each semester shall be 16 weeks.
There shall be no branch transfers after the completion of the admission process.

17. Withholding of Results

If the student has not paid the dues, if any, to the Institute or in any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

Note: All other regulations including attendance requirements related to four year B. Tech Regular program will be applicable for B.Tech. Lateral Entry Scheme.

18. Malpractices Rules

DISCIPLINARY ACTION FOR MALPRACTICES / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/ Improper conduct	Punishment

1 (a)	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the course of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic

		regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant - Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and. a police case will be registered against them.

10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic committee of the Institute for further action to award suitable punishment.	

19. UGC RECOMMENDED PUNISHMENT FOR RAGGING

i. Suspension from attending classes and academic privileges
ii. Withholding/withdrawing scholarships/fellowship and other benefits.
iii. Debarring from appearing in any test/examination or other evaluation process
iv. Withholding results
v. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
vi. Suspension/expulsion from the hostel
vii. Cancellation of admission
viii. Rustication from the institution for period ranging from 1 to 4 semesters.
ix. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
x. Fine may extend up to Rs. 2.5 lakh.

***

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM

~~~~~~~~~~~~

Guidelines B. Tech Minors in Engineering
(Applicable from the Academic Year 2020-21 (VR 20))
~~~~~~~~~~~~

Award of B. Tech. (Minor): A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the minor. The department concerned will determine the required courses for award of minor. The subjects in minor programme would be a combination of mostly core and some electives.

Registering for Minor is optional.

I. OBJECTIVES

The objectives of initiating the minor certification are:

(a) To diversify the knowledge of the undergraduates.
(b) To make the undergraduates more employable.
(c) To have more educational and professional skills after the completion of his undergraduate courses.
(d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

II. Applicability and Enrolment

(a) To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
(b) There shall be no limit on the number of programs offered under Minor. The minor programs in emerging technologies based on expertise in the respective departments may be offered and minor can also be offered in collaboration with the relevant industries/agencies.
(c) Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
(d) If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.
(e) The allotment of seat into minor is based on the percentage of marks obtained in the major degree programme. Percentage of marks shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students
(f) In the event of any tie during the seat allotment for a minor, the concerned major degree department offering minor shall conduct a test/interview on the prerequisite subjects of minor and final decision shall be taken.
(g) For applicability of minor, both regular B Tech and minor courses shall be successfully completed with specified SGPA/CGPA
(h) A student shall report the concerned Principal of the college, if he/she is not interested to pursue/continue the minor programme.
(i) Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted

III. Entry level

(a) The B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor at their choice in any other department offering minor from III semester onwards.
(b) Students registering for minor shall select the subjects from other branches. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall select the subjects specified for minor in Civil Engineering and he/she will get major degree of Electrical & Electronics Engineering with minor of Civil Engineering.
(c) Student pursuing major degree in any engineering branch is eligible to register for

minor in any other engineering branch. However, students pursuing major degree in a particular Engineering are not allowed to register for minor in the same engineering branch.

(d) Only those students, who have a CGPA of 7.75 or above, without any backlog, will be permitted to register for a minor.

(e) An SGPA or CGPA in excess of 7.75 has to be maintained in the subsequent semesters in major as well as minor without any backlogs in order to keep the minor registration active.

(f) Should both the SGPA and CGPA fall below 7.75 at any point after registering for the minor; the minor registration will cease to be active.

(g) A student registered for minor in a discipline must register and pass in all subjects with a minimum GPA of 7.75 that constitute requirement for award of minor.

(h) Separate CGPA shall be shown on semester and final transcripts of regular B. Tech and minor.

(i) Students shall not be permitted to register for minor after completion of VI semester.

(j) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for minor.

(k) The students shall complete minor without supplementary appearance within stipulated period for the completion of regular major B. Tech programme.

(l) Minor shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted

(m) If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses of minor

(n) If a student failed in any registered course of the minor, he/she shall not be eligible to continue the B.Tech minor. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.

(o) The subjects completed under minor programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme

(p) Students completed their degree shall not be permitted to register for minor

IV. Structure of Minor in B. Tech

(a) The student shall earn at least 20 credits for award of minor from other branch/ department/ discipline registered for major degree.

(b) Students can complete minor courses either in the college or in online from platforms like NPTEL/SWAYAM etc.

(c) The overall attendance in each semester of regular B. Tech courses and minor courses shall be computed separately

(d) A student shall maintain an overall attendance of 75% in all registered courses of minor to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee.

(e) Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations.

(f) A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue minor programme

(g) The teaching, examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B. Tech courses

(h) The students may choose theory or practical courses to fulfil the minimum credit requirement.

(i) The students may be allowed to take maximum two subjects per semester pertaining

to their minor

(j) The students are permitted to opt for only a single minor course in his/her entire tenure of B.Tech(Engineering)

(k) The students registered for B. Tech (Hons) shall not be permitted to register for minor

(l) The student is not permitted to take the electives courses from the parent department fulfil the minimum credit requirement.

V. Credits requirement

(a) A Student will be eligible to get minor along with major degree engineering, if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM

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

(c) The colleges offering minor courses shall be ready teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies

(d) The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14weeks.

(e) The teaching and evaluation procedure of minor courses offering in offline mode shall be similar to that of regular B.Tech courses

(f) Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment

(g) The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL.

(h) After successful completion of all major and minor courses with specified CGPA the Institute will award both major and minors

(i) If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the minor

VI. Procedure to Applying for the Minor

(a) The department offering the minor will announce specialization and courses before the start of the session.

(b) The interested students shall apply through the HOD of his/her parent department.

(c) The concerned department will announce the list of the selected students for the minor.

(d) The whole process should be completed within one week before the start of every session.

(e) Selected students shall be permitted to register the courses for minor.

VII. Registering for minor courses

(a) Each department offering the minor will submit the final list of selected students to the principal.

(b) The selected students shall submit a joining letter to the Principal through the concerned HOD offering the minor. The student shall inform same to the HOD of his/her parent department.

(c) Both parent department and department offering minor shall maintain the record of student pursing the minor

(d) With the approval of Principal and suggestion of advisor, students can choose courses from the approved list and shall register the courses within a week as per

the conditions laid down in the structure for the minor.

(e) Each department shall communicate the minor courses registered by the students to the time table drafting committee and accordingly time table will be drafting. Time table drafting committee shall see that no clash in timetables.

(f) If the student wishes to withdraw/change the registration of subject/course, he/she shall inform the same to advisor, subject teacher, HODs of minor department and parent department and Principal within two weeks after registration of the course.

VIII. Procedure for Monitoring the Progress of the Scheme

The students enrolled in the minor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

IX. Allocation of seats for minor

(a) The Institute will notify the number of the seats for minor in the concerned department well in advance before the start of the semester

(b) Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.

(c) The list of the elective for minor will be offered from the list of running majors in the concerned subjects. Each department of concerned institute will notify the seats for the minor well before the start of each session as per the following Table

S. No	Name of the course	Sanction seats of major degree programme	Seats offered for minor	Courses offered	Credits for each course

X. Course Fees for registration of subjects in Minor degree

There is no fee for registration of subjects for minor degree programme offered in offline at the respective colleges.

XI. Examinations

(a) The examination for the minor courses offered in offline shall be conducted along with regular B. Tech programme.

(b) The examinations (internal and external) and evaluation procedure of minor courses offered in offline is similar to regular B.Tech courses.

(c) A separate transcript shall be issued for the minor subjects passed in each semester

(d) There is no supplementary examination for the failed subjects in a minor programme.

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)
VISAKHAPATNAM

~~~~~~~~~~~~

Guidelines for B. Tech Honors - B. Tech (Hons)

(Applicable from the Academic Year 2020-21 (VR20))

Award of B. Tech. (Honors): All the students pursuing regular B.Tech with prerequisite CGPA are eligible to the register Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B.Tech Honors degree. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for
~~~~~~~~~~~~

award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.

I. OBJECTIVES

The objectives of initiating the B. Tech (Honors) degree certification are:

a) To encourage the undergraduates towards higher studies and research
b) To prepare the students to specialize in core Engineering streams
c) To attain the high-level competence in the specialized area of Under Graduate programme
d) To learn the best educational and professional skills in the specialized area after the completion of his undergraduate courses.
e) To provide the opportunity to learn the post graduate level courses in the specified undergraduate programme

II. Applicability and Enrolment

a) To all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology
b) The department offering Honors shall have at least one M. Tech in concerned stream, for B. Tech (Honors)registration.
c) Total number of seats offered for a minor programme shall be a maximum of 35% of sanctioned intake of major degree programme.
d) The allotment of seat into Honors degree is based on the percentage of marks obtained in the major degree programme. Percentage of marks shall be taken up to III semester in case of regular entry students and only III semester in case of lateral entry students
e) In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering minor shall conduct a test/interview on the prerequisite subjects of Honors degree and final decision shall be taken.
f) For applicability of Honors degree, both regular B Tech and Honors degree courses shall be successfully completed with specified SGPA/GCPA
g) A student shall report the concerned Principal of the college, if he/she is not interested to pursue/continue the Honors degree programme. Transfer of credits from a particular minor to regular B. Tech or another major degree and vice-versa shall not be permitted

III. Entry level

(a) The B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for Honors degree at their choice in any same department offering major degree from III semester onwards

(b) Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BOS committee. For example, if a student pursuing major degree in Electrical & Electronics Engineering shall the selects subjects in Electrical & Electronics Engineering only and he/she will get major and Honors degree in Electrical and Electronics Engineering
(c) Only those students, who have a CGPA of 8.0 or above, without any backlog, will be permitted to register for a Honors degree
(d) An SGPA or CGPA in excess of 8.0 has to be maintained in the subsequent semesters in major as well as Honors degree without any backlogs in order to keep the Honors degree registration active.
(e) Should both the SGPA and CGPA fall below 8.0 at any point after registering for the Honors; the Honors degree registration will cease to be active.

(f) A student registered for Honors degree in a discipline must register and pass in all subjects with a minimum GPA of 8.0 that constitute requirement for award of Honors degree.
(g) Separate SGPA/CGPA shall be shown on semester and final transcripts of regular B. Tech and minor.
(h) Students shall not be permitted to register for Honors degree after completion of VI semester.
(i) Students shall be permitted to select a maximum of two subjects per semester from the list of subjects specified for Honors degree.
(j) The students shall complete Honors degree without supplementary appearance within stipulated period as notified by JNTUK for the completion of regular major B. Tech programme.
(k) Honors degree shall not be awarded at any circumstances without completing the regular major B. Tech programme in which a student got admitted
(l) If a student is detained due to lack of attendance, he/she shall not be permitted to register the courses for Honors degree
(m) If a student failed in any registered course of the Honors, he/she shall not be eligible to continue the B. Tech Honors. However, the additional credits and grades thus far earned by the student shall be included in the grade card but shall not be considered to calculate the CGPA.
(n) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme
(o) Students completed their degree shall not be permitted to register for Honors degree

IV. Structure of Honors in B.Tech

(a) The student shall earn at least 20 credits for award of Honors degree from same branch/department/discipline registered for major degree
(b) Students can complete Honors degree courses either in the college or online from platforms like NPTEL/SWAYAM etc.
(c) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses list in the departments, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two NPTEL, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
(d) The overall attendance in each semester of regular B. Tech courses and Honors degree courses shall be computed separately
(e) A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance between 65-75% may be given as per norms. On the recommendations of College Academic Council, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee
(f) Student having less than 65% attendance in Honors courses shall not be permitted for semester end examinations.
(g) A student detained due to lack of attendance in regular B. Tech programme shall not be permitted to continue Honors programme
(h) The teaching, examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B.Tech courses
(i) Students may choose theory or practical courses to fulfil the minimum credit requirement.
(j) Students shall be allowed to take maximum two subjects per semester pertaining to their Honors degree

(k) The students registered for minor shall not be permitted to register for B.Tech (Honors)

V. Credits requirement

(a) A Student will be eligible to get B. Tech (Honors), if he/she completes an additional 20 credits. These may be acquired either in offline or online like NPTEL/SWAYAM

(b) The colleges offering Honors degree courses shall be ready teach the courses in offline at their college in the concerned departments. Curriculum and the syllabus of the courses shall be approved by the Board of Studies

(c) The online NPTEL/SWAYAM subjects selected by a student shall be approved by concerned BOS. The duration of courses shall be a minimum of 14weeks.

(d) The assessment and certification of the NPTEL shall be as per the prescribed norms of the NPTEL.

(e) Students shall produce a certificate issued by the NPTEL/SWAYAM conducting agency as a proof of credit attainment.

(f) The teaching and evaluation procedure of Honors courses offering in offline mode shall be similar to that of regular B.Tech courses

(g) After successful completion of all major and Honors degree courses with specified CGPA the Institute will award B.Tech (Honors)

(h) If a student fails to complete a course offered in online/offline, he/she will not be permitted to continue the Honors degree

VI. Procedure to Applying for Honors degree

(a) The department offering the Honors will announce courses required before the start of the session.

(b) The interested students shall apply for the Honors course to the HOD of the concerned department

(c) The concerned department will announce the list of the selected students for the minor.

(d) The whole process should be completed within one week before the start of every session.

(e) Selected students shall be permitted to register the courses for Honors degree.

VII. Joining in Honors courses in B.Tech

(a) Each department offering the Honors degree shall submit the final list of selected students to the principal.

(b) The selected students shall submit a joining letter to the Principal through the concerned HOD.

(c) The department offering Honors shall maintain the record of student pursing the Honors degree

(d) With the approval of Principal and suggestion of advisor/mentor, students can choose courses from the approved list and shall register the courses within a week as per the conditions laid down in the structure for the Honor degree.

(e) Each department shall communicate the Honors courses registered by the students to the time table drafting committee and accordingly time table will be drafting. Time table drafting committee shall see that no clash in timetables.

(f) If the student wishes to withdraw/change the registration of subject/course, he/she shall inform the same to advisor/mentor, subject teacher, HODs of minor department and parent department and Principal within two weeks after registration of the course.

VIII. Procedure for Monitoring the Progress of the Scheme

The students enrolled in the Honor courses will be monitored continuously at par with the prevailing practices and examination standards. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

IX. Allocation of seats for Honors degree

(a) The Institute will notify the number of the seats for Honors degree in each department well in advance before the start of the semester

(b) Total number of seats offered for Honors degree shall be a maximum of 35% of sanctioned intake of major degree programme.

(c) Each department of concerned institute will notify the seats for the Honors well before the start of each session as per the following Table

S. No	Name of the course	Sanction seats of major degree programme	Seats offered for Honors	Courses offered	Credits for each course

X. Course Fees for registration of subjects in Major degree

There is no fee for registration of subjects for major degree programme offered in offline at the respective colleges.

XI. Examinations

(a) The examination for the Honors degree courses offered in offline shall be conducted along with regular B. Tech programme.

(b) The examinations (internal and external) and evaluation procedure of Honors degree courses offered in offline is similar to regular B. Tech courses.

(c) A separate transcript shall be issued for the minor subjects passed in each semester

(d) There is no supplementary examination for the failed subjects in a Honors degree programme.

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY: VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR 20

I Year – I Semester

S.No.	Course Code	Name of the Course	L	T	P	Credits
1	1000201100	Mathematics-I	3	1	0	3
2	1003201100	Engineering Mechanics	1	0	4	3
3	1005201100	Problem solving and Programming using C	3	0	0	3
4	1000201103	Solid State Physics	3	0	0	3
5	1000201104	Mathematics-II	3	1	0	3
6	1003201110	Engineering Workshop	0	0	3	1.5
7	1005201110	Problem solving and Programming using C lab	0	0	3	1.5
8	1000201112	Solid State Physics lab	0	0	3	1.5
9	1000201121	Constitution of India	2	0	0	0
					Total Credits:	**19.5**

I Year – II Semester

S.No.	Course Code	Name of the Course	L	T	P	Credits
1	1002201200	Electrical Circuit Analysis-I	3	1*	0	3
2	1003201101	Engineering Drawing	1	0	4	3
3	1000201201	Transforms and Vector Calculus	3	1*	0	3
4	1000201102	Technical English Communication	2	0	0	2
5	1000201105	Applied Chemistry	3	0	0	3
6	1000201110	Technical English Communication Lab	0	0	3	1.5
7	1002201211	Electrical Circuit Analysis-I Lab	0	0	3	1.5
8	1000201113	Applied Chemistry Lab	0	0	3	1.5
9	1000201160	Engineering Exploration	0	0	2	1
10	1000201120	Game, Sports and Yoga	0	0	4	0
					Total Credits:	**19.5**

II Year – I Semester

S.No.	Course Code	Name of the Course	L	T	P	Credits
1	1002202100	Fundamentals of signals and systems	3	1	0	3
2	1002202101	Electrical Machines-I	3	0	0	3
3	1002202102	Electro Magnetic Fields	3	1	0	3
4	1004202103	Semiconductor Devices and Circuits	3	0	0	3
5	1002202103	Electrical Circuit Analysis-II	3	1	0	3
6	1002202110	Electrical Machines-I Lab	0	0	3	1.5
7	1004202112	Semiconductor Devices and Circuits Lab	0	0	3	1.5
8	1020202100	Employability Readiness Program	2	0	0	2
9	1000202120	Life Skills	2	0	0	0
					Total Credits:	**20**

II Year – II Semester

S.No.	Course Code	Name of the Course	L	T	P	Credits
1	1004202204	Analog and Digital Electronics	3	0	0	3
2	1002202200	Control Systems	3	1	0	3
3	1002202201	Electrical Machines-II	3	0	0	3
4	1002202202	Power Generation Engineering and Economics	3	0	0	3
5	1099202100	Managerial Economics and Financial Analysis	3	0	0	3
6	1005202213	Fundamentals of Data Structures Lab	0	0	3	1.5
7	1002202210	Electrical Machines-II Lab	0	0	3	1.5
8	1002202211	Control Systems Lab	0	0	3	1.5
9	1005202281	Fundamentals of Data Structures	1	0	2	2
10	1000202121	Environmental Science	2	0	0	0
11	1002202260	Mini Project (EPICS)	0	0	2	1
					Total Credits:	**22.5**

Summer Internship

1		Honors / Minor courses	4	0	0	4

III Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002203100	Power Transmission Engineering	3	1	0	3
2	1002203101	Electrical Measurements and Instrumentation	3	0	0	3
3	1002203102	Power Electronics	3	1	0	3
4	**Professional Elective-I**		3	0	0	3
	1002203130	Digital control systems				
	1002203131	Energy audit conservation and management				
	1002203132	Special Electrical Machines				
	1002203133	Optimization techniques				
5	**Open Elective-I**		3	0	0	3
	1005202200	Database Management Systems				
	1004203143	Micro Electro-Mechanical Systems				
	1003204134	Green Engineering Systems				
	1001202140	Industrial Waste and Waste Water Management				
6	1005203111	Introduction to Python Lab	0	0	3	1.5
7	1002203110	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8	1002203111	Power Electronics Lab	0	0	3	1.5
9	1005203180	Introduction to Python	1	0	2	2
10	1099203120	Entrepreneurship Development	2	0	0	0
11	1002203160	Summer Internship	0	0	0	1.5
		Total Credits:				**23**

12		Honors/Minor courses	4	0	0	4

III Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002203200	Power Electronics Controllers and Drives	3	1	0	3
2	1002203201	Power System Analysis	3	1	0	3
3	1004203101	Micro Processor and Micro Controller	3	0	0	3
4	**Open Elective-II**		3	0	0	3
	1005202101	Operating Systems				
	1012203240	Data Mining				
	1019204131	Introduction to Embedded Systems				
	1001202240	Environmental Pollution and Control (EP&C)				
5	1002203210	Electrical Simulation Lab	0	0	3	1.5
6	1002203211	Power Systems and Simulation Lab	0	0	3	1.5
7	1004203111	Micro Processor and Micro Controller Lab	0	0	3	1.5
8	1054202180	Competitive Programming	1	0	2	2
9	1099203200	Management Science	3	0	0	3
10	1099203220	Universal Human Values and Professional Ethics	2	0	0	0
					Total Credits:	**21.5**

Industrial/Research Internship

11		Honors / Minor courses	4	0	0	4

IV Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	**Professional Elective-II**		3	0	0	3
	1002204130	Digital Signal Processing				
	1002204131	Solar Photovoltaic Energy Systems				
	1002204132	Utilization of Electrical Energy				
	1002204133	Energy storage systems				
2	**Professional Elective-III**		3	0	0	3
	1002204134	Advanced Control Systems				
	1002204135	Switch Gear and Protection				
	1002204136	Microgrids and Smart grids				
	1002204137	Advanced optimization techniques				
3	**Professional Elective-IV**		3	0	0	3
	1002204138	Neural Networks and Fuzzy Logic				
	1002204139	High voltage direct current				
	1002204190	Flexible alternating current transmission system				
	1002204191	Electric vehicles				
	1002204170	MOOCS				
4	**Professional Elective-V**		3	0	0	3
	1002204192	Power system operation and control				
	1002204193	Wind energy conversion systems				
	1002204194	Electrical distribution system				
	1002204195	Power Quality				
	1002204171	MOOCS				
5	**Open Elective-III**		3	0	0	3
	1012203100	Computer Networks				
	1005201202	Web Design				
	1005203233	Big Data Analytics				
	1003204135	Mechatronics				
6	**Open Elective-IV**		3	0	0	3
	1054203100	Machine Learning				
	1003202242	Industrial Robotics				
	1019203200	IoT and its Applications				
	1001204140	Disaster management				
7	1002204180	Industrial Programmable Logic Controllers	1	0	2	2
8	1099204120	IPR & Patents	2	0	0	0
9	1002204160	Industrial/Research Internship	0	0	0	2
					Total Credits:	**22**

10		Honors/Minor courses	4	0	0	4

IV Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002204260	**Main Project**	0	0	0	12
2	**SEMESTER LONG INTERNSHIP**					
					Total Credits:	**12**

GRAND TOTAL CREDITS: (I Y + II Y +III Y + IV Y) = (39 + 42.5 + 44.5 + 34) = 160

I YEAR I SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE

I Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1000201100	Mathematics-I	3	1	0	3
2.	1003201100	Engineering Mechanics	1	0	4	3
3.	1005201100	Problem solving and Programming using C	3	0	0	3
4.	1000201103	Solid State Physics	3	0	0	3
5.	1000201104	Mathematics-II	3	1	0	3
6.	1003201110	Engineering Workshop	0	0	3	1.5
7.	1005201110	Problem solving and Programming using C lab	0	0	3	1.5
8.	1000201112	Solid State Physics lab	0	0	3	1.5
9.	1000201121	Constitution of India	2	0	0	0
Total Credits:						**19.5**

Course Code	MATHEMATICS -I	L	T	P	C
1000201100		3	1	0	3

COURSE OBJECTIVES:

Course Objectives:

1. Utilize mean value theorems to find the characteristics of the function and acquire the knowledge maxima and minima of functions of two variables.
2. To discuss higher order differential equations.
3. To discuss Laplace Transform and its properties.
4. To apply Inverse Laplace transform to different types of functions and to solving initial value problems.
5. To construct partial differential equations by eliminating arbitrary constants and functions and to solve first order partial differential equations.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	**Understand** the mean value theorems and evaluate maxima and minima of functions of two variables without constraints.
CO2	**Understand** different analytical methods to solve higher order linear differential equations
CO3	**Understand** Laplace transform technique to solve initial and boundary value problems arising in engineering stream.
CO4	**Understand** solution of first order linear partial differential equations

UNIT-1 **[10 HOURS]**

Mean Value Theorems: Rolle's Theorem – Lagrange's Mean Value Theorem – Cauchy's Mean value Theorem. Functions of several variables – Partial derivatives – Total derivatives – Chain rule-Jacobian – Functional dependence – Maxima and Minima of functions of two variables without constraints.

UNIT-11 **[8 HOURS]**

Linear Differential Equations of Higher Order: Non-homogeneous linear differential equations of second and higher order with constant coefficients with non-homogeneous terms of the type e^{ax},$\sin ax$, $\cos ax$, x^k, method of variation of parameters.

UNIT- III **[10 HOURS]**

Laplace Transforms: Introduction - Laplace transforms of standard functions – Shifting Theorems - Transforms of derivatives and integrals - multiplication by t^n - division by t – Unit step/Heaviside's function - Dirac'sDelta Function (or Unit Impulse Function) - Laplace Transform of Periodic Function.

UNIT- IV **[10 HOURS]**

Inverse Laplace Transforms –Introduction - Properties – Inverse Laplace by using partial fractions and Convolution theorem - solving initial and boundary value problems by using Laplace Transform.

UNIT- V **[10 HOURS]**

Partial Differential Equations of first order: Introduction -Solutions of first order linear (Lagrange) equation and nonlinear (standard type $f(p,q)=0, f(z,p,q)=0, f(x,p)=g(y,q)$&Claruks) equations

Text Books:

1. Higher Engineering Mathematics by H.K. Dass, S. Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, Tata McGraw Hill Publishing Co. Ltd.

REFERENCE BOOKS

1. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
2. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.
3. A Text book of Engineering Mathematics, N.P. Bali, Laxmi Publications (P) Ltd.
4. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Edition.

Course Code	ENGINEERING MECHANICS	L	T	P	C
1003201100		3	1	0	3

COURSE OBJECTIVES:

Learn how to resolve forces and understand the conditions of equilibrium.
To Understand and Analyze the Concept of Friction.
To identify the concepts of Centroid and Centre of Gravity and evaluate moment of inertia.
To understand the dynamics where the bodies subjected to motion are analyzed.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Study the force systems for equilibrium conditions and able to draw Free Body Diagram and Solve related problems
CO2	Evaluate the frictional forces between contact surfaces.
CO3	Able to differentiate between centroid and centre of gravity and determine Centroid, centre of gravity and second moment of area for composite sections.
CO4	Analyse the motion and calculate trajectory characteristics.

UNIT- I

SYSTEMS OF FORCES [10 Hours]

Introduction to Engg. Mechanics – Basic Concepts. Systems of Forces: Coplanar Concurrent Forces – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems, Graphical method for the equilibrium of coplanar forces. Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Lami's Theorem.

UNIT- II

FRICTION [10 Hours]

Introduction to Friction - limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction. Applications – Ladder friction and wedge friction

UNIT- III

CENTROID &CENTRE OF GRAVITY [10 Hours]

Centroid : Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, pappus theorem.

UNIT- IV

MOMENT OF INERTIA [10 Hours]

Area moments of Inertia : Definition – Polar Moment of Inertia, Transfer Theorem, Moments

of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Masses, mass moment of inertia of composite bodies.

UNIT- V

DYNAMICS [10 Hours]

Kinematics: Rectilinear motion – Velocity and Acceleration – Motion of Rigid Body

Kinetics : Analysis as a Particle and Analysis as a Rigid Body in Translation.

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System.

Impulse momentum method.

Text Books:

1. Engineering Mechanics: Statics and Dynamics,N H Dubey,Mc Graw Hill publications.
2. Engineering Mechanics - S. Timoshenko & D. H. Young., 4th Edn , Mc Graw Hill publications.
3. Engineering Mechanics" , Bhattacharya , Oxford Press.

Reference Books:

1. Engineering Mechanics, Tayal. Umesh Publications.
2. A Text Book of Engineering Mechanics R S Khurmi.
3. A Text Book of Engineering MechanicsDr. R.k. bansalandsanjaybansal
4. Engineering Mechanics statics and dynamics – R. C. Hibbeler, 11th Edn – Pearson Publ.
5. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008.

E-Books: (Specify links)

engineering-mechanics-khurmi-hm-booksformech-blogspot-com-pdf

engineering-mechanics-by-s-s-bhavikatti-book-pdf.html

NPTEL/MOOC: (Specify Links)

https://nptel.ac.in/courses/112/106/112106286/

https://nptel.ac.in/courses/122/104/122104015/

https://nptel.ac.in/courses/112/103/112103109/

https://www.coursera.org/learn/engineering-mechanics-statics

Course Code	PROBLEM SOLVING AND PROGRAMMING USING C	L	T	P	C
1005201100		3	0	0	3

COURSE OBJECTIVES:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Write compile and debug Programs in C language
CO2	Use operators, data types and write programs
CO3	Select the best loop construct for a given problem
CO4	Design and implement C programs

UNIT- I

Introduction to computers: Computer systems, computer Languages, computer number systems.
Introduction to C programming: Background and characteristics of C, Flow Charts, algorithms and pseudo code. Structure of a C Program, Input/output Statements in C, writing C programs, compiling and executing C programs. **[6 Hours]**

UNIT- II

Programming Style: Tokens of C, Keywords, Variables, Constants and rules to form variables and constants, Data Types, Declaration of Variables and initialization, Operators, Operator precedence and associativity. Type conversions
Flow of Control: Selection: Two way selection, multi-way selection
Repetition and Unconditional Control Statements: concept of loop ,pre test and post test loops, initialization and updating loops ,while statement, do-while statement, for statements, nested loops, break ,continue, goto. **[10 Hours]**

UNIT- III

Arrays and Strings:

Arrays: One-Dimensional Arrays, Declaration, Array Initialization, Input and Output of Array Values, Two-Dimensional Arrays.
Strings: String Fundamentals, String Input and Output, String manipulation functions.
[8 Hours]

UNIT- IV

Modular Programming:

Function and Parameter Declarations: Function definition, types of functions, declaration and definition of user defined functions, its prototypes and parameters, calling a function. Arrays as Function Arguments, Variable Scope, storage class, recursive functions..

[7Hours]

UNIT- V

Pointers, Structures, Unions and files:

Pointers: Concept of a Pointer, Initialization of pointer variables, pointers as function arguments, address arithmetic, pointers to pointers, Pointers and arrays, Array of Pointers, parameter passing techniques. Dynamic memory allocation.

Structures and Unions: Structures declaration, Initialization of structures, accessing structures, unions.

Files: Declaring, Opening and closing file streams, Reading from and writing to text files.

[10 Hours]

Text Books:

1. Programming in C, ReemaThareja, and Oxford.
2. The C programming Language, Brain W.kernighan, Dennis Ritchie,2e,pearson
3. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. Pub. Programming with C, Bichkar, Universities Press.

Reference Books:

1. ANSIC Programming garyJ.Bronson. Cengage learning.
2. Let us 'C' by yashwantkanethkar, BPB Publications, 16 edition.

Course Code	SOLID STATE PHYSICS	L	T	P	C
1000201103		3	0	0	3

COURSE OBJECTIVES:

To introduce the basic concepts of crystallography and X-ray diffraction. Understanding of the concepts found in semiconductor physics and provides an insight into magnetic materials, superconductivity and dielectrics.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Identify the various planes in crystal and discuss the structural determination of crystal using X-ray diffraction.
CO2	Make use of the superconductor properties to realize working principles of superconducting devices.
CO3	Apply basic knowledge of energy bands in crystalline solids to understand semiconductor physics.
CO4	Discuss the magnetic and electricalproperties of materials.

UNIT- I

CRYSTAL STRUCTURES [8 Hours]

Introduction to solids -Fundamental terms of crystal structures - Unit cell- coordination number- Lattice parameters - Seven crystal systems - Bravais lattices - Packing factor for Simple cubic, Body centered cubic and Face centered cubic.

UNIT- II

CRYSTAL PLANES AND X-RAY DIFFRACTION [10 Hours]

Introduction— Important features and significance of Miller indices - Crystal planes - Separation between successive (h k l) planes - Bragg's law- Experimental technique for X-ray diffraction: Laue method (single crystal)

UNIT- III

MAGNETIC MATERIALS [10 Hours]

Introduction -Magnetic dipole moment – Magnetic susceptibility and permeability - Origin of permanent magnetic moment: Bohr Magneton - Classification of Magnetic materials – Hysteresis - soft and hard magnetic materials.

SUPERCONDUCTIVITY

Introduction – properties of superconductors – Critical temperature-Meissner effect – critical magnetic field - Type-1 and Type-2 superconductors – Applications.

UNIT- IV

DIELECTRICS [8 Hours]

Introduction to Dielectrics – Dielectric constant-dielectric polarization-dielectric susceptibility- polar and non – polar dielectrics; Types of polarizations: Electronic polarization and expression for electronic polarizability - Lorentz (internal) field in dielectrics- Clausius - Mossotti equation

UNIT- V

SEMICONDUCTOR PHYSICS **[10 Hours]**

Introduction - bond formation in intrinsic semiconductors and extrinsic semiconductors (P-type and N-type) – intrinsic electrical conductivity – Drift & Diffusion –Einstein's equation – Hall effect in semiconductors – Applications of Hall effect.

Text Books:

1. Solid State Physics, A. J. Dekker, Macmillan India Pvt. Ltd., (2011)
2. Introduction to Solid State Physics, C. Kittel, Wiley indiaPvt. Ltd, (2012)
3. Physics of Semiconductor Devices, S. M. Sze,3rd edision, John Wiley & Sons, (2007)
4. Solid State Physics: Structure And Properties Of Materials, M. A. Wahab, Narosa Publishing House Pvt. Ltd. (2005)
5. Fundamentals of Semiconductor Devices by Joseph Lindmayer, Charles Y. Wrigly, Litton Educational Publishing Inc.(1966)
6. Physics of Semiconductor Devices by S.M.Sze, John Wily & Sons, New Delhi. (2012)

Reference Books:

1. Introduction to Magnetic Materials, B. D. Cullity and Charles D. Graham Jr., Wiley-IEEE Press, 2 edition, (2008).
2. A Text Book of Engineering Physics by Dr. M. N. Avadhanulu and Dr. P. G. KshiraSagar, S.Chand& Company Ltd., (2014).
3. Physics Vol 1& 2 (5ed), Resnick , Halliday, Krane, Wiley; Fifth edition (2007)
4. Semiconductor Electronics by A.K. Sharma, New Age International (P) Limited Publisher, New Delhi. (2011)

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

Course Code	MATHEMATICS - II	L	T	P	C
1000201104		3	1	0	3

COURSE OBJECTIVES:

1. To familiarize the students with numerical methods of solving the non-linear equations, Interpolation, Numerical differentiation and integration.
2. Course will illuminate the student in the standard concepts of Linear algebra.
3. Methods to solving system of linear equations and compute Eigen values & Eigen vectors of a real matrix.
4. To apply mathematical statements, ideas and results, with the correct use of mathematical definitions.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	***Compute*** approximate roots of an equation by using different numerical methods.
CO2	***Explain*** difference operators and find the relation among operators and apply forward and backward formulas for compute interpolating polynomial.
CO3	***Apply***different numerical methods to solve integrations and ordinary differential equations.
CO4	***Understand*** to solve the system of Linear equations by direct and iteration methods, and compute eigen values and eigen vectors of a matrix and study the nature of Quadratic form.

UNIT- I

Numerical Solution of Algebraic and Transcendental Equations: [8 Hours]

Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

UNIT- II

Interpolation: **[8 Hours]**

Introduction– Forward Difference, Backward difference, Central difference operators – Newton's formulae for interpolation – Gauss' Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

UNIT- III

Numerical Integrations &Differential Equations: [8 Hours]

Numerical Integration: – Trapezoidal rule – Simpson's $1/3^{rd}$ Rule –Simpson's $3/8^{th}$ Rule.

Numerical solution of Ordinary Differential equations: Solution by Taylor's series method - Euler's method - Modified Euler's method- Runge-Kutta Method of 4^{th} order.

UNIT- IV

Linear system of equations: [8 Hours]
Introduction-Rank-Echelon Form- Normal Form - System of Linear equations - Homogeneous and Non-Homogeneous , Consistency of system of Linear equations - Gauss elimination - Gauss Seidel method.

UNIT- V

Eigen values, Eigen vectors: [10 Hours]
Introduction - Eigen values - Eigen vectors - Properties - Cayley Hamilton theorem (without proof) - Inverse and power of a matrix by using Cayley Hamilton theorem, Reduction of Quadratic form to canonical form by using orthogonal reduction – Rank, index, signature and Nature of quadratic form.

TEXT BOOKS

1. Higher Engineering Mathematics by H.K. Dass, S. Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, Tata McGraw Hill Publishing Co. Ltd.

REFERENCE BOOKS

1. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
2. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.
3. A Text book of Engineering Mathematics, N.P. Bali, Laxmi Publications (P) Ltd.
4. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Edition.

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links

Course Code	ENGINEERING WORKSHOP	L	T	P	C
1003201110		0	0	3	1.5

COURSE OBJECTIVES:

To impart hands-on practice on basic engineering trades and skills.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Identify the different types tools and work benches used in Engineering workshop
CO2	Study the principles of House wiring and develop a switch system
CO3	Design and fabricate the various fittings required for engineering applications
CO4	Select the right material for the given purpose, and develop the fabrication method to obtain the component.

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	**CARPENTRY** 1. T-Lap Joint 2. Cross Lap Joint 3. Dovetail Joint 4. Mortise and Tenon Joint	Saw the wood and develop the required kind of job piece
2	**FITTING** 1. Vee Fit 2. Square Fit 3. Half Round Fit 4. Dovetail Fit	Saw the Steel and develop the required kind of job piece
3	**BLACK SMITHY** 1. Round rod to Square 2. S-Hook 3. Round Rod to Flat Ring 4. Round Rod to Square headed bolt	Prepare the cold worked/hot worked job piece and mould it accordingly
4	**HOUSE WIRING** 1. Parallel / Series Connection of three bulbs 2. Stair Case wiring 3. Florescent Lamp Fitting 4. Measurement of Earth Resistance	Design and develop the switch lamp system for a given configuration
5	**TIN SMITHY** 1. Taper Tray 2. Square Box without lid 3. Open Scoop 4. Funnel	Prepare a job piece as given in the layout

Text Books:

1. Manfacturing Technology, P N Rao, Volume-1, Lakshmi Publications.

Course Code	Problem Solving and Programming using C Lab	L	T	P	C
1005201110		0	0	3	1.5

COURSE OBJECTIVES:

1. To understand computer programming and its roles in problem solving.
2. To understand and develop well-structured programs using C language.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Write compile and debug Programs in C language
CO2	Use operators, data types and write programs
CO3	Select the best loop construct for a given problem
CO4	Design and implement C programs

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	**Exercise – 1** a) Write a C program to compute perimeter and area of rectangle b) Write a C program to calculate distance between points c) Write a C Program to Simulate 3 Laws of Motion	Input/ Output
2.	**Exercise – 2** a) Write a C Program to convert Celsius to Fahrenheit and vice versa b) Write a C program to find maximum of three numbers using conditional operator.	Input/ Output
3.	**Exercise – 3** a) Write a C Program to find Whether the Given Year is a Leap Year or not. b) Write a C Program to find grade of student. c) Write a menu driven program to compute area of different geometrical shapes	Control Statements
4.	**Exercises –4** a) Write a C Program to Find Whether the Given Number is i)Strong number ii)perfect number b) Write a C Program to print the following between 1 to ni)Prime Number ii) Armstrong Number	Loops and Control Statements
5.	**Exercise -5** Demonstration of arrays& Strings a) Write a C program to perform Linear Search b) Write a C program to perform transpose of two matrices	Arrays and Strings

	c) Write a C program to perform multiplication of two matrices d) Implementation of string manipulation operations with and **without** libraryfunction. i)copy ii) concatenate iii)length iv)compare	
6.	**Exercise -6** a) Write a C program to find cube of any number using function. b) Write a c program to find area and volume of geometric shapes using functions. c) Write a C program to check whether a number is even or odd using functions.	Functions
7.	**Exercise -7** a) Write a C Program illustrating Fibonacci, Factorial using recursion b) Write a C program to find power of any number using recursion. c) Write a C program to find GCD and LCM using recursion	Recursive Functions
8.	**Exercise -8** a) Write a C Program to Access Elements of an Array UsingPointer b) Write a C Program to find the sum of numbers with arrays andpointers. c) Write a c program to illustrate parameter passing techniques	Pointers
9.	**Exercise -9** a) Write a C Program to Store Information of a student Using Structures b) Write a C program to create memory for int, char and float variable at run time.	Structures
10.	**Exercise -10** a) Write a program in C to copy a file in another name b) Write a C program to append multiple lines at the end of file	Files

Text Books:

1. Programming in C, ReemaThareja, and Oxford.
2. The C programming Language, Brain W.kernighan, Dennis Ritchie,2e,pearson
3. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage. Pub. Programming with C, Bichkar, Universities Press.

Reference Books:

1. ANSIC Programming garyJ.Bronson. Cengage learning.
2. Let us 'C' by yashwantkanethkar, BPB Publications, 16 edition.

I Year – I Semester	SOLID STATE PHYSICS LABORATORY	L	T	P	C
1000201112		0	0	3	1.5

COURSE OBJECTIVES:

To study the characteristics of pn, Zener, thermistor, laser, and semiconductors. Apply the analytical techniques and graphical analysis to the experimental data.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Demonstratetheelectric polarization in dielectric material and estimation of Planck constant and lattice constant
CO2	Analyze the voltage vs. current characteristics of PN, Zener diode and solar cell
CO3	Study thecharacteristics of thermistor and LCR circuits.
CO4	Identifythe type of semiconductor and estimation of carrier concentration

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Lattice constant	Determination of lattice constant of crystal using diffraction pattern
2	Dielectric constant	Determination of dielectric constant of material using parallel plate capacitor
3	LCR series and parallel circuit	Estimation of resonance frequency
4	Planck constant	Determination of Planck constant determination
5	Stewart's and Gee's	Determination of magnetic field along the axis of a current carrying coil.
6	Hall effect	Identification of semiconductor type and determination of Hall coefficient and carrier concentration
7	Thermistor characteristics	Determination of temperature coefficient of given thermistor
8	P-N junction diode	Study of V-I characteristics of pn junction diode
9	Zener diode	Determination of breakdown voltage of Zener diode
10	solar cell	Study of V-I characteristics of solar cell

Text Books:

1. C.L. Arora, Practical physics, S. Chand Publication

2. B.L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House

Reference Books:

1. P.K. Mittal, N. H. Ayachit, Engineering Physics: With Laboratory Manual, Wiley India.

Course Code	CONSTITUTION OF INDIA (Audit Course)	L	T	P	C
1000201121		2	0	0	0

COURSE OBJECTIVES:

To provide basic information about Indian constitution. To identify individual role and ethical responsibility towards society. Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the importance of constitution, fundamental rights and duties
CO2	Understand the structure of executive, legislature and judiciary
CO3	Understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
CO4	Understand the central and state relation financial and administrative.

UNIT- I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties

LEARNINGOUTCOMES: After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT- II

.Union Government and its Administration Structure of the Indian Union. President: Role, power and position, PM and Council of ministers, ,LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High course

UNIT- III

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

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat

- Differentiate between structure and functions of state secrateriate

UNIT- IV
A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role - CEO of Municipal Corporation PachayatiRaj: Functions ZilaPanchayat, CEO ZilaPanchayat

LEARNING OUTCOMES:-After completion of this unit student will
- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

UNIT- IV
Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:,

LEARNING OUTCOMES:-After completion of this unit student will
- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission

Evaluate various commissions of viz SC/ST/OBC and women

Text Books:

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

E Resources

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

I Year – II Semester

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

I Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1002201200	Electrical Circuit Analysis-I	3	1	0	3
2.	1003201101	Engineering Drawing	1	0	4	3
3.	1000201201	Transforms and Vector Calculus	3	1	0	3
4.	1000201102	Technical English Communication	2	0	0	2
5.	1000201105	Applied Chemistry	3	0	0	3
6.	1000201110	Technical English Communication Lab	0	0	3	1.5
7.	1002201211	Electrical Circuit Analysis-I Lab	0	0	3	1.5
8.	1000201113	Applied Chemistry Lab	0	0	3	1.5
9.	1000201160	Engineering Exploration	0	0	2	1
10.	1000201120	Game, Sports and Yoga	0	0	4	0
Total Credits:						**19.5**

Course Code	ELECTRICAL CIRCUIT ANALYSIS-I	L	T	P	C
1002201200		3	1	3	3

COURSE OBJECTIVES:

- Introduction to concepts of active & passive elements (resistors), types of sources, and basic methods of circuit analysis.
- To understand network theorems and use them for analysis of electrical networks.
- To understand the concepts related to AC networks.
- To analyse RL, RC circuits and RLC circuits with sinusoidal excitation.
- Introduction to magnetic circuits and their analysis.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Solve various Electrical networks in the presence of active and passive elements.
CO2	Analyse Electrical networks with various Network theorems for DC excitation.
CO3	Illustrate R, L, C networks and solve various networks with AC excitation along with theorems
CO4	Compare Electric and Magnetic Circuits and solve Magnetic circuits along with Dot convention

UNIT- I

INTRODUCTION TO ELECTRICAL CIRCUITS: [9 Hours]

Circuits basic concepts, Active and Passive elements, Voltage and Current Sources, Independent and Dependent Sources, Kirchhoff's Laws, Network Reduction Techniques – Series, Parallel, Series Parallel, Star-Delta or Delta-Star Transformations, Voltage division Rule, Current division rule. Nodal Analysis, Mesh Analysis, concept of Super node and Super mesh (The source is DC and passive element is resistor in all cases).

UNIT-II

NETWORK THEOREMS: [8 Hours]

Source Transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem. (Only with DC Sources)

UNIT-III

SINGLE PHASE AC SYSTEMS: **[8 Hours]**

Periodic waveforms (Determination of RMS, average value and form factor). Concept of phase angle and phase difference. Waveforms and phasor diagrams for lagging and leading networks. Complex and polar forms of representations, steady state analysis of R, L and C circuits. Power Factor and its significance Real, Reactive and apparent Power.

UNIT-IV

ANALYSIS OF AC NETWORKS: [8 Hours]

Extension of Node and Mesh analysis to AC networks, Problems on the steady state analysis. Applying Network theorems to analyse AC circuits. Locus diagrams for various combination of R, L and C.

UNIT-V

MAGNETIC CIRCUITS: [8 Hours]

Basic definitions of MMF, flux and reluctance. Analogy between electrical and magnetic circuits. Faraday's laws of electromagnetic induction Concept of self and mutual inductance. Dot convention-coefficient of coupling and composite magnetic circuit. Analysis of series and parallel magnetic circuits.

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company,6 th edition.
2. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.
3. Fundamentals of Electric Circuits by Charles K. Alexander & Mathew N. O. Sadiku, McGraw Hill.

Reference Books:

1. Basic Engineering Circuit Analysis by J. David Irwin and R. Mark Nelms, Wiley
2. Circuit Theory (Analysis and Synthesis) by A.chakrabarthi, DhanpatRai&co

E-Books:

1. https://www.electronicbo.com/p/wating.html??&&url=_http://bit.ly/2KKtD71
2. https://bookboon.com/en/concepts-in-electric-circuits-ebook
3. https://open.umn.edu/opentextbooks/textbooks/dc-electrical-circuit-analysis-a-practical-approach-fiore

4. https://open.umn.edu/opentextbooks/textbooks/ac-electrical-circuit-analysis-a-practical-approach-fiore

NPTEL/MOOC:

1. https://nptel.ac.in/courses/108/104/108104139/

Course Code	ENGINEERING DRAWING	L	T	P	C
1003201101		1	0	4	3

COURSE OBJECTIVES:

To introduce the use and the application of drawing instruments and to make the students construct the polygons and curves. To introduce orthographic projections and to project the points and lines parallel to one plane and inclined to other. To make the students draw the projections of the plane and solids inclined to one planes. To make the students draw isometric views of simple objects

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the use of drawing instruments to construct the polygons and curves
CO2	Learn the principle of orthographic projections. Draw Orthographic projections of points, lines.
CO3	Draw the various types of planes and solids its views in different Positions
CO4	Draw isometric views of simple objects

UNIT- I

INTRODUCTION TO ENGINEERING DRAWING [10 Hours]

Polygons– Construction of regular polygons
Curvesused in Engineering Practice– Ellipse (General method and oblong Method only),Parabola& Hyperbola(General method only)
Introduction to Scales– Vernier & Diagonal Scales.

UNIT- II

ORTHOGRAPHIC PROJECTIONS [10 Hours]

Projections of points– Projections of straight line– Line parallel to one plane and perpendicular to other plane– parallel to both the planes.
Projections of straight lines– parallel to one plane and inclined to the other plane.
Straight lines inclined to both the planes.

UNIT- III

PROJECTIONS OF PLANES [10 Hours]

Regular planes perpendicular/parallel to one plane and inclined to the other reference
Plane inclined to both the reference planes.

UNIT- IV

PROJECTIONS OF SOLIDS [10 Hours]

Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the plane only

UNIT- V

ISOMETRIC PROJECTIONS **[10 Hours]**

Conversion of Isometric Views to Orthographic Views
Conversion of Orthographic Views to Isometric Views.

Text Books:

1. Engineering Drawing, N. D. Bhatt, Chariot Publications.

2. Engineering Drawing, K. L. Narayana & P. Kannaiah, Scitech Publishers

3.Engineering Drawing and Graphics by K Venugopal,New Age international publications .

Reference Books:

1. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers.

2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age.

Course Code	TRANSFORMS AND VECTOR CALCULUS	L	T	P	C
1000201201		3	1	0	3

COURSE OBJECTIVES:

1. Know that any periodic function can be expressed as a Fourier series and determine the Fourier coefficients in the Fourier series of a given function
2. Analyze the characteristics and properties of Fourier transforms.
3. Familiarize with 2-dimensional and 3-dimensional coordinate systems.
4. Generalize calculus to vector functions and to compute line, surface and volume integrals.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	***Formulate*** any periodic function in terms of sine and cosine
CO2	***Simplify*** a non-periodic function as integral representation
CO3	***Apply*** Multiple integration techniques in evaluating areas and volume bounded by region.
CO4	***Explain*** Gradient, divergence and curl operations in vector and scalar fields and ***Apply*** Green's, Gauss and Stoke's theorem as the generalization of fundamental theorem of integral calculus.

UNIT- I

Fourier series: **[10 Hours]**

Determination of Fourier coefficients in interval $(c, c+2l)$ – Even and odd functions $(-l, l)$ - Half- range Fourier sine and cosine expansion in the interval $(0, l)$.

UNIT- II

Fourier transforms: **[10 Hours]**

Fourier integral theorem – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – properties – Finite Fourier sine and cosine transforms.

UNIT- III

Multiple integrals: **[10 Hours]**

Double and triple integrals – change of variables (Polar, Spherical, Cylindrical) - change of order of integration - Areas and Volumes (Cartesian coordinates).

UNIT- IV

Vector Differentiation: **[8 Hours]**

Scalar point function – vector point function – Vector differential operator – Gradient – directional derivative, angle between two surfaces- Divergence - Solenoidal Function - Curl - Irrotational Field - scalar potential.

UNIT- V

Vector Integration: **[10 Hours]**

Line integral - Work done, Circulation, Conservative field – Surface and Volume integrals, Green's, Stoke's and Gauss Divergence theorems (without proofs).

TEXT BOOKS

1. Higher Engineering Mathematics by H.K. Dass, S. Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, Tata McGraw Hill Publishing Co. Ltd.

REFERENCE BOOKS

1. Engineering Mathematics, Greenburg, 2nd Ed, Pearson education.
2. 1. Higher Engineering Mathematics – 43rd Edition by Dr. B. S. Grewal, Khanna Publishers, New Delhi.
3. A Text book of Engineering Mathematics, N.P. Bali, Laxmi Publications (P) Ltd.
4. Advanced Engineering Mathematics, Erwin Kreszig, 8thEd, Wiley Student Edition.

Course Code	TECHNICAL ENGLISH COMMUNICATION	L	T	P	C
1000201102		2	0	0	2

COURSE OBJECTIVES:

- To introduce students to the specific use of English for Technical Communication.
- To develop the overall English proficiency of students and enable them to function effectively in different professional contexts.
- To strengthen student skills in the areas of reading, writing, listening and speaking and enable them to function effectively in their professional sphere

COURSE OUTCOMES:

CO	At the end of the course, the student will have the ability to:
CO1	Read, understand and interpret material on Environment, Science and Technology, tourism, Energy Sources, Social Awareness
CO2	Analyze the functions of language and grammar in spoken and written forms.
CO3	Write effectively on various domains.
CO4	Prepare and exhibit oral presentation skills by using ICT. (Individual/Team)

UNIT- I **No. of lecture hours: 10**

Reading: 1) How to Regain Green Cover 2) Solution to Plastic Pollution

Writing: Functional grammar [articles, prepositions of time, place, direction and movement, verb-tense, subject-verb agreement]

Listening: TED Talk on Water Harvesting (LC) –Answering comprehension-based Qs ~ Listening to improve pronunciation

Speaking: Functional English (LC) ~ Introducing oneself

Activities: Reading Comprehension- Note making while reading 1&2,Letter Writing

UNIT-II **No. of lecture hours: 10**

Reading Texts: 1) The Hubble Telescope 2) Genesis of ISRO

Writing: Writing formal letters ~ Functional grammar ~Modals - Paraphrasing

Listening: Listening to a debate on " Colonizing the Moon" (LC) ~ Note Taking

Speaking: (LC) Making mini presentations on general topics
Activities:

- Reading Comprehension
- Letter Writing-Formal

UNIT-III **No. of lecture hours: 10**

Reading Texts: 1) Southern Splendour 2) Tourism in India: Role in Conflict and Peace

Writing: Paragraph writing ~ Functional grammar [relative pronouns, comparative adjectives, adverbs]

Listening: (LC) Listening comprehension ~ Listening for global meaning ~ Listening for getting at the nuances and the mood of the speaker

Speaking: (LC) Telephonic Skills ~ participating in an interactive video and teleconferencing
Activities:
Reading Comprehension
Paragraph writing
Essay writing

UNIT-IV **No. of lecture hours: 10**

Reading Texts: 1) Wind Energy 2) How pertinent is the nuclear option

Writing: Writing a formal E-mail

Speaking: Group Discussion (LC)

Listening: Listening to an Interview (LC) related to the text ~ listening critically for understanding the attitude/tone of the speaker

Activities: Reading Comprehension, Email Writing

UNIT-V **No. of lecture hours: 10**

Reading Texts: 1) The Evolution of Media 2) The Top Ten Developments in Journalism in the 2000s

Writing: Interpret graphic tools [tables, pie & bar charts ~ writing an abstract ~ Leveraging ICT for communication ~ Preparing a PPT(LC)

Speaking: Making short presentations [individual/team] with the aid of PPT

Listening: Listening to Situation/Scene ~ Sub skills: Listening to understand one's viewpoint ~Listening to understand speaker's intention ~Listening for local understanding.

Activity:

Information Transfer

Suggested Books:

- Elango, K et.al 2014. *Mindscapes: English for Technologists and Engineers*, Orient Blackswan, Hyderabad.

Reference Books:

- Balasubramanian M. 1985. *Business Communication*. Vani Educational Books, New Delhi
- Balasubramanian T. 1989. *A Text book of Phonetics for Indian Students*. Orient Longman, New Delhi.
- Krishnaswamy, N and Sriraman, T. 1995. *Current English for Colleges*. Macmillan India Ltd. Madras.
- Mohan Krishna and Meera Banerjee. 1990. *Developing Communication Skills*. Macmillan India Ltd. New Delhi.
- Narayanaswamy V R. 1979. *Strengthen your Writing*. Orient Longman, New Delhi.
- Naterop, Jean, B. and Rod Revell. 1997. *Telephoning in English.* Cambridge University Press, Cambridge

Course Code	APPLIED CHEMISTRY	L	T	P	C
1000201105		3	0	0	3

COURSE OBJECTIVES:

To introduce various polymers and identify their functionalities. Understanding the concepts of batteries & green methodologies for the preparation of advanced materials. Developing ideas in protecting precious metals from corrosive atmospheres.

COURSE OUTCOMES:

COs	At the end of the course, the student will gain the ability in:
CO1	Identification of different polymers and their functionalities
CO2	Determination of structure to many compounds and apply the basic knowledge in construction of cell and its applications
CO3	Analysis of corrosive environments and protection of precious metal
CO4	Adoption of different green methodologies for preparation of advanced materials

UNIT- I

POLYMER CHEMISTRY [8 Hours]

Introduction to polymers, Classification of polymers, Types of Polymerizations (Addition, Condensation & copolymerization) with examples, properties of polymers (physical and mechanical).
Plastics - Thermoplastics and Thermosetting plastics, compounding of plastics, Moulding Techniques (Compression & Blow moulding), Preparation, properties and applications of – PVC and Bakelite.

UNIT- II

STRUCTURE AND BONDING MODELS [10 Hours]

Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of H_2, C_2, N_2, $O_2$and CO, etc. calculation of bond order, shapes of d orbitals, crystal field theory – salient features – Crystal field splitting in octahedral environments, Crystal field stabilization Energy (CFSE) for high spin and low spin octahedral complexes.

UNIT- III

ELECTROCHEMISTRY AND APPLICATIONS [10 Hours]

Construction and working of Galvanic cell, Electrode potential, Reference electrodes - Standard hydrogen electrode, Electrochemical series & its applications, pH meter and applications (acid-base titrations), concept of conductivity - conductometric titrations (acid-base titrations)

UNIT- IV

CORROSION **[8 Hours]**

Introduction to corrosion, dry corrosion with mechanism, electrochemical theory of corrosion with mechanism.

Types of Electrochemical corrosion (differential aeration corrosion, galvanic corrosion, pitting corrosion & stress corrosion), protection – cathodic protection, corrosion inhibitors, Cathodic & Anodic coatings, Galvanizing & Tinning.

UNIT- V

CHEMISTRY OF ADVANCED ENGINEERING MATERIALS & BIO MOLECULES [10 Hours]

Nanomaterials: Introduction - Carbon nanotubes: Types, preparation (Electric Arc discharge, Laser ablation and CVD techniques), properties and applications, Fullerenes – structure and applications.

Composites - Fiber reinforced materials – CFRP & GFRP

Biodegradable polymers and its applications

Green Chemistry: 12 Principles only

Nucleic acids: DNA & RNA – Structure & their functions.

Text Books:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai PublicatingCo.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015edition.Physics of Semiconductor Devices by S.M.Sze, John Wily & Sons, New Delhi. (2012)

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., LatestEdition
4. Applied Chemistry by H.D. Gesser, SpringerPublishers

Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar andothers, University Press,IIM

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

Course Code	TECHNICAL ENGLISH COMMUNICATION LAB	L	T	P	C
1000201110		0	0	3	1.5

COURSE OBJECTIVES:

- To introduce students to the specific use of English for Technical Communication.
- To develop the overall English proficiency of students and enable them to function effectively in different professional contexts.
- To strengthen student skills in the areas of reading, writing, listening and speaking and enable them to function effectively in their professional sphere.

COURSE OUTCOMES:

COs	At the end of the course, the student will have the ability to:
CO1	Analyze the functions of language and grammar in spoken and written forms.
CO2	Write effectively on various domains.
CO3	Prepare and exhibit oral presentation skills by using ICT.(Individual/Team)

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Just A Minute –Tell about oneself	Speaking
2	Note Taking	Listening & Writing
3	Interactions	Listening &Speaking
4	Mini Presentation	Speaking
5	Letters and Sounds- Some pronouncing Patterns	Speaking
6	Telephonic Skills	Speaking &Listening
7	Group Discussion	Team work, leadership Speaking
8	Mock-Interview	Speaking
9	Impromptu individual presentations	Speaking
10	Information Transfer	Writing

Text Books: Speak Well-Maruthi Publications

Reference Books: Interact –Orient Blackswan

Course Code	ELECTRICAL CIRCUIT ANALYSIS-1 LABORATORY	L	T	P	C
1002201211		0	0	3	1.5

COURSE OBJECTIVES:

- Introduction to concepts of active & passive elements (resistors), types of sources, and basic methods of circuit analysis.
- To understand network theorems and use them for analysis of electrical networks.
- To understand the concepts related to AC networks.
- To analyse RL, RC circuits and RLC circuits with sinusoidal excitation.
- Introduction to magnetic circuits and their analysis.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Analyze the electrical networks with various network reduction techniques and Network Theorems
CO2	Illustrate Series and Parallel Resonance for R, L, C circuits
CO3	Examine the self and Mutual inductance &coeffiecient of coupling for a magnetically coupled circuit
CO4	Solve two port network parameters experimentally

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	Verification of Nodal and Mesh analysis methods	Understanding, analysis
2.	Verification of Thevenin's theorem.	Understanding, analysis
3.	Verification of Norton's theorem.	Understanding, analysis
4.	Verification of Superposition theorem and Reciprocity theorem.	Understanding, analysis
5.	Verification of Maximum power transfer theorem.	Understanding, analysis
6.	Verification of Compensation theorem	Understanding, analysis
7.	Determination of Self, Mutual Inductances and Coefficient of coupling.	Design
8.	Series and Parallel Resonance	Understanding
9.	Determination of Z, Y parameters for 2 port network	Design
10.	Determination of Hybrid, ABCD parameters for 2 port network	Design

Additional experiments:

1) Locus diagrams for RL and RC circuits.
2) Determination of Choke coil parameters.

Text Books:

4. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw Hill Company,6 th edition.
5. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd.
6. Fundamentals of Electric Circuits by Charles K. Alexander & Mathew N. O. Sadiku, McGraw Hill.

Reference Books:

3. Basic Engineering Circuit Analysis by J. David Irwin and R. Mark Nelms, Wiley.
4. Circuit Theory (Analysis and Synthesis) by A.chakrabarthi, DhanpatRai&co.

Course Code	APPLIED CHEMISTRY LABORATORY	L	T	P	C
1000201113		0	0	3	1.5

COURSE OBJECTIVES:

To acquaint the students with the basic phenomenon/concepts of titrations and element analysis in Chemistry. Design the synthetic methods to prepare polymers and nano materials.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Analyze & generate experimental skills
CO2	Enhance the thinking capabilities pertaining modern trends in engineering & technology
CO3	Select and use a suitable instrumental technique for the quantitative estimation and analyze the data obtained
CO4	Learn safety rules during the practice of laboratory investigation

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Total Hardness	Determination of Hardness of a groundwatersample**.**
2	Total alkalinity	Determination of alkalinity ofWater.
3	Complexometric Titration	Determination Copper using standard EDTAsolution.
4	Precipitation Titration	Determination of Zinc (II) by ferrocyanidemethod.
5	Iron permanganate redox titration	Determination of Iron (II) by using standard $KMnO_4$solution
6	pH metry titration	Determination of the Concentration of HCl using Sodium Hydroxide (by pH - metry method).
7	Conductometric Titration	Determination of the Concentration of strong acid vs strong base (by conductometric method)
8	Iron dichromate redox titration	Determination of Iron (II) by using standard $K_2Cr_2O_7$solution.
9	Bakelite – A Thermosetting polymer	Preparation of a polymer (phenol-formaldehyderesin).
10	Nanomaterial Synthesis	Preparation of Nano materials

		(Demonstrationonly)
11	Electrochemical Cell	Construction of Galvanic cell (Virtuallab).
12	Acid – Base titration	Determination of strength of an acid in Pb-Acidbattery.

Text Books:

1. Arthur Vogel and G. Svehla, Qualitative Inorganic Analysis, Pearson Education India.
2. Thompson &Atteshlis, Advanced Practical Chemistry & Resource Pack, John Murray Publications.

Reference Books:

Hill & Holman, Chemistry in Context Laboratory, Nelson Publications.

Course Code	ENGINEERING EXPLORATION	L	T	P	C
1000201160		0	0	2	1

COURSE OBJECTIVES:

To understand the importance of multi-disciplinary Engineering knowledge in the current world, for making any project. To learn Engineering design process for creating any new product/system. To learn the fundamental practical knowledge for starting any inter-disciplinary project.

COURSE OUTCOMES:

c	At the end of the course, the student will have the ability to:
CO1	Realize the purpose/Role of Engineer for solving social problems
CO2	Learn to Design a component/system in an engineering way
CO3	Learn to use mechanisms, Arduino, sensors, motors.
CO4	Integrating different systems (mechanical/Electrical/computer) to work as a unit

UNIT- I

INTRODUCTION TO ENGINEERING AND ENGIENERING STUDY [6 Hours]

Introduction to Engineering, Difference between science and engineering, scientist and engineer, needs and wants various disciplines of engineering, some misconceptions of engineering, Role of engineers in solving social problems, Graduate Attributes.

Activity theme: Activities aimed to understand Engineering

Activities:

1. Identifying Various Engineering disciplines involved in projects/systems

2. Listing down various social problems in the world &Finding how engineering can solve these social problems.

UNIT- II

ENGINEERING DESIGN [10 Hours]

Engineering Design Process, Multidisciplinary facet of design, Generation of multiple solution, Introduction to Mechatronics systems, Motor and Battery Sizing concepts, Introduction to PCB design.

Activity theme: Activities based on the designing & making of models

Activities:

1. Making of a Popsicle sticks prototype bridge
2. Conversion of AC to DC using bridge rectifier
3. Creation of Mobile App using MIT App Inventor

4. Creating a Full adder circuit using Logic gates with IC's

UNIT- III

MECHANISMS [6 Hours]

Basic Components of a Mechanism, Degrees of Freedom (Mobility of a Mechanism), 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism.

Activity theme: Creating a model which illustrate any mechanism

Activities:

1. Determining the number of Degrees of freedom for a given mechanism
2. Assembly of scissors mechanism

UNIT- IV

PLATFORM BASED DEVELOPMENT [8 Hours]

Introduction to platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers and actuators and its interfacing with Arduino.

Activity theme: To Program Arduino to control lights, Motors, Sensors etc.

Activities:

1. Blinking LEDs using Arduino interface
2. Identifying the objects with Infrared sensor
3. Usage of different sensors using Arduino Interface

UNIT- V

DATA ACQUISITION AND ANALYSIS [8 Hours]

Types of Data, Descriptive Statistics techniques as applicable to different types of data, Types of graphs as applicable to different types of data, Usage of Microsoft Excel tool for descriptive statistics, Data Acquisition using Sensors interfaced with Arduino, exporting acquired data to Microsoft Excel and analysis using visual representation.

Activity theme: Acquiring data from sensors using Arduino

Activities:

1. Data analysis of Ultrasonic sensor with Arduino as interface
2. Data analysis of DHT sensor with Arduino as interface

II Year – I Semester

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

II Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002202100	Fundamentals of Signals and Systems	3	1	0	3
2	1002202101	Electrical Machines-I	3	0	0	3
3	1002202102	Electro Magnetic Fields	3	1	0	3
4	1004202103	Semiconductor Devices and Circuits	3	0	0	3
5	1002202103	Electrical Circuit Analysis-II	3	1	0	3
6	1002202110	Electrical Machines-I Lab	0	0	3	1.5
7	1004202112	Semiconductor Devices and Circuits Lab	0	0	3	1.5
8	1020202180	Employability Readiness Program	1	0	2	2
9	1000202120	Life Skills	2	0	0	0
		Total Credits:				**20**

Course Code	Fundamentals of Signals and Systems	L	T	P	Credits
1002202100		3	1	0	3

Course Overview:

This course deals with basic types of signals and systems and their analysis in time domain and frequency domain.

Course Objectives:

- Characterize the signals and systems and Concept of orthogonality.
- Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
- Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
- Understand the relationships among the various representations of LTI systems
- Understand the Concepts of convolution, correlation
- Apply z-transform to analyze discrete-time signals and systems.

Course Outcomes: After completion of the course, students are able to:

CO's	At the end of the course, the student will have the ability to:
CO1	Distinguish between various types of signals and systems.
CO2	Understand the conversion of continuous time signals to discrete time signals and vice versa.
CO3	Analyze continuous time LTI systems
CO4	Analyze discrete time LTI systems

Unit-I:

INTRODUCTION: Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Impulse response, Transfer function of a LTI system. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Condition for Orthogonality

UNIT –II:

FOURIER SERIES AND FOURIER TRANSFORM: Fourier series representation of continuous time periodic signals (without derivations), properties of Fourier series (without proofs), Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series (without derivations), Complex Fourier spectrum. Application of Fourier series analysis to simple electric circuits. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms (without proofs), Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Parseval's theorem

UNIT –III:

SAMPLING THEOREM & ANALYSIS OF LINEAR SYSTEMS: Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing.

Concept of convolution in time domain and frequency domain, Graphical representation of convolution. Filter characteristics of linear systems. Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics relationship between bandwidth and rise time. Cross-correlation and auto-correlation of functions. Properties of correlation function. Relation between convolution and correlation

UNIT –IV:

Analysis of continuous time systems: Review of Laplace transforms,Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of LT(without proofs), Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis, Analysis and characterization of continuous LTI systems using LT.

UNIT –V

Analysis of Discrete time systems: Discrete time signal representation- using complex exponential and sinusoidal, Periodicity of discrete time signals, properties of Z-transforms (without proofs), Z- Transforms of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, Analysis and characterization of discrete LTI systems using ZT.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.

2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.

3. Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub.

Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.

2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015

3. Signals and Systems – K Raja Rajeswari, B Visweswara Rao, PHI, 2009

4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.

5. Signals and Systems – T K Rawat , Oxford University press, 2011

Course Code	Electrical Machines-I	L	T	P	C
1002202101		3	0	0	3

COURSE OBJECTIVES:

1. To analyse the construction of DC generators, DC motors and transformers.
2. To elaborate the characteristics, methods of speed control and testing methods of DC machines and transformers
3. To predetermine the performance of single phase transformers with equivalent circuits and also find regulation and efficiency.
4. To describe poly-phase transformers and auto transformers and achieve three phase to two phase conversion.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the working principle and construction of DC machine and Transformers
CO2	Examine the characteristics and Testing methods of DC Machines and Transformers
CO3	Illustrate speed control methods of DC Motors and study the losses in DC Machines and Transformers
CO4	Develop Phasor diagrams for Transformer with different load conditions

UNIT 1

INTRODUCTION TO DC MACHINES: [8]

Construction and principle of operation of DC generator – Armature Windings-EMF equation for generator – Classification of DC machines based on excitation – OCC and External characteristics of DC shunt generator. Armature reaction and commutation– DC motor-principle of operation-Torque and back-emf equation of DC motors.

UNIT 2

PERFORMANCE AND TESTING OF D.C. MACHINES: [8]

Characteristics of separately-excited and self excited motors (shunt, series and compound) - losses and efficiency- applications of dc motors. Necessity of starter – Starting by 3 point and 4 point starters – Speed control by armature rheostat and field control – Testing of DC machines - brake test, Swinburne's method –- retardation test .

UNIT-III

SINGLE-PHASE TRANSFORMERS: [8]

Types and constructional details - principle of operation - EMF equation - operation on no load and operation on load –phasor diagrams on load and no load– equivalent circuit(Exact and approximate) – regulation – losses and efficiency-All day efficiency

UNIT-IV

SINGLE-PHASE TRANSFORMERS TESTING: [8]

Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses- effect of variation of frequency and supply voltage on losses -parallel operation with equal voltage ratios and problems

UNIT–V

AUTO TRANSFORMERS AND 3-PHASE TRANSFORMERS: [8]

Basic principle of operation of Auto transformers, Construction of 3-PhaseTransformers-Connections Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ-Third harmonics in phase voltages– On load and off load tap changers -Scott connection

Text Books:

1. Electrical Machines – P.S. Bhimbra, Khanna Publishers,7th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications,5th edition

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, Mc Graw Hill Publications, 4th edition
2. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH
3. Electrical Machinery by AbijithChakrabarthi and Sudhipta Debnath, McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
5. Electric Machines by Mulukutla S. Sarma&Mukeshk. Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons

NPTEL/MOOC:

1. https://nptel.ac.in/courses/108/105/108105017/

Course Code	Electro Magnetic Fields	L	T	P	C
1002202102		3	1	0	3

COURSE OBJECTIVES:

- To study the production of electric field due to different charge configurations and to understand the application of Gauss Law.
- To study the production of magnetic field due to different current configurations, and to understand the application of Ampere's law.
- To understand the behaviour of materials in Electric Field and to study the magnetic force.
- To do inductance and capacitance calculations.
- To study Maxwell's equations and Poynting vector.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understanding of coordinate systems, electric field intensity, electric potential, electric dipole, magnetic field intensity, energy stored in inductor, energy stored in capacitor and Faraday's laws of electromagnetic induction. Outline of Maxwell's equations, Poynting theorem and vector.
CO2	Apply basics of electrostatics in different coordinate systems and analyzebehavior of electric field in conductor, dielectric and interfaces. Make use of various laws to solve electromagnetic problems for time varying fields. Apply Faraday's Law to calculate induced EMF. Identification of properties of materials by utilizing Poisson's and Laplace's equations and learn the .
CO3	Analyze the energy stored in different types of inductor and capacitors. Discover problems involving lossy media with planar boundaries using uniform plane waves. Distinguish the propagation of wave in different media.
CO4	Design of energy storage device and Formulate the properties of electromagnetic wave propagation in different mediums.

UNIT- I

ELECTROSTATIC FIELDS: [9 Hours]

Review of Vector calculus, coordinate systems, Coulomb's Law – Electric Field Intensity (EFI)- EFI due to a finite and infinite line charges- Gauss's law & applications-Work done in moving a point charge in an Electrostatic field- Electric Potential & Potential gradient - Laplace's and Poison's equations. Electric dipole – Dipole moment – potential and EFI due to an electric dipole- Torque on an Electric dipole.

UNIT-II

STATIC MAGNETIC FIELDS: [8 Hours]

Biot-Savart's law &*Oersted's E*xperiment-Magnetic field intensity (MFI) magnetic flux density- MFI due to a straight current carrying filament- Ampere's circuital law -Point form of Ampere's circuital law- Applications of Amperes law viz. MFI due to an infinite sheet of current, a long filament carrying conductor, solenoid current a circular loop, rectangular loop-Magnetic Levitation principles.

UNIT-III

MATERIALS IN ELECTRIC FIELD [9 Hours]

Dielectrics- polarization- Behavior of Conductors and Insulators-Boundary conditions-Conduction and Convection current densities-Ohm's law in point form, Equation of continuity.

MAGNETIC FORCE

Lorentz force equation – Force on a current element in a magnetic field- Force on a straight and a long current carrying conductor in a magnetic field- Force between two straight long and parallel current carrying conductors - Torque on a current loop placed in a magnetic field- Application of Electromagnetic meta-Materials.

UNIT-IV

CAPACITANCE CALCULATIONS [8 Hours]

Energy stored and energy density in a static electric field- Capacitance & capacitance of parallel plates with composite dielectrics -capacitance of spherical and coaxial cables.

INDUCTANCE CALCULATIONS

Energy stored and density in a magnetic field-Self and Mutual inductance -determination of self-inductance of a solenoid and toroid.

UNIT-V

TIME VARYING FIELDS [8 Hours]

Faraday's laws of electromagnetic induction Its integral and point forms -Maxwell's fourth equation, Curl (E)=-∂B/∂t- Statically and Dynamically induced EMFs, Simple problems – Modification of Maxwell's equations for time varying fields- Displacement current- Poynting Theorem and Poynting Vector.

Text Books:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics", 6th Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
2. Principles of Electro Magnetics by Matthew N.O.Sadiku, Oxford Publications,4th edition

Reference Books:

1. Introduction to Electro Dynamics by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition
2. Electromagnetic Field Theory by Yaduvir Singh, Pearson
3. Fundamentals of Engineering Electromagnetics by Sunil Bhooshan, Oxford higher Education.

E-Books:

1. http://scipp.ucsc.edu/~haber/ph214/EMFT_Book_Thide.pdf
2. https://civildatas.com/download/elements-of-electromagnetics-by-matthew-sadiku

NPTEL/MOOC:

1. https://nptel.ac.in/courses/108/106/108106073/

Course Code	Semi-Conductor Devices and Circuits	L	T	P	C
1004202103		3	0	0	3

COURSE OBJECTIVES:

1. To study the construction details, operation and characteristics of junction diode and application of diodes
2. To learn biasing stabilization and compensation methods and to analyze transistor amplifiers.
3. To understand the concepts of positive and negative feedbacks and their role in amplifiers and oscillators.
4. To understand the basic operation of differential amplifiers and learn the linear and non-linear applications of operational amplifiers

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Distinguish the characteristics of different diodes and choose appropriate diode for an application based on the operation
CO2	Design different biasing and stabilization circuits and apply compensation techniques for a transistor.
CO3	Analyse the merits and demerits of positive and negative feedback and the role of feedback in oscillators and amplifiers.
CO4	Design circuits using operational amplifier for various applications.

UNIT- I

DIODE AND ITS APPLICATIONS [12 Hours]

PN Junction Diode – Formation Of Junction, Junction Capacitance, Characteristics, Diode Equations.

Diode Application Circuits :Rectifiers- Halfwave, Fullwave centre tapped and Bridge rectifiers. Filters-capacitor filter, inductor filter

Special Diodes : Zener Diode, Varactor Diode, LED.

UNIT-II

TRANSISTOR COFIGURATION **[** 10 Hours]

BJT Configurations and Characteristics, current gains, DC analysis and biasing of BJTs. Transistors acts as switch and amplifier.

FET Configuration and Characteristics: JFET and MOSFET.

UNIT-III

SMALL SIGNAL TRANSISTOR AMPLIFIERS **[** 12 Hours]

Transistor hybrid model, determination of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using Simplified h-parameters

UNIT-IV
FEEDBACK AMPLIFIER [10 Hours]

Basic concepts of feedback-Negative feedback advantages and Classification. Voltage/Current Series/Shunt, Positive feedback, effect of feedback on input and output resistances.

Oscillators – barkhausen criteria, RC phase shift oscillator and wein bridge oscillators Using BJT and FET.

UNIT-V

CHARACTERISTICS & APPLICATIONS OP-AMP **[1**2 Hours]

CHARACTERISTICS:

Block Diagram of Op-amp, Characteristics of ideal and practical Op-amp, Op-Amp parameters: Input & Output off set voltages & currents, Input bias current, slew rate, CMRR, PSRR, drift, Pin diagram of IC-741.

APPLICATIONS :

Linear applications of op-amp – summing, subtracting, averaging amplifier, differentiator and integrator, Instrumentation Amplifier.

Nonlinear applications of op-amp – Comparator, Square wave generator, Triangular wave generator.

Text Books:

1. S.Salivahanan, N.Sureshkumar. “Electronic Devices &Circuits , TATA McGraw Hill 2nd ed”(2011)
2. Millman, Jacob, and Cristos C. Halkias. "Satyabrata Jit; Electronic Devices and Circuits." TATA McGraw Hill 2nd ed”(2011).
3. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.

Reference Books:

1. Boylestad, Robert L., and Louis Nashelsky. "Electronic Devices and Circuit Theory Pearson/Prentice Hall, 9thEdition, 2006
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.

NPTEL/MOOC:

1. https://www.youtube.com/watch?v=9g9dowLjmCA&list=PLp6ek2hDcoNDAw1BehPFazZ5ogPV8UlQa
2. https://www.youtube.com/watch?v=pkIxCmaxWFg&list=PLbRMhDVUMngehqNF2w_UbAi94qIycZOTG

Course Code	Electrical Circuit Analysis-II	L	T	P	C
1002202103		3	1	0	3

COURSE OBJECTIVES:

- To study the concepts of balanced three-phase circuits and its power measurement.
- to study the concepts unbalanced three-phase circuits and network graph theory
- To study the transient behavior of electrical networks with DC, pulse and AC excitations.
- To study the performance of a network based on input and output excitation/response
- To understand the realization of electrical network function into electrical equivalent passive elements.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the measurement of three-phase power under balanced and unbalanced load condition.
CO2	Analyze transient response of the electrical networks with DC and AC excitation.
CO3	Determine the two port network parameters for different types of electrical networks.
CO4	Realize the electrical equivalent network for a given network transfer funcions

UNIT- I

THREE PHASE CIRCUITS: [8 Hours]

Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents. Analysis of three phase balanced and unbalanced circuits. Loop method, Star-Delta transformation technique, measurement of active and reactive power.

UNIT-II

RESONANCE: [8 Hours]

Series and Parallel Resonance, Different combinations, Quality factor, Bandwidth, Selectivity.

INTRODUCTION TO GRAPH THEORY (ELEMENTARY TREATMENT ONLY)

Basic definitions, Incidence matrix, basic tie set matrix, basic cutest matrix.

UNIT-III

TRANSIENT ANALYSIS IN DC AND AC CIRCUITS: [8 Hours]

Transient response of R-L, R-C, R-L-C circuits for DC and AC excitations, Solution using Laplace transforms.

UNIT-IV

TWO PORT NETWORKS: [8 Hours]

Two port network parameters -Z, Y, ABCD and Hybrid parameters and their relations, Interconnected networks.

UNIT-V

NETWORK SYNTHESIS: [8 Hours]

Positive real function - basic synthesis procedure - LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function - Foster and Cauer methods.

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw Hill Company, 8th edition
2. Network synthesis: Van Valkenburg; Prentice-Hall of India Private Ltd
3. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India), 6th edition.
4. Network Theory Analysis and Synthesis by SmarajitGhosh, PHI publications

Reference Books:

1. Introduction to circuit analysis and design by TildonGlisson. Jr, Springer Publications.
2. Circuits by A. Bruce Carlson , Cengage Learning Publications
3. Networks and Systems by D. Roy Choudhury, New Age International publishers
4. Electric Circuits by David A. Bell, Oxford publications
   Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi,DhanpatRai&Co.

E-Books:

1. https://www.electronicbo.com/p/wating.html??&&url=_http://bit.ly/2KKtD71
2. https://bookboon.com/en/concepts-in-electric-circuits-ebook
3. https://open.umn.edu/opentextbooks/textbooks/dc-electrical-circuit-analysis-a-practical-approach-fiore
4. https://open.umn.edu/opentextbooks/textbooks/ac-electrical-circuit-analysis-a-practical-approach-fiore

NPTEL/MOOC:

1. https://nptel.ac.in/courses/108/104/108104139/

Course Code	Electrical Machines-I Lab	L	T	P	C
1002202110		0	0	3	1.5

COURSE OBJECTIVES:

1. To plot the magnetizing characteristics of DC shunt generator and understand the mechanism of self-excitation.
2. To control the speed of the DC motors.
3. Determine and predetermine the performance of DC machines.
4. To predetermine the efficiency and regulation of transformers and assess their performance.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Determine the losses and efficiency of dc machines and transformers by conducting various tests
CO2	Analyze the performance characteristics of dc machines
CO3	Control the speed of dc machine by different methods
CO4	Investigate the parallel operation and scott connection of transformers

LIST OF EXPERIMENTS

S.No.	Name of the experiment
1	Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2	Brake test on DC shunt motor. Determination of performance curves.
3	Swinburne's test and Predetermination of efficiencies as Generator and Motor.
4	Speed control of DC shunt motor by Field and armature Control.
5	Retardation test on DC shunt motor. Determination of losses at rated speed.
6	OC & SC test on single phase transformer.
7	Sumpner's test on single phase transformer.
8	Scott connection of transformers
9	Parallel operation of Single-phase Transformers
10	Separation of core losses of a single phase transformer

Text Books:

1. Electrical Machines – P.S. Bhimbra, Khanna Publishers , 7th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications,5th edition

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition
2. Electric Machinery by A.E.Fitzgerald, Charleskingsley, Stephen D.Umans, TMH
3. Electrical Machinery by AbijithChakrabarthi and Sudhipta Debnath, McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010

Course Code	Semi-Conductor Devices and Circuits Lab	L	T	P	C
1004202112		0	0	3	1.5

COURSE OBJECTIVES:

1. To understand the operation and characteristics of junction diode and application of diodes, Special diode and FET
2. To learn operation and characteristics ofTransistor CE Characteristics
3. To understand the concepts of Voltage Series Amplifier and RC Phase Shift Oscillator.
4. To understand the Characteristics of op-amp and Applications of op-amp

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Distinguish the characteristics of different diodes and choose appropriate diode for an application based on the operation
CO2	learn operation and characteristics ofTransistor CE Characteristics
CO3	Analyze the concepts of Voltage Series Amplifier and RC Phase Shift Oscillator
CO4	Design circuits using operational amplifiers for various applications.

LIST OF EXPERIMENTS

S.No.	Name of the experiment
1	PN Junction Diode V-I Characteristics
2	Zener Diode V-I Characteristics
3	Half WaveRectifier Without and With Filter
4.	Full wave Rectifier Without and With Filter
5.	Transistor CE Characteristics (Input & Output).
6	JFET Characteristics
7	Frequency response of CE Amplifier.
8	Voltage Series Feedback Amplifier
9	RC Phase Shift Oscillator.
10	Op-amp Applications: adders , Subtractors and Comparators
11	Op-amp Applications: Integrators and Differentiators.
12	Function generator using IC741

Text Books:

1. S. Salivahanan,N.Sureshkumar. “Electronic Devices & Circuits, TATA McGraw Hill 2nd ed” (2011)
2. Millman, Jacob, and Cristos C. Halkias. "Satyabrata Jit; Electronic Devices and Circuits." TATA McGraw Hill 2nd ed” (2011).
3. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.

Reference Books:

1. Boylestad, Robert L., and Louis Nashelsky. "Electronic Devices and Circuit Theory Pearson/Prentice Hall, 9thEdition, 2006.
2. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition, 2003

Course Code	Skill Oriented Course	L	T	P	C
1020202180	Employability Readiness Program	1	0	2	2

COURSE OBJECTIVES

1. To enhance the problem solving skills in the area of 'Quantitative Aptitude' this will enable the students to achieve in-campus placements and competitive examinations.
2. To improve the logical thinking capability of students by enhancing the skills in Reasoning.
3. To encourage the all-round development of students by focusing on verbal ability.
4. To perform better during Campus Recruitment and various interviews they face in their career.

COURSE OUTCOMES

CO	At the end of the course, the student will have the ability to:
CO1	Follow strategies in minimizing time consumption in problem solving and apply shortcut methods to solve problems and confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.
CO2	Apply various methods of solving a problem by analysing the concept and situation effectively.
CO3	Communicate effectively with improved vocabulary and able to write e-mails, essays and resumes appropriately.
CO4	Succeed in professional and personal life by applying all mathematical, reasoning and verbal skills.

Part-A **No. of lecture hours: 25**

Aptitude

Number System: Speed Maths, Numbers, Factors, Prime & Co-Primes, LCM, HCF, Divisibility rules, finding unit place digit and last two digits of an expression.

Averages and Ages: Average of different groups, change in averages by adding, deleting and replacement of objects, problems on ages.

Ratio, Proportion and Variations: Definition of Ratio, Ratio of Proportion, Comparison of ratios, Compound ratio, Direct and indirect proportion.

Allegation and mixtures: Allegation rule, Mean value of the mixture, Replacement of equal amount of quantity.

Percentages: Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings

Time and Work: Men and Days, Work and Wages, Hours and Work, Alternate days concept.

Time and Distance: Difference between the average and relative speeds, reaching the destination late and early, Stoppage time per hour, time and distance between two moving bodies.

Trains, Boats and Streams: Train crossing man, same and opposite directions, Speed of boat and stream.

Profit and loss: Relation between Cost price and Selling price, Discount and Marked price, Gain or Loss percentages on selling price

Simple and Compound Interest: Problems on Interest (I), Amount (A), Principal (P) and Rate of

Interest(R), Difference between the simple interest and compound interest for 2 and 3 years.

Permutation and Combination: Fundamental rules, problems on permutations & combinations.

Outcome:

1. Apply shortcut methods to solve mathematical problems.

2. Follow strategies in minimizing time consumption in problem solving and to perform well in various competitive exams and placement drives.

3. Solve various Basic Mathematics problems by following different methods

4. Solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.

Logical Reasoning

Blood Relations: Defining the various relations among the members of a family, Solving Blood Relation Puzzles by using symbols and notations. Problems on Coded relations.

Series completion: Number series, Alphabet series, and Letter series.

Coding and Decoding: Letter coding, Number coding, Number to letter coding, Matrix coding, Substitution, Mixed letter coding, Mixed number coding, deciphering individual letter codes by analysis.

Direction sense test: Sort of directions in puzzles distance between two points, problems on shadows, Application of triangular triplets.

Clocks: Relation between minute-hour hands, angle vs. time, exceptional cases in clocks

Calendars: Definition of a Leap Year, Finding the odd days, finding the day of any random calendar date, repetition of calendar years.

Outcome:

1. Solve various Basic Mathematics problems by following different methods and analyses.

2. Follow strategies in minimizing time consumption in problem solving

3. Apply shortcut methods to solve problems and confidently solve any mathematical problems

Part-B **No. of lecture hours: 25**

Verbal: Competitive Grammar: Verb-Tenses, Adjectives & Adverb, Preposition, Conjunction, Syntax (Activity based learning).

Word Etymology, One word substitutes, Word games – Vocabulary development.

Reading Comprehension: General Strategies for Reading Comprehension: Narrative Text, Strategies for Reading Comprehension: Expository Text, Main Idea/Summarization

Sentence Correction/ Improvement/ Completion, Subject-verb agreement, Repetition, Error in modifiers.

Direct-Indirect Speech, Active Passive Voice, Cloze Test

Outcome:

1. Understand the vocabulary.
2.Understand the core competencies to succeed in professional and personal life.

3. Students have the adequate writing skills that are needed in an organization.

Text Books:

1. Quantitative Aptitude by R S Agarwal, S Chand Publications

2. Quantitative Analysis. Third edition (Hall, William Thomas). Norris F. Hall · Cite this: J. Chem. Educ. 1942, 19, 7, 350.

3. A Modern Approach to Verbal Reasoning by R S Agarwal, S.Chand Publications.

4. Arun Sharma and Meenakshi Upadhyay for verbal ability

Reference Books:

1. Quantitative Aptitude – Abhijit Guha, McGraw Hills.

2. Logical Reasoning, Arun Sharma, McGraw Hill.

3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications

4. Mc Graw Hill Objective English 5 th edition.

Course Code	Audit Course	L	T	P	C
1000202120	Life Skills	2	0	0	0

COURSE OBJECTIVE:

The students will be able to build self-confidence, encourage critical thinking, foster independence and help people to communicate more effectively.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Build Self Confidence and Interpersonal and Intrapersonal relationships.
CO2	Practice Emotional Competency while communicating with others
CO3	Gain Intellectual Competency by practicing ethics and morals

UNIT1: LIFE SKILLS: Positive Attitude and Positive Work Ethics, Time Management, Goal Setting: Short term, Long Term. (Activity has to be conducted)

UNIT2: EMOTIONAL INTELLIGENCE: Self Awareness through Johari Window and SWOT analysis (Activity has to be conducted)

UNIT3: PROBLEM SOLVING SKILLS: Critical Thinking and Brain Storming, Creative Thinking, Conflict Management. (Activity has to be conducted)

UNIT4: PUBLIC SPEAKING: Body Language, presentation skills, impromptu presentation, interviewing others. (Activity has to be conducted**)**

UNIT 5: NPTEL Course/ Coursera /Any relevant Certificate Course has to be done

Assessment: In order to clear internal assessment, the student has to submit Project Report and give Presentation on all the activities he/she has done during the course. The student has to do a certificate course also. (Presentation, Project Report and Certificate in total will be the criteria for the assessment)

References:

- Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
- Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.
- Larry James (2016); "The First Book of Life Skills"; First Edition; Embassy Books. Shalini Verma (2014); "Development of Life Skills and Professional Practice"; First Edition; Sultan Chand (G/L) & Company
- John C. Maxwell (2014); "The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc.

II YEAR II SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

II Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1004202204	Analog and Digital Electronics	3	0	0	3
2	1002202200	Control Systems	3	1	0	3
3	1002202201	Electrical Machines-II	3	0	0	3
4	1002202202	Power Generation Engineering and Economics	3	0	0	3
5	1099202100	Managerial Economics and Financial Analysis	3	0	0	3
6	1005202213	Fundamentals of Data Structures Lab	0	0	3	1.5
7	1002202210	Electrical Machines-II lab	0	0	3	1.5
8	1002202211	Control Systems lab	0	0	3	1.5
9	1005202281	Fundamentals of Data Structures	1	0	2	2
10	1000202121	Environmental Science	2	0	0	0
11	1002202260	Mini Project(EPICS)	0	0	2	1
		Total Credits:				**22.5**
Summer Internship Mandatory						
12		Honors/Minor courses	4	0	0	4

Course Code	Analog and Digital Electronics	L	T	P	C
1004202204		3	0	0	3

COURSE OBJECTIVES:

1. To Understand the concepts of PLL and Timer.
2. To design various types of Active Filters such as LPF, HPF, BPF, BRF, NBPF, Notch Filter, ALL pass filters.
3. To understand the number systems and the Logic gates and minimization of logic functions.
4. To explain the realization of logic functions using combinational circuits.
5. To explain the design of counters, registers using Flip Flops.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Able to design various types of filters using Op-amp.
CO2	Understand the conversion between different number systems, Binary Arithmetic and understand the logic gates and Minimization of Logic Functions.
CO3	Realise Logic functions using multiplexers, encoders and decoders.
CO4	Design different types of counters and different sequential circuits using flip flops**.**

UNIT- I

TIMER 555 AND PHASE LOCKED LOOPS [10 hrs]

IC 555 Pin Description, Functional block diagram of IC 555, Mono-stable and astable multivibrators using IC 555 and it's Applications, Voltage Controlled Oscillator (IC 566) **Phase Locked Loops**: Introduction to PLL (IC 565), Principles and description of individual blocks ofPLL

UNIT-II

ACTIVE FILTERS [10 hrs]

Advantages of active filters over passive filters, Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and All pass filters.

UNIT-III

DIGITAL TECHNIQUES [12 hrs]

Logic Gates-Basic Gates, Universal Gates and realization of other gates using universal gates. Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms, Canonical representation, Duality Theorem, Minimization Techniques using Boolean laws and Karnaugh Map(up to 4 variables)

UNIT-IV

COMBINATIONAL CIRCUITS [10 hrs]

Half-Adder, Full-Adder, Half subtractor, Full Subtractors, 4 bit binary adder.

Design of Multiplexer, higher order multiplexing, De-multiplexer, higher order demultiplexing Encoder, Priority Encoder, Decoder, Comparator(4-bit), realization of Boolean functions using decoders and multiplexers.

UNIT-V

SEQUENTIAL CIRCUITS **[14 hrs]**

Introduction to Sequential Circuits, Latches, Flip-Flops: Types of Flip Flops -RS, T, D, JK, Master-Salve JK, Flip Flop conversion.

Shift Registers, types of shift registers, Universal Shift Register. Asynchronous and synchronous counters.

Text Books:

1. Linear Integrated Circuits by D. Roychowdary, New age international.
2. Zvikohavi and Niraj K.Jha, " Switching and finite Automata Theory", Cambridge University Press, 3rd edition, 2010

Reference Books:

1. Switching Theory and Logic Design by A. Anand Kumar
2. Digital Design by M. Morrics Mano, Micheal D. Ciletti, Pearson Publication 4Th edition. PHI
3. OP–AMPS and liner integrator circuits by Ramakanth A. Gayakwad (PHI).

NPTEL/MOOC: (Specify Links)

1. https://www.youtube.com/watch?v=M0mx8S05v60&list=PLBlnK6fEyqRjMH3mWf6kwqiTbT798eAOm
2. https://www.youtube.com/watch?v=NFXyItNODpQ&list=PLqGm0yRYwTgMpFqoWg2WiQ0huPKFNCdN
3. https://www.youtube.com/watch?v=CeD2L6KbtVM&list=PL2140D6A6E9875994

Course Code	Control Systems	L	T	P	C
1002202200		3	1	0	3

Course Objectives

- To learn the mathematical modelling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
- To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers
- To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
- To present the Frequency Response approaches for the analysis of Linear time Invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
- To discuss basic aspects of design and compensation of linear control systems using Bode plots.
- Ability to formulate state models and analyze the systems. To present the concepts of Controllability and Observability

Course Outcomes:

CO's	At the end of the course, the student will have the ability to:
CO1	Understanding of basic linear feedback principles and develop the mathematical model of physical systems
CO2	Analyze the Transient & Steady State Performance of a different system
CO3	Design different types of controllers & compensators to improve system transient and steady state response
CO4	Present and analyze linear control system using the state space technique

UNIT- I **L: 12**

Mathematical Modeling of Control Systems:

Classification of control systems, Open Loop and closed loop control systems and their differences, Feed Back Characteristics, transfer function of linear system, Differential equations of electrical networks, Translational and Rotational mechanical systems, Transfer Function of DC Servo motor - AC Servo motor- Synchro, transmitter and receiver - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

Outcome: Represent mathematical model and transfer function for any Given systems.

Activity:

- Finding mathematical model and transfer function for any Given systems using MATLAB Software.

Experiments:

- Characteristics of Synchro Transmitter & Receiver.
- Characteristics of AC servo motor & DC servo motor.
- Potentiometer as an error detector.
- Transfer function of DC motor- MATLAB Simulation & Experiment.

UNIT II **L: 08**

Time Response Analysis

Standard test signals - Time response of first and second order systems - Time domain specifications - Steady state errors and error constants –Effects of PI,PD and PID.

Stability and Root Locus Technique

The concept of stability – Routh's stability criterion –limitations of Routh's stability –Root locus concept - construction of root loci (Simple problems)-Effect of additional open loop pole and zero on root locus.

Outcome: Analyze the Transient & Steady State Performance for first and second order system and also analyze the stability of any system using root locous

Activity:

- Finding the time domain response & time domain specifications for any Given systems using MATLAB Software.
- Finding the stability for any given system using root locous method using MATLAB Software.

Unit-III **L: 12**

Frequency Response Analysis

Introduction-Sinusoidal transfer function - Frequency domain specifications - Bode diagrams-transfer function from the Bode Diagram- Polar Plots, Nyquist Stability criterion – Relative stability analysis -Phase margin and Gain margin.

Outcome: Analyze the stability, Phase Margin & Gain Margin for any given system using various methods (root locous,bode plots, polar plots & Nyquist plots).

Activity:

- Finding the stability, Phase Margin & Gain Margin for any given system using various methods (root locous, bode plots, polar plots & Nyquist plots) using MATLAB Software.

Unit-IV **L: 8**

Classical Control Design Techniques:

Lag, Lead, Lag-Lead compensators, design of compensators using Bode plots.

Outcome: Design Lag, Lead, Lag-Lead compensators and PI, PD controllers for any given system.

Activity:

- Design Lag, Lead, Lag-Lead compensators and PI, PD controllers for any given system using MATLAB Software.

Unit-V **L: 10**

State Space Analysis of LTI Systems:

Concepts of state, state variables and state model, state space representation of transfer function, Solving the time invariant state equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability

Outcome: Represent any given systems as state model and Analyse their response. Also understanding the concepts of controllability and observability.

Activity:

- Finding state model for any given system using MATLAB Software.

Text Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt. Ltd., 4th Edition.
2. Automatic control systems, Benjamin C. Kuo, Prentice Hall of India,2nd Edition
3. Control Systems Engineering, Norman S. Nice, Jon wiley, Inc, 6th Edition.

Reference Books:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Control Systems, Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering, I.J. Nagarath and M. Gopal, Newage International Publications, 5th Edition.
4. Control Systems Engineering, S. Palani, Tata McGraw Hill Publications.

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

https://nptel.ac.in/courses/107/106/107106081/

Course Code	Electrical Machines-II	L	T	P	C
1002202201		3	0	0	3

COURSE OBJECTIVES:

1. To discuss the principle of operation and performance of three-phase induction motor and synchronous machines
2. To explain the torque producing mechanism of a single phase induction motor.
3. To describe the principle of emf generation, the effect of armature reaction and predetermination of voltage regulation in synchronous generators.
4. To elaborate the operation, performance and starting methods of synchronous motors.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the construction and operation of induction motors and synchronous machines
CO2	Interpret the torque producing mechanism and testing methods of induction motors and regulation of synchronous machines
CO3	Analyze various starting methods, phasor diagrams and equivalent circuit of induction motors and synchronous machines
CO4	Evaluate the performance of induction motors and synchronous machines in real time applications

UNIT 1

3-PHASE INDUCTION MOTORS: [8]

Construction details of cage and wound rotor machines - production of rotating magnetic field - principle of operation - rotor emf and rotor frequency - rotor current and pf at standstill and during running conditions - rotor power input, rotor copper loss and mechanical power developed and their interrelationship – equivalent circuit – phasor diagram, numerical , Applications

UNIT 2

CHARACTERISTICS AND TESTING METHODS OF INDUCTION MOTORS:[8]

Torque equation - expressions for maximum torque and starting torque - torque slip characteristic - double cage and deep bar rotors - crawling and cogging –speed control of induction motor with V/f constant method – no load and blocked rotor tests - circle diagram for predetermination of performance.

UNIT-III

STARTING METHODS OF 3-PHASE INDUCTION MOTORS AND 1-PHASE IM MOTORS [8]

Methods of starting – starting current and torque calculations – induction generator operation (Qualitative treatment only) , Single phase induction motors – Constructional features - Double revolving field theory–Starting methods - Equivalent circuit

UNIT-IV:

CONSTRUCTION, OPERATION AND VOLTAGE REGULATION OF SYNCHRONOUS GENERATOR [8]

Constructional features of non–salient and salient pole type – Armature windings– Distribution– Pitch and winding factors –E.M.F equation-Armature reaction-Voltage regulation by synchronous impedance method–and Potier (ZPF) triangle method–Phasor diagrams– Two reaction analysis of salient pole machines and phasor diagram..

UNIT–V

PARALLEL OPERATION OF SYNCHRONOUS GENERATOR, SYNCHRONOUS MOTOR – OPERATION, STARTING AND PERFORMANCE [8]

Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing- Control of real and reactive power- Numerical problems

Synchronous Motor principle and theory of operation– Methods of starting – Phasor diagram – Starting torque– Variation of current and power factor with excitation –Synchronous condenser –Hunting and its suppression , Applications

Text Books:

1. Electrical Machines – P.S. Bhimbra, Khanna Publishers , 7th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications,5th edition

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition
2. Electric Machinery by A.E.Fitzgerald, Charleskingsley, Stephen D.Umans, TMH
3. Electrical Machinery by AbijithChakrabarthi and Sudhipta Debnath, McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010

NPTEL/MOOC:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee38/

Course Code	Power Generation Engineering and Economics	L	T	P	C
1002202202		3	0	0	3

COURSE OBJECTIVES: This course aims at study of Power generating stations and Renewable energy sources. It also interprets various tariff methods and economic aspects of power generation from load curves.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the operation of thermal and nuclear power stations, and their components.
CO2	Analyze the operation of PV cells.
CO3	Understand the operation of Hydro, Wind, Tidal, Wave Power Plants.
CO4	Interpret various load curves and compare different methods of tariff.

**Strength of mapping (Intensity Scale) – 1(Lightly mapped), 2(Moderately mapped), 3(Heavily mapped)

UNIT- I

THERMAL POWER STATIONS (8 hours)

Energy scenario in India, Line diagram of Thermal Power Station (TPS) showing paths of coal,steam, water, air, ash and flue gases- Brief description of TPS. Components: Economizers, Boilers, Super heaters, Turbines,Condensers, Chimney and Cooling towers, ESP, Turbo-Generator features, Efficiency of TPP.

UNIT II

NUCLEAR AND HYDROELECTRIC POWER PLANTS (10 hours)

Nuclear Power Stations: Nuclear Fission and Chain reaction – Nuclear fuels - Principle of operation of nuclear reactor.-Reactor Components: Moderators, Control rods, Reflectors and Coolants.

Hydroelectric Power Stations: Hydroelectric power Plant Layout, Classification, Components, Calculation of available Power, types of Hydroelectric Power Plants - micro, small, large, Hydro electric generator features, Types of Turbines.

UNIT-III

PHOTOVOLTAIC CELLS (10 hours)

Solar photovoltaic cell, I-V characteristics, Block Diagram of PV, Equivalent circuit of solar cell, Efficiency of solar cells, module, array, Series and Parallel connection.

UNIT-IV

WIND, OCEAN AND TIDAL ENERGY (10 hours)

Wind Energy, Types of forces acting on wind turbines, Betz Criteria (no proof), power in wind, Types of Wind turbines: Based on Axis of rotation and number of blades, Block diagram of WECS.
Ocean Thermal Energy, Tidal Energy, Wave energy-Principle of operation only.

UNIT-V

ECONOMICS OF POWER GENERATION AND TARIFF METHODS (12 hours)
Load curve, load duration and integrated load duration curves-load, Demand, diversity, capacity, utilization and plant use factors-(Numerical Problems on load factor).
Costs of Generation and their division into Fixed, Semi-fixed and Running Costs, Desirable Characteristics of a Tariff Method, Tariff Methods- Flat Rate, Block-Rate, two-part, three –part, and power Factor tariff methods, Numerical Problems.

Text Books:

1. B H Khan, "Non-Conventional Energy Resources," 3rd Edition, McGraw Hill Education [Unit-1,2,3,4]
2. M.L. Soni, P.V. Gupta, U.S. Bhatnagar and A. Chakraborti, "A Text Book on Power System Engineering",2nd Edition, DhanpatRai& Co. Pvt. Ltd., 2010.[Unit-5]

Reference Books:

1. D. P. Kothari, K. C. Singal, RakeshRanjan, "Renewable Energy Sources and Emerging Technologies", 2nd Edition, PHI Learning Private Limited, 2011.
2. M.V.Deshpande, "Elements of Power Station Design and Practice", Wheeler Publishing,1979.
3. G. D. Rai, "Non-Conventional Energy Sources", 5th Edition, Khanna Publishers.

NPTEL/MOOC:

1. Steam and Gas Power Systems - Course (nptel.ac.in)
2. Electric Power Systems | Coursera
3. GATE & ESE - Course on Power System Generation by Unacademy

Course Code	Managerial Economics and Financial Analysis	L	T	P	Credits
1099202100		3	0	0	3

Course Overview: The present course is designed in such a way that it gives an overview of concepts of Economics. Managerial Economics enables students to understand micro environment in which markets operate how price determination is done under different kinds of competitions. Financial Analysis gives clear idea about concepts, conventions and accounting procedures along with introducing students to fundamentals financial statements. Break Even Analysis is very helpful to the Business Concern for Decision Making, controlling and forward Strategic Planning.

Course Objectives:

1. Understand the concepts of managerial economics and the market dynamics namely Demand, Elasticity of demand and pricing in different market structures.
2. Acquire the knowledge about production theories and cost analysis besides dealing with the production and factors of production.
3. Analyze the different market structures and understand various pricing methods which are adopted in attracting the customers under different markets.
4. To provide the basic knowledge on financial accounting
5. To understanding Capital budgeting decisions.

Course Outcomes:

Cos	Course outcome
CO1	Analyze the Demand, Price and Cost.
CO2	Identify the Nature of different markets
CO3	Understand Various Business Forms
CO4	Evaluate investment project proposals

Unit-I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand, Demand schedule, Demand curve - Law of Demand and its Exceptions- Elasticity of Demand & Its types - Demand forecasting and Methods of forecasting.

Unit-II

Production and Cost Analysis: Concept of Production function- Cobb-Douglas Production function – Leontief production function, Production Function with One variable Input, Two Variable Inputs and Concept of Returns to scale -economies of scale,Different cost concepts – Cost –Volume-Profit (CVP) analysis (simple problems)

Unit-III

Part-I: Introduction to Market Structures and pricing methods: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly- Features – Price and Output

Determination, Significance of Pricing and various methods of pricing with contemporary examples

Part-II: Introduction to Business: Features, Merits and Demerits - Sole Trader, Partnership, Joint Stock Company – Public Enterprises – Business Cycles: Meaning and Features – Phases of Business Cycle.

Unit-IV

Introduction to Financial Accounting: Systems of Book-keeping, Golden rules of Accounting, Accounting Principles, Accounting Cycle- Journal, Ledger, Trail Balance, Preparation of Trading-Account, P&L Account and Balance Sheet (Simple Problems)

Unit-V

Capital and Capital Budgeting Decisions: Introduction to Capital, Classification of Capital, Time value of money. Types of Capital Budgeting Decisions: Traditional Methods (Payback period, Accounting rate of return) and Modern methods (Net Present Value method, Internal Rate of Return Method and Profitability Index Method) (Simple Problems)

Text Books:

1. M.Kasi Reddy & Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 10th Revised Edition, 2012.

2.Varshney&Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.

3.S.N. Maheshwari &S.K.Maheshwari, "Financial Accounting", Vikas Publication House Pvt.Ltd, 4th Edition, 2012.

Reference Books:

1. D.N. Dwivedi, "Managerial Economics", Vikas Publication House Pvt.Ltd, 2nd Edition, 2012.

2.R.Narayana Swamy, "Financial Accounting- A managerial Perspective", Pearson publications, 1st Indian Reprint Edition, 2012.

3.J.V.Prabhakar Rao &P.V.Rao, "Managerial Economics & Financial Analysis", Maruthi Publishers, 1st Revised Editon, 2011

NPTEL/SWAYAMMOOCS:

1.https://onlinecourses.swayam2.ac.in/imb19_mg08/preview

2.https://www.coursera.org/learn/strategic-management

Course Code	Fundamentals of Data Structures Lab	L	T	P	C
1005202213		0	0	3	1.5

COURSE OBJECTIVES:

- ✓ To develop skills to design and analyze simple linear and non-linear data structures
- ✓ To Strengthen the ability to identify and apply the suitable data structure for the given real-world problem
- ✓ To gain knowledge in practical applications of data structures

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Implement the programs on arrays and linked lists
CO2	Implement Standard Data Structures like Stacks and Queue
CO3	Analyze the time and space efficiency of the data structure be capable to identity the appropriate data structure for given problem
CO4	Have practical knowledge on the application of data structures

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	Develop C programs to implement the following using an array a) Linear search b) binary search	Searching Strategies
2	Develop a C Program to find number of comparisons and swapping for a given list of numbers a) Bubble Sort b) Selection Sort	In-Place Sorting techniques
3	Develop a C program for the following a) Merge Sort b) Quick Sort	Divide and Conquer
4	Develop C programs to implement the following using an array and Linked List a) Stack b) Queue	Linear DS
5	Develop a C program to do the following a) Infix to postfix conversion. b) Evaluation of postfix expression.	Applications of Stack
6	Develop a C program to Implement a Single Linked List	Linear DS

7	Write C programs that use recursive functions to traverse the given binary tree in a) Pre-order b) In-order c) Post-order.	Tree Traversals
8	Write a C program to Implement Binary Search trees operations	Binary Search Tree

Text Books:

- Fundamentals of Data structures in C, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition,Universities Press, Pvt. Ltd.
- Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd.,Second Edition

Reference Books:

- Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
- Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
- Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition.

Course Code	Electrical Machines-II Lab	L	T	P	C
1002202210		0	0	3	1.5

COURSE OBJECTIVES:

1. To control the speed of three phase induction motors.
2. To determine /predetermine the performance three phase and single phase induction motors.
3. To improve the power factor of single phase induction motor.
4. To predetermine the regulation of three–phase alternator by various methods, find X_d/ $X_q$ratio of alternator and asses the performance of three–phase synchronous motor.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Determine the regulation and Xd and Xq values of alternators
CO2	Evaluate the efficiency and control the speed of induction motor
CO3	Analyze the equivalent circuit of single phase induction motor
CO4	Assess the performance of induction motor and alternator

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Brake test on Three phase induction motor	Calculation, Analysis
2	No–load & Blocked rotor tests on three phase Induction motor	Calculation, Analysis
3	Speed control of induction motor by V/f method.	Understanding
4	Equivalent circuit of single phase induction motor	Calculation
5	Power factor improvement of single phase induction motor by using capacitors and load test on single phase induction motor.	Calculation, Analysis
6	Regulation of a three–phase alternator by synchronous impedance	Calculation, Analysis
7	Regulation of three phase alternator by potiermethod.	Calculation, Analysis
8	Determination of efficiency of three phase alternator by loading with three phase induction motor.	Calculation, Analysis
9	Determination of X_d and X_q of a salient pole synchronous machine	Calculation
10	V and Inverted V curves of a three—phase synchronous motor	Understanding

Text Books:

1. Electrical Machines – P.S. Bhimbra, Khanna Publishers, 7th edition
2. Electrical Machines - R.K.Rajput, Lakshmi publications, 5th edition

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition
2. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH

3. Electrical Machinery by AbijithChakrabarthi and SudhiptaDebnath, McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
5. Electric Machines by Mulukutla S. Sarma&Mukeshk. Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons

Course Code	Control Systems Lab	L	T	P	C
1002202211		0	0	3	1.5

COURSE OBJECTIVES:

- To learn the mathematical modelling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
- To analyse the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers
- To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
- To present the Frequency Response approaches for the analysis of Linear time Invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
- To discuss basic aspects of design and compensation of linear control systems using Bode plots.
- Ability to formulate state models and analyse the systems. To present the concepts of Controllability and Observability

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Determine the characteristics of control system components like ac servo motor, synchro, potentiometer, servo voltage stabilizer and use them in error detector mode.
CO2	Apply different stability methods of time & frequency domain in control systems using software & examine their stability.
CO3	Convert the transfer function into state space & vice versa & obtain the time domain response of a second order system for step input and their performance parameters using MATLAB.
CO4	Design the controller and demonstrate the response of first and second order system.

**Strength of mapping (Intensity Scale) – 1(Lightly mapped), 2(Moderately mapped), 3(Heavily mapped)

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Characteristics of Synchro Transmitter & Receiver.	Understanding, Analysis
2	Characteristics of AC servo motor & DC servo motor.	Understanding, Analysis
3	Potentiometer as an error detector.	Designing
4	Transfer function of DC motor	Design
5	DC position control system	Design, Analysis

6	Time response of Second order system- MATLAB Simulation and Experiment using CRO	Understanding, Analysis
7	Effect of P, PD, PI, PID Controller on a second order systems- MATLAB Simulation & Experiment.	Understanding, Analysis
8	Drawing Bode plot, Root Locus, and Nyquist plot of a system in MATLAB.	Design, Analysis
9	Design of Lag and lead compensators for a system in frequency domain using MATLAB.	Design, Analysis
10	Finding state model for any given system using MATLAB Software	Design, Analysis

Text Books:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt. Ltd., 4th Edition.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India,2nd Edition

Reference Books:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Control Systems, Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering, I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
4. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications.

Course Code	Skill Oriented Course	L	T	P	C
1005202280	Fundamentals of Data Structures	1	0	2	2

Prerequisites:
Basics of C Programming

COURSE OBJECTIVES:

1. Basics of data structures including their fundamentals building blocks: arrays and linked list.
2. To solve problems using linear data structures such as linear lists, stacks, queues.
3. To solve problems using searching and sorting techniques.
4. To be familiar with non-linear data structures such as trees.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Apply the C language Concepts: Pointers, Structures, Unions and recursion to solve the problems
CO2	Implement Standard Data Structures like Stack, Queue, List and Tree
CO3	Choose appropriate data structure while building new application
CO4	Explain the need for data structuring techniques

Brief Introduction about the Course:

Data structures are amongst the most fundamental ingredients in the recipe for creating efficient algorithms and good software design. Knowledge of how to create and design good data structures is an essential skill required in becoming an exemplary programmer. This course will teach how to master the fundamental ideas surrounding data structures. Well organised data structures allow for quick and efficient retrieval of information and are essential for modern computing. Organised data can be easily sorted, ordered, and searched to retrieve information that meets certain requirements.

DETAILED SYLLABUS

S.No.	Theory	Practical	Skill
1.	**ARRAYS AND LINKED LISTS**: Abstract DataTypes(ADTs), Dynamic allocation of Arrays, Structures and unions, Polynomials, Spares Matrices. Single Linked List and Chains, Representing Chains in C, Polynomials, Polynomial Representation- Adding Polynomials-Circular List Representation of Polynomials, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input-Deleting a Sparse Matrix, Doubly Linked Lists.	1. Write a C program to perform Array insertion, deletion and searching. 2. Write a C Program to implement addition of two polynomials using arrays.	Arrays and Linked Lists
2.	**SEARCHING AND SORTING:** Searching: Linear Search, Binary Search. Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.	1. Write a C program to implement insertion sort.	Searching and Sorting
3.	**STACKS AND QUEUES:** The Stack, Stacks using Dynamic Arrays, Recursion, Linked Stacks, The Queue, Linked Queues, Circular Queues using Dynamic Arrays,De-queue. Application of stacks and queues, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.	1. Write a C program to implement Stack using Arrays. 2. Write a C program to implement Queue using Arrays.	Stacks, Queues and Trees
4.	**TREES:** Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal-InorderTraversal,Preorder Traversal, Postorder Traversal. **ADVANCED CONCEPT OF TREES:** Binary Search Trees, Definition, Searching a Binary Search Tree, Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.	1. Perform various operations on Binary search Trees.	Binary Search Trees
5.	**GRAPHS:** Graph ADT, Elementary operations on graphs-BFS, DFS	1. Write a C program to perform BFS of a given graph. 2. Write a C program to perform DFS of a given graph.	Graphs

Text Books:

- Fundamentals of Data Structures in C, Ellis Horowtiz, S.Sahni, Andrews Freed, University Press (India). Second Edition.
- Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.

Reference Books:

1. Classic Data Structures, Debasis Samantha, PHI. (Second Edition)
2. Data Structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
3. Data Structures using C, Reema Thareja, Oxford Home Publications, Second Edition

E-Books:

1. https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf
2. https://vardhaman.org/wp-content/uploads/2018/12/Data%20Structures.pdf
3. https://www.ncertbooks.guru/data-structures/

NPTEL/MOOC:

https://nptel.ac.in/courses/106/102/106102064/

Course Code	Audit Course	L	T	P	C
1000202121	Environmental Science	2	0	0	0

COURSE OBJECTIVES:

1. Classify, describe and explain the concepts of Ecosystems and environmental Studies.
2. Overall understanding of different types of natural resources and its conservation.
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
4. An understanding of the environmental impacts of developmental activities and the importance of environmental management.
5. Awareness on the social issues, environmental legislations and global treats.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental problems.
CO2	Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities.
CO3	Learn the management of environmental hazards and to mitigate disasters and have a clear understanding of environmental concerns and follow sustainable development practices.

UNIT I **(8 hrs)**

Multidisciplinary nature of Environmental Studies: Definition Scope and its importance, Multidisciplinary nature of Environmental science.
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Energy flow in the ecosystem – Ecological pyramids - Ecological succession.
Social Issues and the Environment: Impacts of microbial toxins on human health. Urban problems related to energy- Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions. Climate change, Global warming, Acid rain, Ozone layer depletion.

UNIT II - **(3 hrs)**

BIODIVERSITY AND ITS CONSERVATION: Definition: genetic, species and ecosystem diversity –Value of biodiversity, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India – Conservation of biodiversity.

UNIT III: **(8 hrs)**

Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case

studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources

UNIT IV – (9hrs)

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Noise pollution
e. Nuclear hazards

Role of an individual in prevention of pollution – Pollution case studies

Environmental Laws: Wildlife Protection Act 1972 –Water pollution prevention and control Act 1974 - Forest Conservation Act 1980n –Air pollution prevention and control Act 1981. Environmental Protection Act 1986 and 2006 - – Public awareness

SOLID WASTE MANAGEMENT: Causes**,** effects and control measures of urban and industrial wastes.

Sustainable Development: Goals of Sustainability, Conferences, Carbon credits and carbon footprints.

UNIT V – (4hrs)

Environmental Management:

EIA and EA: Introduction, definition, scope, objectives and methodology.

Disaster management: Definition, floods, earthquake, cyclone and landslides.

Ecotourism: Definition, principles, advantages and disadvantages

Environmental Diary

Field Trip

Field work/Environmental Visit: Visit to a local area to document environmental assets – reserve forest/ eco-tourist spot : Visit to a local polluted site - Study of local environment - common plants, insects, birds - Study of simple ecosystems –pond, river, hill slopes etc - Visit to industries/water treatment plants/effluent treatment plants.

Text Books:

1. Text book of Environmental Studies for Undergraduate courses by ErachBharuncha for University Grants Commission, Universities Press.

2. Environmental Studies by Palaniswamy – Pearson Education.

3. Environmental Studies by Dr. S. Azeem Unnisa, Academic Publishing Company

Reference Books:

1.Textbook of Environmental Science by Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.

2. Text of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.

3. Comprehensive Environmental studies by J.P Sharma, Laxmi Publications.

4. Environmental sciences and Engineering – J Glynn Henry and Gary W Heinke – Prentice hall of India Private Limited.

5. A textbook of Environmental Studies by G.R Chatwal, Himalaya Publishing house.

6. Introduction to Environmental engineering and science by Gilbert M Masters and Wendell P Ela – Prentice hall of India private limited.

Course Code	Mini Project (EPICS)	L	T	P	C
1002202260		0	0	2	1

INTRODUCTION

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development

2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.

3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

OBJECTIVE

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

2. To help students to realize the stark realities of the society.

3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability

4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.

5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.

6. To help students to initiate developmental activities in the community in coordination with public and government authorities.

7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

1. Positive impact on students' academic learning

2. Improves students' ability to apply what they have learned in "the real world"

3. Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development

4. Improved ability to understand complexity and ambiguity

Personal Outcomes

1. Greater sense of personal efficacy, personal identity, spiritual growth, and moral development

2. Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

1. Reduced stereotypes and greater inter-cultural understanding

2. Improved social responsibility and citizenship skills

3. Greater involvement in community service after graduation

Career Development

1. Connections with professionals and community members for learning and career opportunities

2. Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

1. Stronger relationships with faculty

2. Greater satisfaction with college

3. Improved graduation rates

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for students. It is highly expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

Implementation Procedure:

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

2. The Community Service Project is a twofold one –

a) First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.

b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Horticulture
5. Herbal plants
6. Marine products
7. Aqua culture
8. Nutrition
9. Traditional health care methods
10. Air pollution
11. Water pollution
12. Soil protection
13. Renewable energy
14. Organic farming
15. Access to safe drinking water
16. Blood groups and blood levels
17. Internet Usage in Villages
18. Android Phone usage by different people
19. Utilization of free electricity to farmers and related issues
20. Natural disaster management

EVALUATION PROCEDURE:

1. Preliminary survey report - 20 M
2. Final Presentation – 10M
3. Final report submission &Final demo module – 20 M

For each student's batch, a separate attendance record should be kept in the preliminary survey report and final report, which should be countersigned by the teacher-mentor, HOD, and Principal.

Reports should include photographs that have a geotag.

III YEAR I SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

III Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002203100	Power Transmission Engineering	3	1	0	3
2	1002203101	Electrical Measurements and Instrumentation	3	0	0	3
3	1002203102	Power Electronics	3	1	0	3
4	**Professional Elective-I**		3	0	0	3
	1002203130	Digital control systems				
	1002203131	Energy audit conservation and management				
	1002203132	Special Electrical Machines				
	1002203133	Optimization techniques				
5	**Open Elective-I**		3	0	0	3
	1005202200	Database Management Systems				
	1004203143	Micro Electro-Mechanical Systems				
	1003204134	Green Engineering Systems				
	1001202140	Industrial Waste and Waste Water Management				
6	1005203111	Introduction to Python Lab	0	0	3	1.5
7	1002203110	Electrical Measurements and Instrumentation Lab	0	0	3	1.5
8	1002203111	Power Electronics Lab	0	0	3	1.5
9	1005203180	Introduction to Python	1	0	2	2
10	1099203120	Entrepreneurship Development	2	0	0	0
11	1002203160	Summer Internship	0	0	0	1.5
		Total Credits:				**23**

12		Honors/Minor courses	4	0	0	4

Course Code	POWER TRANSMISSION ENGINEERING	L	T	P	C
1002203100		3	1	0	3

COURSE OBJECTIVES:

1) To compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.
2) To study the short and medium length transmission lines, their models and performance.
3) To study the effect of travelling waves on transmission lines.
4) To study the factors affecting the performance of transmission lines and underground cables
5) To discuss sag and tension computation of transmission lines as well as to study the performance of overhead insulators.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.
CO2	Analyze the performance of short, medium and long transmission lines.
CO3	Summarize various factors related to charged transmission lines and underground cables.
CO4	Estimate sag/tension of transmission lines, performance of line insulators

UNIT- I

TRANSMISSION LINE PARAMETERS [10 Hours]

Conductor materials - Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for single phase and three phase– Single and double circuit lines– Concept of GMR and GMD– Symmetrical and asymmetrical conductor configuration with transposition –Bundled conductors-Numerical Problems–Calculation of capacitance for 2 wire and 3 wire systems Capacitance calculations for symmetrical single and three phase– Single and double circuit lines- Bundled conductors–Numerical Problems.

UNIT- II

PERFORMANCE OF TRANSMISSION LINES [10 Hours]

Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T–Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants– Interpretation of the Long Line Equations, regulation and efficiency–Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems).

UNIT- III

WAVES IN LONG TRANSMISSION LINES AND POWER SYSTEM TRANSIENTS

[10 Hours]

Long Transmission Lines– Incident, Reflected and Refracted Waves –Surge Impedance and SIL of Long Lines–Wave Length and Velocity of Propagation of Waves, Power Line Carrier Communication (PLCC).

Types of System Transients – Travelling or Propagation of Surges – Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line– Short Circuited Line – T-Junction– Lumped Reactive Junctions.

UNIT- IV

VARIOUS FACTORS GOVERNING THE PERFORMANCE OF TRANSMISSION LINE AND UNDERGROUND CABLES

[10 Hours]

Skin and Proximity effects – Description and effect on Resistance of Solid Conductors – Ferranti effect -Corona – Description of the phenomenon–Factors affecting corona–Critical voltages and power loss –

Underground Cables: Types of cables, capacitance of single-core cable, grading of cables, capacitance of 3-core belted cable, Location of faults in ac Cables.

UNIT- V

SAG AND TENSION CALCULATIONS AND OVERHEAD LINE INSULATORS

[10 Hours]

Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor–Numerical Problems –Types of Insulators – String efficiency and Methods for improvement– Numerical Problems – Voltage distribution–Calculation of string efficiency–Capacitance grading and Static Shielding

Text Books:

1. Electrical power systems – by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1998.
2. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2ndEdition

Reference Books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4thedition.
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.BhatnagarA.Chakrabarthy, DhanpatRai& Co Pvt. Ltd. Electrical Power Systems by P.S.R. Murthy.

Course Code	Electrical Measurements and Instrumentation	L	T	P	C
1002203101		3	0	0	3

COURSE OBJECTIVES:

1. To study the principle of operation and working of different types of instruments for Measurement of voltage and current Power, energy and various physical quantities.
2. To understand the principle of operation and working of dc potentiometers
3. To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
4. To study the applications of CRO for measurement of frequency, phase difference and hysteresis loop using Lissajous patterns, and also Study about the digital instruments in electrical measurements.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Choose right type of instrument for measurement of voltage and current for ac and dc and measurement of power, energy and various physical quantities.
CO2	Calibrate ammeter voltmeter and potentiometer
CO3	Select suitable bridge for measurement of electrical parameters
CO4	Measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements

UNIT- I

MEASURING INSTRUMENTS [13 Hours]

Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type– Expression for the deflecting torque and control torque – Errors and compensations– Extension of range using shunts and series resistance – CT**:** Ratio and phase angle errors –Basic Numerical problems

UNIT-II

MEASUREMENT OF POWER, ENERGY, POWER FACTOR, POTENTIOMETERS&MAGNETIC MEASUREMENTS

[12 Hours]

MEASUREMENT OF POWER

Single phase and three phase dynamometer wattmeter – LPF and UPF – Expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers.

MEASUREMENT OF ENERGY

Single phase induction type energy meter – Driving and braking torques – errors and compensations – Adjustable resistance, Shading bands, creeping – Phantom loading.

MEASUREMENT OF POWER FACTOR

Single phase and three phase dynamometer type power factor meter.

POTENTIOMETERS
Principle and operation of D.C Crompton's potentiometer –Standardization, Measurement of unknown resistance– Current – Voltage.

MAGNETIC MEASUREMENTS- Flux meter

UNIT-III

MEASUREMENTS OF ELECTRICAL PARAMETERS [16 Hours]

DC BRIDGES
Method of measuring low, medium and high resistance –Wheat stone's bridge – Kelvin's double bridge for measuring low resistance – Loss of charge method for measurement of high resistance – Megger

AC BRIDGES
Measurement of inductance– Maxwell's bridge – Hay's bridge – Anderson's bridge – Measurement of capacitance– Desauty Bridge – Schering Bridge – Wien's bridge.

UNIT-IV

TRANSDUCERS [8 Hours]

Definition of Transducers – Classification of Ttransducers – Principle operation of Light sensors-Photo Diode, Solar Cell, Temperature –Thermocouple, Position-LVDT,Force/Pressure-Strain Gauge, Speed-Tacho-generator

UNIT-V

DIGITAL METERS [8 Hours]

Digital Voltmeter– Ramptype, integrating type, Successive approximation type -Measurement of phase difference, Frequency using lissajious patterns in CRO– Digital frequency meter– Digital multimeter – Digital Tachometer - Digital Energy Meter

Text Books:

1. Electrical and Electronic Measurements and Instrumentation by A. K. Sawhney, Dhanpat Rai& Co. (Pvt.) Ltd. Delhi, 9th Revised edition-2011.
2. Electrical Machines by R.K.Rajput, Lakshmi publications,6th edition-2016.
3. Electrical Measurements and measuring Instruments – by E.W. Golding and F. C. Widdis, Wheeler Publishing. fifth Edition-2011

Reference Books:

7. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
8. Electrical Measurements – by Buckingham and Price, Prentice – Hall

9. Electrical Measurements by Forest K. Harris. John Wiley and Sons, Willy Eastern PVT. LTD.
10. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers-1989.
11. Electrical and Electronic Measurements –by G.K.Banerjee, PHI Learning Private Ltd, New Delhi–2012.

E-Books: (Specify links)

https://drive.google.com/file/d/1TrLAlAujF8t8wedDwTf6XtsJUlDuwaYP/view

https://drive.google.com/file/d/1Hsn7BK5ISxMwCCDelUyYKgLO40h6Y1XW/view

https://www.smartzworld.com/downloads/download/em-complete-pdf-notes/

file:///C:/Users/PUSHPALATHA/Downloads/Electrical-Measurements.pdf

file:///C:/Users/PUSHPALATHA/Downloads/A_K_Sawhney_A_course_in_Electrical_and_E.pdf

NPTEL/MOOC: (Specify Links)

https://nptel.ac.in/courses/108/105/108105153/

Course Code	POWER ELECTRONICS	L	T	P	C
1002203102		3	1	0	3

COURSE OBJECTIVES:

1. To study the characteristics of various power semiconductor devices and to design firing circuits for SCR.
2. To understand the operation of single phase full–wave converters and analyze harmonics in the input current.
3. To study the operation of 3-Ph. full–wave converters.
4. To understand the operation of different types of DC-DC converters.
5. To understand the operation of inverters and application of PWM techniques for voltage control and harmonic mitigation. To analyze the operation of AC-AC regulators

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the static and dynamic characteristics of various power semiconductor devices
CO2	Distinguish the operation of single phase and three phase rectifiers.
CO3	Analyze the operation of different types of DC-DC converters.
CO4	Distinguish the operation of AC-AC Converters

UNIT I

POWERSEMI-CONDUCTOR DEVICES: [8]

Thyristors–Silicon controlled rectifiers (SCR's) –Characteristics of power MOSFET, IGBT and TRIAC – Basic theory of operation of SCR–Static characteristics– Turn on and turn off methods–Dynamic characteristics of SCR–Gate firing circuits of SCR , Basic requirements of gating circuits for SCR, IGBT and MOSFET , Snubber circuit design– problems

UNIT-II

AC-DC 1-PHASE CONTROLLED CONVERTERS: [8]

Applications of AC to DC converters- 1-ph. half wave controlled rectifiers – R load and RL load with and without freewheeling diode – 1-ph. Bridge type full wave controlled rectifiers with- R, RL & RLE load– continuous and discontinuous conduction – 1-ph. Semi converter with RL load- Effect of source inductance in 1-Ph. fully controlled bridge rectifier with continuous conduction,.

UNIT-III:

AC-DC 3-PHASE CONVERTERS: [8]

3-Ph. half wave controlled rectifier with R and RL load - 3-Ph. Uncontrolled rectifier with RL load- 3-Ph. fully controlled rectifier with R, RL and 3-Ph. semi controlled rectifier with R and RL load.

AC – AC REGULATORS:

Application of AC-AC converters, Modes of operation – 1-Ph. Phase angle control of AC-AC regulator with R and RL load – For continuous and discontinuous conduction

UNIT-IV

SWITCHED MODE DC–DC CONVERTERS: [8]

Applications of Switched mode DC-DC converters, Volt-Sec & Current-Sec balance Equations, Analysis of Buck, boost and buck-boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) – Output voltage equations using volt-sec balance in CCM & DCM, output voltage ripple & inductor current, ripple for CCM only

UNIT–V

DC–AC CONVERTERS: **[8]**

Application of DC-AC Converters- 1- Ph. half bridge and full bridge inverters with R and RL loads, Single phase uni-polar and bipolar switching. – 3-phase square wave inverters – 120^0 conduction and 180^0 conduction modes of operation –Quasi-square wave pulse width modulation – Sinusoidal pulse width modulation.

Text Books:

1. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics: Essentials & Applications by L. Umanand, Wiley, Pvt. Limited, India.

Reference Books:

1. Elements of Power Electronics–Philip T.Krein.oxford.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.

NPTEL/MOOC: https://nptel.ac.in/courses/108/102/108102145/

.

Course Code	Professional Elective-I **Digital control systems**	L	T	P	C
1002203130		3	0	0	3

Course Overview:

In recent years digital controllers have become popular due to their capability of accurately performing complex computations at high speeds and versatility in leading non-linear control systems. In this context, this course focuses on the analysis and design of digital control systems.

Course Objectives:

- To understand the concepts of digital control systems and assemble various components associated with it. Advantages compared to the analog type.
- The theory of z–transformations and application for the mathematical analysis of digital control systems.
- To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
- To examine the stability of the system using different tests.
- To study the conventional method of analyzing digital control systems in the w–plane.
- To study the design of state feedback control by "the pole placement method."

Course Outcomes:

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

	Course outcome
CO1	Modelling of Digital control Systems in frequency domain and time domain.
CO2	Understand z–transformations and their role in the mathematical analysis of different systems
CO3	Analyse stability criterion for digital systems
CO4	Design of state feedback controller for Linear Discrete systems.

Unit-I:

Digital signal processing

Introduction to analog and digital control systems – Advantages of digital systems – examples – Signals and processing – Sample and hold devices – Sampling theorem- Frequency domain characteristics of zero order hold.

Unit-II:

Z–transformations Z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

Unit-III:
Mapping and Stability analysis
Mapping between the S–Plane and the Z–Plane – Primary strips and Complementary Strips – Stability criterion – Modified routh's stability criterion and jury's stability test. Root locus technique in the z–plane.

Unit-IV:
State space analysis
State Space Representation of discrete time systems – State transition matrix Discretization of continuous – Time state equations –Concepts of controllability and observability.

UNIT–V
Design of discrete–time control systems and state feedback controllers
Transient and steady state specifications – Design using frequency response in the w–plane for lag and led compensators (no numerical). Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

Text Books:

- Discrete–Time Control systems – K. Ogata, Pearson Education/PHI, 2nd Edition.
- 2. Digital Control and State Variable Methods by M.Gopal, TMH, 4th Edition.

Reference Books:

- Digital Control Systems, Kuo, Oxford University Press, 2nd Edition, 2003.

NPTEL/MOOC:

- https://nptel.ac.in/courses/108/106/108106075/
- https://nptel.ac.in/courses/108/103/108103008/

Course Code	Professional Elective-I Energy audit conservation and management	L	T	P	C
1002203131		3	0	0	3

COURSE OBJECTIVES:

To introduce basic principles of energy auditing and to know about energy management. Also it provides immense knowledge about energy efficient motors, power factor improvement, lighting and energy instruments. Finally economic aspects are analyzed.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand energy efficiency, scope, conservation new technologies and energy conservation in HVAC systems.
CO2	Design and analyse energy efficient lighting systems and minimize the operation cost.
CO3	Estimate/calculate power factor of systems and propose suitable compensation techniques.
CO4	Calculate life cycle costing analysis and return on investment on energy efficient technologies.

UNIT- I

BASIC PRINCIPLES OF ENERGY AUDIT [7 hours]

Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Piecharts –Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems.

UNIT-II

PRINCIPLES OF ENERGY MANAGEMENT [7 hours]

Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions of energy manager – Language – Questionnaire – Check list for top management.

UNIT-III

POWER FACTOR IMPROVEMENT AND ENERGY EFFICIENT MOTORS. [9 hours]

Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Basic Numerical problems.

Energy efficient motors , factors affecting efficiency, loss distribution, characteristics – variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT-IV

SPACE HEATING, VENTILATION AND ENERGY INSTRUMENTS [8 hours]

Introduction – Heating of buildings – Transfer of Heat–Space heating methods Ventilation and air–conditioning –Insulation–Cooling load – Electric water heating systems Energy Instruments – Data loggers –Pyrometers– Tong testers – Power analyzer.

UNIT-V

ECONOMIC ASPECTS, ANALYSIS & COMPUTATION [8 hours]

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method , replacement analysis, life cycle costing analysis. Need of investment, Calculation of simple payback period–Return on investment – Net present value – Internal rate of return – numerical examples

Text Books:

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995

Reference Books:

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

2. Energy management hand book by W. C. Turner. John wiley and sons

E-Books: (Specify links)

NPTEL/MOOC: (Specify Links)

Course Code	Professional Elective-I **Special Electrical Machines**	L	T	P	C
1002203132		3	0	0	3

COURSE OBJECTIVES:

- To describe the operation and characteristics of permanent magnet dc motor.
- To explain the performance and control of stepper motors, and their applications.
- To explain theory of operation and control of switched reluctance motor.
- To explain about different types of brush less dc motors**.**
- To explain the theory of travelling magnetic field and applications of linear motors.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the performance and principle of operation of stepper motor, Switch d reluctance motor, PMDC, PM Materials and BLDC motors.
CO2	Implement different control and switching circuits for stepper motor ,SRM, BLDC motors
CO3	Designing the constructional features of Switched reluctance motor
CO4	Illustrating the theory of travelling magnetic field and applications of linear motors in electric traction

UNIT- I

STEPPER MOTORS: [8 hours]

Construction and principle of operation of Variable Reluctance Motor (VRM) – Single stack and multiple stack – Open loop control of 3- phase VR Stepper Motor;

Construction and principle of hybrid stepper motor – Different configuration for switching the phase windings control circuits for stepper motors; Closed loop control of stepper motor; Applications

UNIT-II

SWITCHED RELUCTANCE MOTORS: [8 hours]

Construction; Principle of operation; Design of stator and rotor pole arcs; Torque producing principle and torque expression; Modes of operation of SRM; Different converter configurations for SRM; Position sensing of rotor with hall probes; Applications of SRM.

UNIT-III

PERMANENT MAGNET MATERIALS AND PMDC MOTORS: [9 hours]

Permanent-magnet materials and characteristics; Minor hysteresis loops and recoil line; Temperature effects: reversible and irreversible losses-high temperature effects-reversible losses-Irreversible losses recoverable by magnetization; Equivalent circuit of a PM; Construction and working of PMDC motor-Stator frames of conventional PM dc motors;

Development of electronically commutated dc motor from conventional dc motor**.** Differences between electronic commutation and mechanical commutation**.**

UNIT-IV

BLDC MOTORS: [8 hours]

Types of construction; Principle of operation of BLDC motor; Sensing and switching logic scheme: Sensing, Logic controller, Lockout pulses; Drive and power circuits: Base drive circuit, Power converter circuit; Methods of reducing torque pulsations: 1800 pole arc and 1200 current sheet.

UNIT-V

LINEAR INDUCTION MOTORS (LIM): [8 hours]

Construction of LIM- Axial field motors and transverse flux LIM; Double sided LIM from rotating type Induction Motor –Schematic of LIM drive for traction – Development of one-sided LIM with back iron; Equivalent circuit of LIM.

Text Books:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special electrical Machines, K.VenkataRatnam, University press, 2009, New Delhi

Reference Books:

1. Special Electrical Machines, E.G.Janardhan

Course Code	Professional Elective-I **Optimization Techniques**	L	T	P	C
1002203133		3	0	0	3

COURSE OBJECTIVES:

- To define an objective function and constraint functions in terms of design variables, and then state the optimization problem.
- To state single variable and multi variable optimization problems, without and with constraints.
- To explain linear programming technique to an optimization problem, define slack and surplus variables, by using Simplex method

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
CO2	Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
CO3	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
CO4	Apply gradient and non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.

UNIT-I [10 Hours]

INTRODUCTION TO LINEAR PROGRAMMING:

Introduction-objective function and constraints.Examples from real world. Standard form of linear programming problem. Geometricalsolution, System of linear equations. Simplex method, two phases of simplex method.

UNIT-II [8 Hours]

LINEAR PROGRAMMING:

Dual simplex method, Transportation problem, Assignment problem,examples.

Nonlinear programming: Unconstrained optimization-direct methods: Powell's Method,conjugate direction, Indirect search methods: steepest descent, Newton's methods.

UNIT-III [8 Hours]

CONSTRAINED OPTIMIZATION:

Sequential linear programming, Methods of feasible directions, gradient projection method, penalty function method, Augmented Legrangian multipliers method. Kuhn-Tucker conditions.

UNIT-IV

DYNAMIC PROGRAMMING: [8 Hours]

Multistage decision processes, Principal of optimality, computational procedure, linear programming as a case of dynamic program. All integer and mixed integer programming, Branch and Bound method.

UNIT-V [9 Hours]

INTRODUCTION TO SWARM INTELLIGENCE SYSTEMS:

Swarm intelligence programming methods - Basic Particle Swarm Optimization (PSO) – Method – Characteristic features of PSO procedure of the global version – Parameters of PSO (Simple PSO algorithm – Operators selection criteria – Fitness function constraints) – Comparison with other evolutionary techniques – Engineering applications of PSO.

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, New Age International (P) Limited, 3rd edition, 1998.
2. Ashok D. Bellegundu and T.R. Chandru Patla, "Optimization Concepts and Application in Engineering" Pearson Edition Asia, 2002.
3. Soft Computing with Matlab Programming by N. P. Padhy & S. P. Simson, Oxford University Press – 2015.

Reference Books:

1. **"**Optimization methods in operations Research and Systems Analysis" by K.V.MitalandC.Mohan, New Age International (P) Limited, Publishers, 3rd edition, 1996.
2. Genetic Algorithms in search, optimization, and Machine Learning by David E.Goldberg,ISBN:978-81-7758-829-3, Pearsonby Dorling Kindersley (India) Pvt. Ltd.
3. "Operations Research: An Introduction" by H.A.Taha, PHI pvt. Ltd., 6th edition.
4. Linear Programming by G.Hadley.

NPTEL/MOOC: https://nptel.ac.in/courses/111/104/111104071/

Course Code	Open Elective-I	L	T	P	C
1005202200	**Database Management Systems**	3	0	0	3

COURSE OBJECTIVES:

1. Provide students with theoretical knowledge and practical skills in the use of database and database management systems in information technology applications.
2. The logical design, physical design and implementation of relational databases are covered.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Describe ER model and normalization for database design.
CO2	Create, maintain and manipulate a relational database using SQL.
CO3	Design and build database system for a given real world problem.
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions.

UNIT- I

Introduction to Database Systems, File System Vs DBMS, Advantages of DBMS, Structure of DBMS, Levels of Data Abstraction (Data Independence), Database Users and Administrators, Different Data Models.

E-R Model: Overview of Database Design, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model **[8 Hours]**

UNIT-II

Introduction to the Relational Model, Relational model constraints over relations. Relational Algebra and calculus **[8 Hours]**

UNIT-III

SQL Queries: The Form of Basic SQL Query, Union, Intersect and Except-Nested Queries-Aggregative Operators- Group By and Having Clauses-Null Values-Outer Joins.

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), De-normalization.

[**8 Hours]**

UNIT-IV

Overview of Storage and Indexing: Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing. **[8 Hours]**

UNIT-V

Query processing, Transaction Management, Concurrency Control and Crash recovery Transactions: Acid Properties of Transaction - Transaction States - Schedule: Serial Schedule Concurrent Schedules - Anomalies Associated with Concurrent Schedules (RW WR - and WW Conflicts) -Serializability – Conflict Serializability - and View Serializability. Introduction to Lock Management-Lock Based Concurrency Control: 2pl-Strict 2pl Concurrency without Locking, Timestamp–Based Concurrency Control – Optimistic Concurrency Control. Introduction to ARIES - The Log - The Write-Ahead Log
Protocol Check Pointing. **[8 Hours]**

Text Books:

1. Database System Concepts. 6/e Silberschatz, Korth, TMH
2. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA
2. The Database book principles & practice using Oracle/MySql Narain Gehani, University Press.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Course Code	Open Elective-I	L	T	P	C
1004203143	**Micro Electro-Mechanical Systems**	3	0	0	3

Course Objectives:

This course provides the knowledge on Importance of Miniaturization and its applications in various domains, Scalable rules in the process of miniaturization for different fields of applications, various MEMS design methodologies, modelling of MEMS devices that combine multiple disciplines of Engineering, Consideration of MEMS design challenges on the device level, system level and packaging level.

Course Outcomes:

	Course outcome
CO1	**Interpret** the role of miniaturization in microelectronic devices and scaling rules of MEMS**.**
CO2	**Articulate** the techniques for building the microelectronic devices on various types materials.
CO3	**Deduce** the Microsystems technology for technical feasibility.
CO4	**Design** MEMS based micro systems and micro devices,

Unit-I:

Overview of MEMS

MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

Unit-II:

Scaling Laws in Miniaturization Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces. MEMS Design Considerations.

Unit-III:

Micro Fabrication–I: Introduction, Photolithography, Photo resists and Application, Light Sources, Photo resist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD),
Sputtering, Deposition by Epitaxy, Etching.

Unit-IV: Micro Fabrication – II

Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison Surface
Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.

Unit-V:

MEMS Devices and Structures: Micro sensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.

Micro actuation: Actuation using thermal forces, Piezoelectric crystals, Electrostatic forces, MEMS with micro actuators: Micro grippers, Micro motors, Micro gears, Micro pumps.

Text Books:

1. "MEMS & Microsystems Design and Manufacture", Tai-Ran Hsu, Tata McGraw Hill.
2. "Microsystem Design", Stephen D Senturia, Springer Publication, 2000.

Reference Books:

1. "Fundamentals of Micro Fabrication.", Marc Madou, 3rdEdition, CRC Press
2. "Foundations of MEMS", Chang Liu, Pearson Education Inc., 2012
3. "The MEMS Handbook", Mohamed Gad-el-Hak, CRC Press

Course Code	Open Elective-I	L	T	P	C
1003204134	**Green Engineering Systems**	3	0	0	3

COURSE OBJECTIVES:

The course aims to highlight the significance of alternative sources of energy, green energy systems and processes and provides the theory and working principles of probable sources of renewable and green energy systems that are environmentally friendly.

COURSE OUTCOME:

COs	Course Outcome
CO1	understanding various types of solar thermal collectors
CO2	Describe the working of a photovoltaic system and wind energy conversion system
CO3	Analyze the operation of fuel cells and biomass conversion technologies
CO4	Elaborate on ocean, geothermal, electrical and Mechanical systems

UNIT-I

INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics0

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT –IV

ENERGY EFFICIENT SYSTEMS:
ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps**.**

UNIT-V

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013

References:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering / D.YogiGoswami, Frank Krieth& John F Kreider / Taylor & Francis
3. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Non conventional Energy Source/ G.D Roy/Standard Publishers
6. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
7. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

Course Code	Professional Elective-I Industrial Waste and Waste Water Management	L	T	P	C
1001202140		3	0	0	3

COURSE OBJECTIVES:

This course will give the student knowledge about Industrial waste water along with managing and treatment methods required for these waste water.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation
CO2	Impart knowledge on selection of treatment methods for industrial wastewater.
CO3	Describe the common methods of treatment in different industries
CO4	Explain operational problems of common effluent treatment plant

UNIT- I

INDUSTRIAL WATER QUALITY ANALYSIS [8 Hours]

Wastewater Quality characterization - Physical, Chemical and Biological; unit operations and processes used in water and waste water treatment.

UNIT- II

MISCELLANEOUS TREATMENT [10 Hours]

Introduction to Advanced water treatments - Adsorption - Ion Exchange - Reverse Osmosis - Electro dialysis - Micro, Ultra & Nano filtration - Chemical oxidation process.

UNIT- III

BASIC THEORIES AND INDUSTRIAL WASTEWATER MANAGEMENT [10 Hours]

Measurement of industrial wastewater flow - Industrial wastewater sampling and preservation of samples for analysis - Toxicity of industrial effluents due to Heavy metals - Volume and Strength reduction -Neutralization - Equalization, Stabilization and proportioning.

UNIT- IV

INDUSTRIAL WASTEWATER DISPOSAL MANAGEMENT [12 Hours]

Discharges into Streams, Lakes and oceans and associated problems - Land treatment - Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges.

UNIT- V

PROCESS AND TREATMENT OF SPECIFIC INDUSTRIES [12 Hours]

Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Paper and Pulp industries, Tanneries, Sugar Mills, Distillers, Dairy and food processing industries, Fertilizers, Textiles, Steel plants, Pharmaceutical Plants.

Text Books:

1. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
2. Industrial Wastewater Treatment by KVSG Murali Krishna.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi
4. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition

Reference Books:

2. Wastewater Engineering by Metcalf and Eddy Inc., Tata McGrawhill Co., New Delhi
3. H. S Peavy, D. R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill International Ed., 1985.
4. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
5. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rd Edition.

Course Code	INTRODUCTION TO PYTHON LAB	L	T	P	C
1005203111		0	0	3	1.5

COURSE OBJECTIVES:

- To learn about Python programming language syntax, semantics, and the runtime environment.
- To be familiarized with universal computer programming concepts like data types, containers.
- To be familiarized with general computer programming concepts like conditional execution, loops & functions.
- To be familiarized with general coding techniques and object-oriented programming.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Demonstrate the usage of Python syntax and semantics in solving the problems
CO2	Develop python programs using functions and built-in modules
CO3	Implement Python data structures to solve the complex problems
CO4	Apply object-oriented concepts to design solution to real world scenarios

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1.	Exercise – 1 a) Running instructions in Interactive interpreter and a Python Script b) Write a program to purposefully raise Indentation Error and Correct it	Python Basics
2.	Exercise – 2 Develop Python programs using basic operations in Python	Operations
3.	Exercise – 3 Develop Python programs that makes use of conditional and control flow structures	Flow Control
4.	Exercises –4 Develop Python programs using recursive and non-recursive functions	Functions
5.	Exercise -5 Develop Python programs using suitable Data structures	Data Structures
6.	Exercise -6 Illustrate installing packages via PIP and develop python programs using modules	Modules
7.	Exercise -7 Application oriented Case Studies	Implementation Knowledge
8.	Exercise -8	OOPS Concepts

	Illustrate Class variables and instance variable Develop Python programs to exemplify the concepts of inheritance and overloading.	
9.	Exercise -9 Write a simple exception handling program with try- except Write a program for catching multiple exceptions	Exception Handling
10.	Exercise -10 Demonstrate raising and re raising exceptions. Apply else and finally clauses	Exception Handling

Text Books:

1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017.
2. Charles Severance, " Python for Informatics- Exploring Information", 1stedition Shroff Publishers, 2017.

Reference Books:

1. Mark Lutz,"Learning Python", 5th edition, Orielly, 2013.
2. Allen Downey "Think Python, How to Think Like a Computer Scientist",2nd edition, Green Tea Press, 2015.
3. W.Chun , "Core Python Programming", 2nd Edition, Prentice Hall, 2006.
4. Kenneth A. Lambert, "Introduction to Python", 1st edition, CengageLearning, 2011.

Course Code	Electrical Measurements and Instrumentation Lab	L	T	P	C
1002203110		0	0	3	1.5

COURSE OBJECTIVES:

- To understand the correct function of electrical parameters and calibration of voltage, current, single phase and three phase power and measurement of electrical characteristics of resistance, inductance and capacitance of a circuits through appropriate methods.
- To understand testing of transformer oil.
- To understand the measurements of displacement and strain

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Measure the electrical parameters voltage, current, power, displacement, Strain
CO2	Calibrate the Voltmeter, Ammeter and Wattmeter, Energy Meter.
CO3	Determine electrical characteristics of resistance, inductance and capacitance.
CO4	Test transformer oil for its effectiveness

Any 10 of the following experiments are to be conducted.

LIST OF EXPERIMENTS

S.No.	Name of the experiment
1	Calibration and Testing of single phase energy Meter
2	Calibration of LPF wattmeter using phantom loading
3	Calibration of dynamometer wattmeter by direct loading.
4	Calibration of PMMC ammeter and voltmeter using Crompton D.C. Potentiometer
5	Measurement of 3 phase power with single watt meter and using two C.Ts.
6	Measurement of Power by 3 Voltmeter and 3 Ammeter method
7	Measurement of Resistance using Kelvin's double Bridge.
8	Measurement of Capacitance using Schering bridge
9	Measurement of Inductance using Anderson bridge.
10	Measurement of displacement using LVDT
11	Measurement of Strain using Strain Gauge
12	Dielectric oil testing using H.T test Kit

Text Books:

1. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney,Dhanpat Rai & Co. (Pvt.) Ltd. Delhi, 9th Revised edition-2011.

Reference Books:

Electrical Machines by R.K.Rajput, Lakshmi publications,6th edition-2016.

Course Code	Power Electronics Lab	L	T	P	C
1002203111		0	0	3	1.5

Course objectives:

- To study the characteristics of various power electronic devices and analyze firing circuits and commutation circuits of SCR.
- To analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
- To understand the operation of AC voltage regulator with resistive and inductive loads.
- To understand the working of Buck converter, Boost converter and inverters.

Course Outcomes:

After completing this Course, the student should be able to:

COs	Course Outcomes
CO1	Explain about characteristics of various power semiconductor devices and firing circuits.
CO2	Analyze the performance of single–phase and three–phase full–wave bridge converters with both resistive and inductive loads.
CO3	Illustrate the working of Buck converter, Boost converter, single–phase square wave inverter and PWM inverter.
CO4	Describe the operation of single phase AC voltage regulator with resistive loads.

Any 10 of the Following Experiments are to be conducted

1. Study of Characteristics of Thyristor, MOSFET & IGBT.
2. Design and development of a firing circuit for Thyristor.
3. Design and development of gate drive circuits for IGBT.
4. Single -Phase Half controlled converter with R and RL load
5. Single -Phase fully controlled bridge converter with R and RL loads
6. Single -Phase AC Voltage Regulator with R and RL Loads
7. Single -Phase square wave bridge inverter with R and RL Loads
8. Three- Phase fully controlled converter with RL–load.
9. Design and verification of voltages gain of Boost converter in Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode (DCM).
10. Design and verification of voltages ripple in buck converter in CCM and DCM operation.
11. Single -phase PWM inverter with sine triangle PWM technique.

Course Code	INTRODUCTION TO PYTHON	L	T	P	C
1005203180		1	0	2	2

COURSE OBJECTIVES:

- To learn about Python programming language syntax, semantics, and the runtime environment.
- To be familiarized with universal computer programming concepts like data types, containers.
- To be familiarized with general computer programming concepts like conditional execution, loops & functions.
- To be familiarized with general coding techniques and object-oriented programming

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Interpret the python syntax and semantics of control flow statements
CO2	Apply functions and modules in Python to solve a problem
CO3	Apply 3rd party packages for developing solutions for real time problems.
CO4	Implement the problems in terms of real-world objects using OOPs concept.

Brief Introduction about the Course:

Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. This course covers data types, control flow, functions, lists, dictionaries, tuples and object-oriented programming.

Detailed Syllabus:

S.No.	Theory	Practical	Skill
1.	**Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.	1. Installing Python IDE and running "Hello World" Program.	Installation of Python
2.	**Types, Operators and Expressions:** Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.	1. Write a program to get the binary form of a given number in Pycharm.	Operators and Expressions
3.	**FUNCTIONS** Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Modules- Creating modules, import statement, from. Import statement, name spacing, Python Packages-Introduction to PIP, Installing Packages via PIP, Using Python Packages.	1. Why functions are called First Class Objects in Python? Justify with a program.	Functions
4.	**Lists**: Syntactically, accessing element from list, slicing a list, lists are mutable sequences, deleting items in a list and deleting list, methods, searching **Dictionaries**: Creating a dictionary, Dictionary operations, Dictionary methods, Aliasing and copying **Tuples**: Tuples are immutable, comparing tuples, Tuple assignment, Dictionaries and tuples, multiple assignment with dictionaries, using tuples as keys in dictionaries	1. Write a Python program to insert a new element into a Tuple of elements at a specified position.	Lists, Dictionaries, Tuples

	Strings: A string is a sequence, Getting the length of a string using Len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, string methods **Sets**: Modifying a Set, removing items from set, set operations.		Strings, Sets
5.	**Object Oriented Programming in Python:** Python Classes, Methods, Constructors, Class variables &Instance Variables, Basic inheritance, Special methods, Data Hiding, Error and Exceptions: Difference between an Error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.	1. Create a bank class where deposits and withdrawals can be handled by using instance methods.	Object Oriented Programming in Python

Text Books:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson

Reference Books:

1. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
2. Programming and Problem Solving with Python, Ashok NamdevKamthane, Amit Ashok Kamthane, TMH, 2019.
3. Core Python Programming - Covers Fundamentals to Advanced Topics Like OOPS, Exceptions, Data Structures, Files, Threads, Networking, GUI, DB Connectivity and Data Science Second Edition (English, Paperback, Rao R. Nageswara)

E-Books: https://www.python.org/doc/

NPTEL/MOOC:

1. Charles Severance: University of Michigan, Python for Everybody [COURSERA]. (05-01-2021), Available: https://www.coursera.org/
2. Prof. SudarshanIyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, The Joy Of Computing Using Python [NPTEL], (05-01-2021), Available:https://nptel.ac.in/courses/106/106/106106182/#
3. Charles Russell Sevarance, University of Michigan, Python for Everybody, 2019 https://www.coursera.org/learn/python

Course Code	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
1099203120		2	0	0	0

COURSE DESCRIPTION:

This course provides business and non-business majors with the skills necessary to succeed as an entrepreneur. The fundamentals of starting and operating a business, and its types, and developing a business plan, obtaining financing from banks and financial institutions, marketing a product or service and developing an effective business model, basic knowledge on institutions like MSME's others, which provide financial and EDP's will be covered.

COURSE OBJECTIVES:

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

1. To understand the meaning, role and qualities of an entrepreneur.
2. To give an overview on the concept of Entrepreneurship
3. To know basic idea or knowledge about business plan and MSME's.
4. To understand the basic knowledge about Capital structure, Sources of finance.
5. To understand the concept of Creativity and Entrepreneurial Plan.

COURSE OUTCOMES:

Acquaint the students with

CO's	At the end of the course, the student will have the ability to:
CO 1	Understand the outline of Entrepreneurship development
CO 2	To understand the factors, remedies for sickness of industry
CO 3	To understand capital and financial sources, Govt. polices.
CO 4	To know how to select, generate idea, feasibility study and control of project.

UNIT I:

Introduction to Entrepreneur: Definition, requirements to be an entrepreneur, characteristic of successful entrepreneurs, Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Entrepreneur and Manager, Growth of entrepreneurship in India. Factors Affecting Entrepreneurial Growth. The role of entrepreneurship in economic development;

UNIT II:

Introduction to entrepreneurship: entrepreneurship process; Classification of entrepreneurship, Entrepreneurial motivation and barriers; Factors impacting emergence of entrepreneurship; Types of Entrepreneurships, Sick industries, Reasons for Sickness, Remedies for Sickness.Role of BIFR in revival, Bank Syndications.

Unit III:

Introduction to Business, Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Types of Business Organization, Micro, Small and Medium scale

enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation.

Unit IV:

Capital structure, Sources of finance: debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs, Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

Unit V:

Creativity and Entrepreneurial Plan: Business Idea Generation – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study: market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors.

Relevant cases have to be discussed in each unit and in examination case is compulsory from any unit.

Text Books:

- VSP Rao, Kuratko: "Entrepreneurship', Cengage Learning, NewDelhi,
- K.Ramachandran: "Entrepreneurship Development", TMH, NewDelhi, 2012
- B.Janakiram, M Rizwana: "Entrepreneurship Development" ExcelBooks, New Delhi, 2011
- Rajeev Roy: "Entrepreneurship", Oxford University Press, NewDelhi,2012
- Manjunatha, Amit Kumar Goudar: "Management andEntrepreneurship" University Science Press, New Delhi, 2011
  Eric A Morse, Ronald K Mitchell: "Cases in Entrepreneurship", SAGE Publication, New Delhi, 2011.

References:

1. Couger, C-Creativity and Innovation (IPP, 1999)
2. Nina Jacob, -Creativity in Organisations (Wheeler, 1998)
3. Jonne&Ceserani-Innovation &Creativity(Crest) 2001.
4. BridgeSetal-Understanding Enterprise: Entrepreneurship and Small Business (Palgrave,2003)
5. Holt-Entrepreneurship: New Venture Creation (Prentice-Hall) 1998.
6. Singh P&Bhanderkar A-Winning the Corporate Olympiad:TheRenaissan cearadigm(Vikas)
7. Dollinger M J-Entrepreneurship (Prentice-Hall, 1999).
8. Tushman, M.L. & Lawrence, P.R. (1997)-Managing Strategic Innovation & Change Oxford .
9. Jones T. (2003)-Innovating at the Edge: How Organizations Evolve and Embed Innovation Capability.Butterwork Heinemann, U. K.
10. Amidon, D. M.(1997)-Innovation Strategy for the Knowledge Economy:The Kanawakening.Butterwork-Heinemann, New Delhi, India.

E-Books and Online Resources

1. https://www.dynamictutorialsandservices.org/2018/10/entrepreneurship-development-notes.html
2. https://www.google.com/search?client=avast-a-1&q=entrepreneurship+development+notes&oq=entrepreneurship+development+notes&aqs=avast..69i64j69i59i450l8.12j0j7&ie=UTF-8

NPTEL/SWAYAMMOOCS:

1. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
2. https://onlinecourses.nptel.ac.in/noc21_hs102/preview

Course Code	SUMMER INTERNSHIP	L	T	P	C
1002203160		0	0	0	1.5

III YEAR II SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

III Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002203200	Power Electronics Controllers and Drives	3	1	0	3
2	1002203201	Power System Analysis	3	1	0	3
3	1004203101	Micro Processor and Micro Controller	3	0	0	3
4	**Open Elective-II**		3	0	0	3
	1005202101	Operating Systems				
	1012203240	Data Mining				
	1019204131	Introduction to Embedded Systems				
	1001202240	Environmental Pollution and Control (EP&C)				
5	1002203210	Electrical Simulation Lab	0	0	3	1.5
6	1002203211	Power Systems and Simulation Lab	0	0	3	1.5
7	1004203111	Micro Processor and Micro Controller Lab	0	0	3	1.5
8	1054202180	Competitive Programming	1	0	2	2
9	1099203200	Management Science	3	0	0	3
10	1099203220	Universal Human Values and Professional Ethics	2	0	0	0
		Total Credits				**21.5**

Industrial/Research Internship

11		Honors/Minor courses	4	0	0	4

Course Code	Power Electronics Controllers and Drives	L	T	P	C
1002203200		3	1	0	3

COURSE OBJECTIVES:

1. To learn the fundamentals of electric drive and different electric braking methods.
2. To analyze the operation of 3-Ø converter controlled dc motors and four quadrant operation of dc motors using dual converters.
3. To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
4. To learn the principles of static rotor resistance control and various slip power recovery schemes.
5. To understand the speed control mechanism of synchronous motors.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the fundamentals of electric drive and different electric braking methods
CO2	Analyze the speed control DC motors through controlled converters (3-Ø) and choppers.
CO3	Differentiate the stator side control and rotor side control of three phase induction motor using power converters.
CO4	Describe Separate control and self- control of the synchronous motor

UNIT- I

FUNDAMENTALS OF ELECTRIC DRIVES [8 Hours]

Block diagram of Electric drive & Advantages – Fundamental torque equation – Load torque components – Nature and classification of load torques– Steady state stability – Four quadrant operation of drive (hoist control) – Braking methods for DC shunt & series motor**:** Dynamic – Plugging – Regenerative method

UNIT-II

CONTROLLED CONVERTER FED DC MOTOR DRIVES [17 Hours]

3-phase half and fully controlled converter fed separately excited and series DC motor drive – Output voltage waveforms – Speed-torque expressions – Speed-torque characteristics — Principle of operation of dual converters and dual converter fed DC motor drives - Numerical problems.

DC–DC CONVERTERS FED DC MOTOR DRIVES

Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited & DC series motors – Continuous current operation– Output voltage and current waveforms –

Speed–torque characteristics –Four quadrant operation – Closed loop operation (qualitative treatment only)

UNIT-III

STATOR SIDE CONTROL OF 3-PHASE INDUCTION MOTOR DRIVE [8 Hours]

Introduction to speed control of Induction motor - Introduction to soft starters & applications - Stator voltage control using 3-phase AC voltage regulators – Waveforms –Speed torque characteristics – Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop v/f control of induction motor drives (qualitative treatment only).

UNIT-IV

ROTOR SIDE CONTROL OF 3-PHASE INDUCTION MOTOR DRIVE [6 Hours]

Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics – Advantages –Application

UNIT-V

CONTROL OF SYNCHRONOUS MOTOR DRIVES [6 Hours]

Separate control & self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI – Closed Loop control operation of synchronous motor drives (qualitative treatment only).

Text Books:

3. Fundamentals of Electric Drives – by G K Dubey, Narosa Publications
4. Power Semiconductor Drives, by S.B.Dewan, G.R.Slemon, A.Straughen, Wiley- India Edition.

Reference Books:

1. Electric Motors and Drives Fundamentals, Types and Applications, by Austin Hughes and Bill Drury, Newnes.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications.
3. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI
4. Power Electronics handbook by Muhammad H.Rashid, Elsevier.

E-Books:

https://drive.google.com/file/d/1FgmnUVz3Yp9Zt59PD-q5H6zNl3AwWbZ1/view

https://ee.eng.usm.my/eeacad/syafrudin/nota/LeLecture%202-Basic%20Components%20Of%20An%20Electric%20Drives%20System.pdf

http://sdeuoc.ac.in/sites/default/files/sde_videos/Electrical%20Drives%20and%20Controls_0.pdf

NPTEL/MOOC: (Specify Links)

https://nptel.ac.in/courses/108/102/108102046/

https://nptel.ac.in/courses/108/104/108104140/

https://nptel.ac.in/courses/108/105/108105066/

Course Code	Power System Analysis	L	T	P	C
1002203201		3	1	0	3

COURSE OBJECTIVES:

1. To development the impedance diagram (p.u) and formation of Ybus & Zbus.
2. To study the different load flow methods.
3. To study short circuit calculation for symmetrical & unsymmetrical faults and their effects.
4. To study the rotor angle stability of power systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Compute the per unit values of system and formulate Ybus & Zbus for a given power system network
CO2	Calculate the load flows in a power system using various numerical methods.
CO3	Compute symmetrical and asymmetrical fault calculations for a given power system network
CO4	Analyze the steady state and transient stabilities of power system.

UNIT- I

PER UNIT REPRESENTATION & Y–BUS FORMULATION [08 Hours]

Per Unit Representation

Per Unit Quantities, Single line diagram, Impedance diagram of a power system.

Y–Bus formulation

Formation of Y–bus matrix by direct inspection methods.

UNIT- II

POWER FLOW STUDIES [12 Hours]

Necessity of power flow studies, Derivation of static power flow equations, Power flow solution using Gauss-Seidel Method - Problems on 3–bus system only, Newton Raphson Method (polar coordinates form only)- Problems on 3–bus system only, Decoupled and Fast Decoupled methods – Algorithmic approach only, Comparison of Power Flow Studies.

UNIT- III

Z–BUS FORMULATION & SYMMETRICAL FAULT ANALYSIS [10 Hours]

Z–Bus formulation:

Algorithm for modification of ZBus matrix for addition of element in the following cases: new bus to reference, new bus to old bus, old bus to reference and between two old busses, *Modification of ZBus (without mutual impedances)*

Symmetrical Fault Analysis:

Transients on a Transmission line, Short circuit of synchronous machine (on no-load)
3–Phase short circuit currents and reactance's of synchronous machine
Short circuit MVA calculations

UNIT- IV

UNSYMMETRICAL FAULT ANALYSIS [10 Hours]

Definition of symmetrical components, symmetrical components of unbalanced three phase Systems, Power in symmetrical components, Sequence impedances – Synchronous generator – Transmission line and transformers, Sequence networks, Various types of faults LG– LL– LLG and LLL on unloaded alternator, unsymmetrical faults on power system

UNIT- V

POWER SYSTEM STABILITY ANALYSIS [10 Hours]

Elementary concepts of Steady state, Dynamic and Transient Stabilities,
Description of Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability,
Derivation of Swing Equation, Determination of Transient Stability by Equal Area Criterion, Applications of Equal Area Criterion, Methods to improve steady state and transient stability

Text Books:

1. I.J. Nagrath and D.P. Kothari, '*Modern Power System Analysis*', Tata McGraw-Hill Publishing Company, New Delhi, 1990.
2. Jhon J. Grainger and W.D. Stevenson Jr., '*Power System Analysis*', McGraw Hill International Book Company, 1994

Reference Books:

1. C.L. Wadhwa, '*Electrical Power Systems'*, New age International-3rd Edition
2. Hadi Saadat, "*Power System Analysis*", McGraw Hill, 3rd edition, 2011.
3. M.A. Pai, "*Computer Techniques in Power System Analysis*", TMH Publications, 2nd Edition, 2000.
4. O.I. Elgerd, "*Electric Energy Systems Theory*", Tata McGraw-Hill, 2nd Edition, 2005.

Course Code	Micro Processor and Micro Controller	L	T	P	C
1004203101		3	0	0	3

COURSE OVERVIEW:

The course covers the topics of architectures of Intel 8086 microprocessors along with 8051 microcontroller. Interfacing, Programming and control of different peripheral devices using 8086 Microprocessor and 8051 microcontroller.

COURSE OBJECTIVES

The objective of the course is to understand Architectures of basic microprocessors and Microcontroller, interfacing techniques and controlling different peripheral devices with 8086 and 8051.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO's	At the end of the course, the student will have the ability to:
CO1	**Understand** the concepts of microcomputer system and explore the architecture of microprocessors and microcontroller.
CO2	**Explore** hardware configuration of 8086 and able to write assembly language program for basic arithmetic applications.
CO3	**Apply** the knowledge of Interfacing memory and I/O devices with 8086
CO4	**Develop** interfacing circuit of different sensors and actuators with 8051. And **Apply** the knowledge of programming for industrial applications.

UNIT- I
INTRODUCTION TO MICRO COMPUTER SYSTEM AND MICROPROCESSORS:

[8 Hours]

Block diagram representation of microcomputer system / microprocessors and the role of various functional units. 8086 microprocessor architecture, Pin Configuration, 8086 Control signal interfacing, Minimum and Maximum mode operations, Read and write cycle timing diagrams.

UNIT II
8086 MICRO PROCESSOR: [10 Hours]

Memory interfacing with 8086, Addressing modes, Instruction Set, Programming of 8086.

UNIT-III
INTERFACING WITH 8086: [10 Hours]

8255 PPI architecture, Modes, Interfacing of different I/O devices (LEDs, Seven Segment Display units, ADC, DAC, Stepper motor) using 8255, Basic architecture of 8259 interrupt controller, 8257 DMA controller.

UNIT-IV
MICRO CONTROLLERS: [10 Hours]

Architecture of 8051 microcontroller, Signals, I/O ports and Memory Organization, Timers and Counters, Serial Communication, Interrupts, Addressing modes, Instruction set and simple programs for 8051.

UNIT-V
8051 MICRO CONTROLLER PROGRAMMING: [10 Hours]

Programming 8051; LED interfacing, seven segment interfacing, ADC, DAC, Sensor interfacing, Stepper motor interfacing.

Text Books:

5. Ray and Burchandi, "Advanced Micro Processors and Interfacing", Tata McGraw–Hill.
6. Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
7. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.

Reference Books:

12. R.S. Kaler, "A Text book of Microprocessors and Micro Controllers", I.K. International Publishing House Pvt. Ltd.
13. B Ram "Fundamentals of Microprocessor and Microcontrollers".
14. Ajay V. Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw–Hill Companies –2005.

Course Code	Open Elective-II Operating Systems	L	T	P	C
1005202101		3	0	0	3

COURSE OBJECTIVES:

1. Study the basic concepts and functions of operating systems.
2. Understand the structure and functions of OS.
3. Learn about Processes, Threads and Scheduling algorithms.
4. Understand the principles of concurrency and Deadlocks.
5. Learn various memory management schemes.
6. Study I/O management and File systems.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Summarize various concepts of Operating Systems
CO2	Implement and Apply Process Scheduling Algorithms
CO3	Illustrate concepts of Paging, Segmentation and Apply Concurrency, Deadlock Mechanisms in real world
CO4	Analyze the concepts of file systems in operating systems

UNIT- I

INTRODUCTION TO OPERATING SYSTEM CONCEPT

Types of operating systems, operating systems concepts, operating systems services, Introduction to System call, System call types. **[8 Hours]**

UNIT-II

PROCESS MANAGEMENT

Process concept, The process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Inter process Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms. **[8 Hours]**

UNIT-III

MEMORY MANAGEMENT

Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation.

VIRTUAL MEMORY MANAGEMENT

Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing **[10 Hours]**

UNIT-IV

CONCURRENCY

Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples.

PRINCIPLES OF DEADLOCK

System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock **[8 Hours]**

UNIT-V

FILE SYSTEM INTERFACE

The concept of a file, Access Methods, Directory structure, File system mounting, files sharing, protection. File System implementation- File system structure, allocation methods, free-space management Mass-storage structure overview of Mass-storage structure, Disk scheduling, Device drivers. Introduction to Dockers. **[10 Hours]**

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second 2016.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education", 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, TataMc Graw-Hill Education, 2007.

Course Code	Open Elective-II Data Mining	L	T	P	C
1012203240		3	0	0	3

COURSE OBJECTIVES:

This course gives an introduction to methods and theory for development of data analysis using data mining. Data quality and methods and techniques for pre-processing of data. Algorithms for classification, clustering and association rule analysis.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand data pre-processing and data visualization techniques
CO2	Study algorithms for finding hidden and interesting patterns in data
CO3	Understand and study of various classification techniques.
CO4	Understand and apply various clustering techniques using tools in various algorithms

UNIT- I

DATA MINING – INTRODUCTION

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures. **[8 Hours]**

UNIT-II

ASSOCIATION ANALYSIS

Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.

[8 Hours]

UNIT-III

CLASSIFICATION

Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbour Classifiers, Bayesian Classifiers. **[12 Hours]**

UNIT-IV

CLUSTERING ANALYSIS

Clustering: Introduction to clustering, Basic issues in clustering Types of clustering system, Partitioning methods: k-means, k-mediods, Hierarchical methods: distance-based agglomerative and divisible clustering, Conceptual clustering: Cobweb **[10 Hours]**

UNIT-V

Advanced techniques, Data Mining software and applications: Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and Applications. **[10 Hours]**

Text Books:

1. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
2. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining: Introductory and Advanced topics : Dunham, Pearson.
3. Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.

E-Books:

1. https://www.academia.edu/6489220/Data_Mining_ebook
2. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf

Course Code	Open Elective-II Introduction to Embedded Systems	L	T	P	C
1019204131		3	0	0	3

Course Overview: In this course, the fundamentals of embedded system hardware and firmware design will be explored. Issues such as embedded processor selection, hardware/firmware partitioning, glue logic, development tools, firmware architecture, firmware design, and firmware debugging techniques will be discussed.

Course Objectives:

- The basic concepts of an embedded system are introduced and the various elements of embedded hardware and their design principles are explained.
- Different steps involved in the design and development of firmware for embedded systems is elaborated.
- Fundamental issues in hardware software co-design were presented and explained.
- Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
- Embedded system implementation and testing tools are introduced and discussed

Course Outcomes:

	Course outcome
CO1	Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function
CO2	Design the Embedded hardware by considering the hardware components required for an embedded system
CO3	Analyze the various embedded firmware design approaches on embedded environment to suit for desired application
CO4	Understand how to integrate hardware and firmware of an embedded system and apply this knowledge to real time operating system.

Unit-I: Embedded System -Definition, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Characteristics of an embedded system.

Unit-I Outcome:

- Able to understand the application-specific and Domain-Specific examples of an embedded system.

Activity/Event on Unit-1:

Student will examine all peripherals and its usage

Unit-II: EMBEDDED HARDWARE DESIGN:

Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

Unit-II Outcome:

- Design the Embedded hardware by considering the hardware components required for an embedded system

Activity/Event on Unit-II:

Student will distinguish various components based on functionality.

Unit-III: EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

Unit-III Outcome:

- Student can be able to design a new firmware required for a specific system.

Activity/Event on Unit-III: The designed firmware will be simulated in keil

Unit-IV: HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware.

Unit-IV Outcome:

- Student will be able to design a prototype.

Activity/Event on Unit-IV:

PPT presentation by every student individually

Unit-V: EMBEDDED SYSTEM DEVELOPMENT: The integrated development environment, Types of files generated on cross-compilation, Dissembler/Decompiler, Simulators, Emulators and Debugging, Boundary Scan, Embedded Software development process and tools.

Unit-V Outcome:

- Student will be able to use the different IDE tools.

Activity/Event on Unit-V:

- Seminar presentation by every student individually on Embedded system development process and tools.

Text Books:

1. Embedded Systems-architecture, programming and design by RajKamal 3rd edition, McGraw hill
2. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
3. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Reference Books:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

Course Code	Open Elective-II Environmental Pollution and Control (EP&C)	L	T	P	C
1001202240		3	0	0	3

COURSE OBJECTIVES:

The students will be explained

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution.
2. Differentiate the solid wastes and hazardous wastes based on characterization.
3. Introduces some basics of sanitation methods essential for protection of community health.
4. Provide basic knowledge on sustainable development.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Have knowledge on air pollutant control devices and the NAAQ standards.
CO2	Differentiate the treatment techniques used for solid and industrial wastewater treatment methods.
CO3	Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.
CO4	Appreciate the importance of sustainable development while planning a project or executing an activity.

UNIT- I

AIR POLLUTION [6 Hours]

Air pollution Control Methods– Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

UNIT- II

INDUSTRIAL WASTEWATER MANAGEMENT [8Hours]

Industrial wastewater Management: Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards

UNIT- III

SOLID WASTE MANAGEMENT: [8 Hours]

Solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.

UNIT- IV

ENVIRONMENTAL SANITATION AND HAZARDOUS WASTE [10 Hours]

Environmental Sanitation: Sanitation Methods for institutions and hospitals

Hazardous Waste: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

UNIT- V

SUSTAINABLE DEVELOPMENTS [8 Hours]

Sustainable developments Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development

Text Books:

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003.
2. Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

Reference Books:

1."Air Pollution Control: A Design Approach" by C David Cooper and F C Alley
2."Encyclopaedia of Air Pollution Control Equipments: Selection, Design, Operation and Maintenance" by Frederick W Lipfert and Litao Wang Hsiaolan Liu
3.Environmental Pollution and Control, J Jefferey Peirce

Course Code	Electrical Simulation Lab	L	T	P	C
1002203210		0	0	3	1.5

COURSE OBJECTIVES:

- To simulate integrator circuit, differentiator circuit, Boost converter, Buck converter, full convertor and PWM inverter.
- To simulate transmission line by incorporating line, load and transformer models.
- To perform transient analysis of RLC circuit and single machine connected to infinite Bus (SMIB).

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Perform transient analysis of RLC circuit and Simulate transmission line by incorporating line, load and transformer models.
CO2	Simulate time response and frequency response plots
CO3	Simulate integrator circuit, differentiator circuit, Boost converter, Buck converter, full convertor and PWM inverter.
CO4	Simulation of rectifier and inverter circuits, single machine connected to infinite bus (SMIB).

LIST OF EXPERIMENTS

S.No.	Name of the experiment	Skill
1	Simulation of transient response of RLC circuits a. Response to pulse input b. Response to step input c. Response to sinusoidal input	Finding Time domain Specifications
2	Analysis of three phase circuit representing the generator transmission line and load. Plot three phase currents & neutral current.	Measuring Unbalanced 3-phase currents
3	Simulation of single–phase full converter using RLE loads and single phase AC voltage controller using RL loads	Measuring Average voltage output
4	Plotting of Bode plots, root locus and Nyquist plots for the transfer functions of systems up to 5th order	Finding stability analysis for a system
5	Simulation of Boost and Buck converters.	Measuring steady state voltage response
6	Integrator & Differentiator circuits using op–amp.	Finding integration and differentiation of given signals
7	Simulation of D.C separately excited motor using transfer function approach.	Finding speed and Torque variation of the motor
Any 2 of the following experiments are to be conducted:		

1	Modelling of transformer and simulation of lossy transmission line.	Measuring different parameters of a Transformer
2	Simulation of single phase inverter with PWM control.	Generation of PWM pulses according to required output
3	Simulation of three phase full converter using MOSFET and IGBTs.	Generation of gate pulses for a three phase system
4	Transient analysis of single machine connected to infinite bus(SMIB).	Analyze the stability of a given machine

Reference Books:

1. "Simulation of Power Electronic Circuit",byM.B.patil, V.Ramanarayan V.T.Ranganathan.Narosha,2009.

2. Pspice for circuits and electronics using PSPICE – by M.H.Rashid, M/s PHI Publications

3. Pspice A/D user`s manual – Microsim, USA

4. Pspice reference guide – Microsim, USA

5. MATLAB user`s manual – Mathworks, USA

6. MATLAB – control system tool box – Mathworks, USA

7. SIMULINK user`s manual – Mathworks, USA

8. EMTP User`s Manual.

Course Code	Power Systems and Simulation Lab	L	T	P	C
1002203211		0	0	3	1.5

Course Objectives:

1. To impart hands on experience and to calculate the fault current and fault impedance for alternator and transformer.
2. To understand the basic tools used in MATLAB/SIMULINK

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Analyze the fault current and sequence impedance of 3-phase alternator and transformer
CO2	Compare the settling time and steady state error for LFC with and without controller.
CO3	Perform load flow analysis for a N-bus system using GS & NR method
CO4	Calculate the economical load dispatch for optimum operation of generators.

LIST OF EXPERIMENTS

S.No.	Name of the experiment
1	Sequence impedances of 3 phase Transformer
2	Sequence impedances of 3 phase Alternator by Fault Analysis
3	Sequence impedances of 3 phase Alternator by Direct method
4	ABCD parameters of long medium and short Transmission line.
5	Calibration of Tong Tester.
6	Load flow studies using Gauss-seidel method.
7	Load flow studies using N-R method
8	Load frequency control with controller.
9	Load frequency control without controller.
10	Economic load dispatchwithout losses.
11	Economic load dispatch with losses.

Text Books:

Modern power System Analysis by DP Kothari & IJ Nagrath, McGrawHill publications

Reference Books: Power system Operation and control by S. Sivanagaraju & G. Sreenivasan by pearson publications

Course Code	Micro Processor and Micro Controller Lab	L	T	P	C
1004203111		0	0	3	1.5

COURSE OBJECTIVES:

This course introduces the assembly language programming of 8086 and 8051 microcontroller. it gives a practical training of interfacing the peripheral devices with the 8086 microprocessor and 8051 microcontroller.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Develop the necessary Algorithm and Assembly Language Program for the arithmetic, logical and string operations.
CO2	Apply instructions to solve different mathematical problems
CO3	Identify various interfacing devices and perform 8086 and 8051 interfacing with different peripherals and implement Programs.
CO4	Implement different applications with 8086 microprocessor and 8051 microcontroller.

LIST OF EXPERIMENTS

PART- A: (Minimum of 5 Experiments has to be performed)

8086 Programs

1. Multi byte Addition/Subtraction, Multiplication and Division operations.
2. ASCII Arithmetic Operations
3. Code Conversions
4. Sum of Squares/Cubes of a given-numbers
5. Factorial of given-numbers
6. String Operations.
7. Sorting

PART- B: (Minimum of 3 Experiments has to be performed)

8051 Programs

1. Arithmetic Operations
2. Finding number of 1's and number of 0's in a given 8-bitnumber
3. Addition of even numbers from a given array
4. Average of N numbers

PART- C: (Minimum of 2 Experiments has to be performed)

Interfacing of I/O Devices

1. D/A Interface through Intel 8255 to 8086 & 8051
2. Stepper Motor Interface to 8086 & 8051
3. Hardware/Software Interrupt Application using 8086 & 8051
4. Traffic Light Controller

Equipment Required:

1. Adapters
2. keyboards
3. Analog/Digital Storage Oscilloscopes
4. 8086 Microprocessor kits
5. 8051 microcontroller kits
6. DAC module
7. ADC module
8. Stepper motor module
9. Traffic light module

Text Books:

8. Ray and Burchandi, "Advanced Micro Processors and Interfacing", Tata McGraw–Hill.
9. Microprocessors and Interfacing, Douglas V Hall, Mc–Graw Hill, 2nd Edition.
10. Kenneth J Ayala, "The 8051 Micro Controller Architecture, Programming and Applications", Thomson Publishers, 2nd Edition.

Reference Books:

15. B Ram "Fundamentals of Microprocessor and Microcontrollers".
16. Ajay V. Deshmukh, "Microcontrollers – Theory and Applications", Tata McGraw–Hill Companies –2005.

Course Code	Competitive Programming	L	T	P	C
1054202180		1	0	2	2

COURSE OBJECTIVES:

1. To improve logical and analytical skills
2. To improve programming patterns like recursion

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Apply bit manipulation techniques to solve problems
CO2	Apply the modular programming techniques to simplify the programs.
CO3	Able to solve problems using strings

S.No.	Name of the experiment
1	Bit manipulations
2	Number theory: primality
3	Number theory: combinatorics
4	Recursions
5	Arrays
6	String manipulations
7	Time and space complexity optimization
8	Types of errors

Text Books:

1. Problem Solving and Program Design in C, Jeri R. Hanly, Ellot B. Koffman,7th Edition, Pearson.
2. 101 Programming puzzle problems solved: High School Junior to Seniors Join us to win Informatics Olympiad, N.B.Venkateswarlu, Feb, 2015.

Reference Books:

1. Programming in C, PradipDey, Manas Ghosh, 2nd Edition, OxfordUniversityPress.
2. How to Solve it by Computer- R.G.Dromey,PHI.

E-Books:

https://graphics.stanford.edu/~seander/bithacks.html

NPTEL/MOOC:

https://onlinecourses.nptel.ac.in/noc21_cs99/preview

Course Code	MANAGEMENT SCIENCE	L	T	P	Credits
1099203200		3	0	0	3

Course Overview: This course is intended to familiarize the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organizational structure, production operations, marketing, Human resource Management, product management and strategy.

Course Objectives:

1. To familiarize with the process of management and to provide basic insight into select contemporary management practices
2. To provide conceptual knowledge on functional management and strategic management.

Course Outcomes:

Cos	Course outcome
CO1	Illustrate basic insights of management principles
CO2	Summarize Production process, and Inventory techniques
CO3	Apply Strategies and policies to functional areas
CO4	Understand Contemporary management Practices

Unit-I

Introduction to Management: Concept –nature and importance of Management –Generic Functions of Management – Scientific Management – Administrative Management - Theories of Motivation (Maslow's, hertz berg and X-Y Theory) – Designing organization structure ,Decision making process- Principles of organization.

Unit-II

Operations Management: Plant location, Principles and Types of plant layout , Work study- Statistical Quality Control- Control Charts (X Bar chart &R-charts, P-chart and C-chart) - production methods (job, batch mass production) – Material Management: Need for Inventory control- Tools and techniques of Inventory Control - EOQ, ABC analysis, HML, SDE, VED, and FSN analyses.

Unit-III

Strategic Management: Strategic Management Process - Vision, Mission, Goals, and Strategy - Environmental Scanning –Strategy Formulation – Strategy Implementation – Strategy Control. Project Management: (PERT/CPM): Development of Network – Difference between PERT and CPM, Identifying Critical Path- (Simple Problems)

Unit-IV

Functional Management: Concept of HRM: Definition, Functions. Concept of HRM, HRD and PMIR- Functions of HR Manager, Job Evaluation and Merit Rating, Concept of MM-Definition, Marketing Functions, Marketing Mix, Product Life Cycle.

Unit-V

Contemporary Management Practices: Basic concepts of MIS, Just-in-Time(JIT) system, Total Quality Management(TQM), Six sigma and Modes of Logistics, Enterprise Resource Planning (ERP), Business process Re-engineering, Green Marketing, Human Resource Accounting, MRP, CMM, Supply Chain Management, Business Process outsourcing (BPO), Bench marking, Balanced Scorecard.

Text Books:

1.Dr. P. Vijaya Kumar &Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.

2.Dr. A. R. Aryasri, Management Science' TMH 2011.

3.Dr. P. Vijaya Kumar &Dr. N. Appa Rao, 'Management Science' Cengage, Delhi, 2012.

4.Dr. A. R. Aryasri, Management Science' TMH 2011

Reference Books:

1. Koontz &Weihrich: 'Essentials of management' TMH 2011

2. Seth & Rastogi: Global Management Systems, Cengage learning , Delhi, 2011

3. Robbins: Organizational Behaviour, Pearson publications, 2011

4. Kanishka Bedi: Production & Operations Management, Oxford Publications, 2011

5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications

6. Biswajit Patnaik: Human Resource Management, PHI, 2011

NPTEL/SWAYAMMOOCS:

1.https://onlinecourses.swayam2.ac.in/imb19_mg08/preview

2.https://www.coursera.org/learn/strategic-management

Course Code	Universal Human Values and Professional Ethics	L	T	P	C
1099203220		2	0	0	0

Course Overview:
Universal Human Values & Professional Ethics subject provides character-oriented education that instils basic values and ethnic value in one's individual professionalism.

Course Objectives:

1. To help the student to see the need for developing a holistic perspective of life.
2. To help students distinguish between values and skills and understand the need, basic guidelines, content and process of value education and Harmony.
3. To help the students understand their role as engineers, behavior and how to use ethical theories.
4. To help the students remember the codes, their responsibilities towards society, safety and risk.
5. Making the students aware and sensitive to value system in real life situations. To help the students to discriminate between ephemeral and eternal values.

Course Outcomes:

CO's	At the end of the course, the student will have the ability to:
CO1	Recognize importance of Universal human values, self-exploration and environment
CO2	Describe the core values that shape the ethical behavior of an engineer through value education, harmony and ethical human conduct.
CO3	Recall basics of professional ethics and Ethical theories.
CO4	Listing sustained happiness through identifying their responsibilities.

Unit-I

Universal Human Values-I – Introduction

Self-exploration- Aspirations and Concerns- Self-Management- Health- Relationships- Society- Natural Environment- Sharing and feedback

Unit-II

Universal Human Values-II - Understanding Harmony and Ethical Conduct

Introduction to Value Education- Harmony in the Human Being, Family and Society, Nature/Existence- Implications of the Holistic Understanding – a Look at Professional Ethics.

Unit-III

Engineering Ethics:

The History of Ethics-Purposes for Engineering Ethics-Engineering Ethics-Consensus and Controversy – Professional and Professionalism –Professional Roles to be played by an Engineer –Self Interest, Customs and Religion-Uses of Ethical Theories-Professional Ethics-

Types of Inquiry – Engineering and Ethics- Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma

Unit-IV

Engineering as Social Experimentation & Engineers' Responsibility for Safety and Risk

Engineers as Managers, Consultants, and Leaders – Accountability – Role of Codes – Codes and Experimental Nature of Engineering-Engineers'- Responsibility for Safety and Risk: Safety and Risk, Concept of Safety – Types of Risks - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

Unit-V

Engineers' Responsibilities and Rights:

Collegiality-Loyalty-Professionalism and Loyalty- Professional Rights –Professional Responsibilities-Conflict of Interest-Ethical egoism-Confidentiality-Acceptance of Bribes/Gifts- when is a Gift and a Bribe-examples of Gifts v/s Bribes-problem solving-interests in other companies- Occupational Crimes - Whistle Blowing -Cross-culture Issues.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. "Engineering Ethics and Human Values" by M. Govindarajan, S. Natarajan and V.S. Senthil Kumar- PHI Learning Pvt. Ltd-2009
3. "Professional Ethics and Morals" by Prof. A. R. Aryasri, Dharanikota Suyodhana-Maruthi Publications
4. "Professional Ethics and Human Values" by A. Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications
5. "Professional Ethics and Human Values" by Prof. D.R.Kiran

Reference Books:

1. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R.Gaur (1990), Commonwealth Publishers, New Delhi.
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester &Harper Collins, USA
5. "Indian Culture, Values and Professional Ethics" by PSR Murthy-BSP Publication
6. "Ethics in Engineering" by Mike W. Martinand Roland Schinzinger–Tata McGraw-Hill–2003.
7. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
8. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.

9. Samagrakranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
10. Small Is Beautiful: A Study of Economics as if People Mattered, E. F.Schumacher, 1973, Blond & Briggs, UK.

E-Books and Online Resources:

1.https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf
2.https://india.oup.com/productPage/5591038/7421214/9780199475070

NPTEL/SWAYAMMOOCS:

1. https://nptel.ac.in/courses/109/104/109104068/
2. https://onlinecourses.swayam2.ac.in/ntr19_ge06/preview

IV YEAR I SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

IV Year – I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	**Professional Elective-II**		3	0	0	3
	1002204130	Digital Signal Processing				
	1002204131	Solar Photovoltaic Energy Systems				
	1002204132	Utilization of Electrical Energy				
	1002204133	Energy storage systems				
2	**Professional Elective-III**		3	0	0	3
	1002204134	Advanced Control Systems				
	1002204135	Switch Gear and Protection				
	1002204136	Microgrids and Smart grids				
	1002204137	Advanced optimization techniques				
3	**Professional Elective-IV**		3	0	0	3
	1002204138	Neural Networks and Fuzzy Logic				
	1002204139	High voltage direct current				
	1002204190	Flexible alternating current transmission system				
	1002204191	Electric vehicles				
	1002204170	MOOCS				
4	**Professional Elective-V**		3	0	0	3
	1002204192	Power System operation and control				
	1002204193	Wind energy conversion systems				
	1002204194	Electrical distribution system				
	1002204195	Power Quality				
	1002204171	MOOCS				
5	**Open Elective-III**		3	0	0	3
	1012203100	Computer Networks				
	1005201202	Web Design				
	1005203233	Big Data Analytics				
	1003204135	Mechatronics				

6	**Open Elective-IV**		3	0	0	3
	1054203100	Machine Learning				
	1003202242	Industrial Robotics				
	1019203200	IoT and its Applications				
	1001204140	Disaster management				
7	1002204180	Industrial Programmable Logic Controllers	1	0	2	2
8	1099204120	IPR & Patents	2	0	0	0
9	1002204160	Industrial/Research Internship	0	0	0	2
		Total Credits:				**22**

10		Honors/Minor courses	4	0	0	4

Course Code	Professional Elective-II Digital Signal Processing	L	T	P	C
1002204130		3	0	0	3

COURSE OBJECTIVES:

The course objectives are:

1. Analyze the discrete-time signals and systems in time and frequency domains.
2. Know the importance of FFT algorithm for computation of Discrete Fourier Transform
3. Learn the FIR and IIR Filter design procedures
4. Learn the concept of Multi-Rate Signal Processing and Applications of it
5. Learn the concepts of DSP Processors

COURSE OUTCOMES:

CO's	Course Outcomes
CO1	Design, simulate and realize different digital filters.
CO2	Estimate the spectra of signals that are to be processed by discrete time system and to verify the performance of various spectrum estimation techniques
CO3	Design multi rate digital signal processing system.
CO4	Understand the architecture of DSP processor

Unit-I:
Introduction to Digital Signal Processing:
Discrete time signals & sequences, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations, solution of difference equations. Frequency domain representation of discrete time signals and systems.

Unit-II:
Discrete Fourier Series & Fourier Transforms:

Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

Unit-III:
IIR & FIR Digital Filters:

Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Analog-Digital transformations-Bilinear Transformation method, Design of FIR Digital Filters using Window Techniques-Rectangular window, Hamming window, Comparison of IIR & FIR filters.

Unit-IV:
Multirate Digital Signal Processing:

Decimation, interpolation, fractional sampling rate conversion and its Implementation, efficient transversal structure for interpolator and decimator, applications of multi rate DSP.

Unit-V:

Introduction To DSP Processors:

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, multiport memory, VLIW architecture, Pipelining, Architecture of TMS 320C5X Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On- chip registers, On-chip peripherals.

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris Z.Manolakis, Pearson Education / PHI, 4th edition, 2007.
2. Digital Signal Processors Architecture, Programming and Applications, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 1st edition, 2002.

Reference Books:

1. Digital Signal Processing, A. Anand Kumar, PHI, 2nd edition, reprint 2014.
2. Digital Signal Processing, P.Ramesh babu, Scitech 4th edition, reprint 2007.

E-Books: (Specify links)

1. https://toaz.info/doc-viewer.

2. https://engineering.purdue.edu/~ee538/4th-digital-signal-processing-proakis-and-manolakis1.pdf.

NPTEL/MOOC: (Specify Links)

1. https://nptel.ac.in/courses/108/105/108105055/

Course Code	Professional Elective-II Solar Photovoltaic Energy Systems	L	T	P	C
1002204131		3	0	0	3

COURSE OBJECTIVES:

(i) To learn the fundamentals of solar photovoltaic (PV) energy systems

(ii) To study the types of electrical components and schemes used in such PV systems

(iii) To analyze the characteristics of solar radiation, PV cells, modules and arrays, stand-alone PV schemes with battery energy storage and grid-connected PV schemes

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the fundamentals of solar photovoltaic (PV) energy systems
CO2	To analyze the characteristics of solar radiation, PV cells, modules and arrays
CO3	Explain the concept of stand- alone PV schemes with battery energy storage and grid-connected PV schemes
CO4	To analyze the system level issues related to PVenergy systems

UNIT- I

Modelling of PV Array [8 Hours]

Introduction to PV cell, Module, Array - effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; schemes for maximum power point tracking (Basic methods only). Sizing of PV array for given load vaule.

UNIT- II

Design of grid connected PV System,Control of real and reactive power [8 Hours]

Block diagram of Grid connected PV system with single stage/double stage, Design DC-DC converter with MPPT, Design of Inverter, Role and design of filters (L,LC, and LCL),expression for real and reactive power control, block diagram of grid connected PV system with decoupled real and reactive power control (PI Controller)

UNIT- III

Design of Battery Energy Storage [8 Hours]

Different types of the battery, lead-acid battery, lithium ion battery, performance difference of these batteries, simple model of battery, battery sizing and turn-around efficiency.

UNIT- IV

Design of Isolated PV system, Control of Voltage and frequency [8 Hours]

Applications, Block diagram of Isolated PV system for AC and DC loads, energy demand analysis, Sizing of the overall system, control of voltage and frequency using Droop Controller, pros and cons of an Isolated and grid connected PV systems.

UNIT- V

PV System Level Issues [8 Hours]

Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation.

Text Book:

1. Gilbert M. Masters: Renewable and Efficient Electric Power Systems. John Wiley & Sons, 2004.

2.Weidong Xiao: Photovoltaic Power System, Modeling, Design, and Control. John Wiley & Sons, 2017.

Reference Books:

1. Roger A. Messenger & Jerry Ventre: Photovoltaic Systems Engineering. CRC Press, 2004, 2nded.

2. Solanki: Solar Photovoltaics: Fundamentals, Technologies and Applications. PHI Learning Pvt Ltd, 2009.

E-Books: https://www.bookzz.ren/bookzz/2865920/b53364, https://www.bookzz.ren/bookzz/2918940/02810a

NPTEL/MOOC: https://nptel.ac.in/courses/115/103/115103123/, https://nptel.ac.in/courses/115/107/115107116/

Course Code	Professional Elective-II Utilization of Electrical Energy	L	T	P	C
1002204132		3	0	0	3

COURSE OBJECTIVES:

- To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
- To acquaint with the different types of heating and welding techniques.
- To study the basic principles of illumination and its measurement and understand different types of lightning system including design.
- To understand the basic principle of electric traction including speed–time curves of different traction services.
- To understand the method of calculation of various traction system for braking, Acceleration and other related parameters.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Identify a suitable motor for electric drives and industrial applications
CO2	Describe various electrical heating, welding methods.
CO3	Explain the basic terminology in illumination and compare the type of lamps
CO4	Analyze the speed –time characteristics of different services of traction and calculate tractive effort, power and specific energy.

UNIT- I

SELECTION OF MOTORS [8 Hours]

Choice of motor, type of electric drives, starting and running characteristics–Speed control–Temperature rise–Applications of electric drives–Types of industrial loads–continuous–Intermittent and variable loads–Load equalization, ingress protection for electric motors.

UNIT- II

[8 Hours]

ELECTRIC HEATING

Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating – Arc furnaces – Direct and indirect arc furnaces

ELECTRIC WELDING

Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding

UNIT- III

ILLUMINATION FUNDAMENTALS & VARIOUS ILLUMINATION METHODS: [8 Hours]

ILLUMINATION FUNDAMENTALS

Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Discharge lamps, MV and SV lamps— Lumen or flux method of calculation Sources of light.

VARIOUS ILLUMINATION METHODS:

Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting, principle of operation, street lighting and domestic lighting – Conservation of energy.

UNIT- IV

ELECTRIC TRACTION – I [8 Hours]

System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor, basic principle of Magnetic levitation trains–Mechanics of train movement-Speed– time curves for different services – Trapezoidal and quadrilateral speed time curves.

UNIT- V

ELECTRICTRACTION – II [8 Hours]

Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking, retardation adhesive weight and coefficient of adhesion–Principles of energy efficient motors-Modern traction motors

Text Book:

1. Utilization of Electric Energy – by E. Openshaw Taylor, Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai& Sons.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
2. Generation, Distribution and Utilization of electrical Energy – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1997.

E-Books: https://www.bookzz.ren/bookzz/5441788/abf631
https://www.bookzz.ren/bookzz/553917/25330d

https://www.bookzz.ren/bookzz/11674123/6ba52b

NPTEL/MOOC: https://nptel.ac.in/courses/108/105/10810506

Course Code	Professional Elective-II Energy storage systems	L	T	P	C
1002204133		3	0	0	3

COURSE OBJECTIVES:

1. Explain about various electrical energy storage systems
2. Discuss different electrochemical batteries
3. Explain about Electric Vehicles Charging Station

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Discuss about electrical energy storage systems
CO2	Explain about various electrochemical batteries
CO3	Explain in detail about Li-ion battery
CO4	Discuss about Electric Vehicles Charging Station

UNIT- I

INTRODUCTION TO ELECTRICAL ENERGY STORAGE[8 Hours]

Relevance and scenario. Perspective on development of Energy storage systems. Energy storage criteria, General concepts. Conventional batteries – fundamentals and applications. Grid connected and Offgrid energy storage systems and requirements.

UNIT- II

ELECTROCHEMICAL BATTERIES[8 Hours]

Battery capacity, Discharge Rate, SOC, SOD, SOH, DOD, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies (used in Tesla Car), Lead-acid battery, Nickel based battery (Nickel Metal Hydride), Lithium battery (Li-ion and LiPolymer), Introduction to Sodium battery, Compare all Electrochemical batteries.

UNIT- III

Li-ion BATTERY [8 Hours]

Equivalent circuit modeling, linear polarization-equivalent series resistance, diffusion voltages, Warburg impedance, R-C model circuit.

UNIT- IV

FUEL CELL [8 Hours]

Overview of key fuel cell technologies- Various types of fuel cells, Materials for electrodes, electrolytes and other components, Working mechanisms, Hydrogen generation and storage: limitations, Recent progress in fuel cells, Safety issues and cost expectation and life cycle analysis of fuel cells.

UNIT- V

ELECTRIC VEHICLES CHARGING STATION [8 Hours]

Types of charging station, Selection and Sizing of charging station, Components of charging station, Single line diagram of charging station, Charging Station Placement for Electric Vehicles: A Case Study of Visakhapatnam city, India, Case Study of Tesla.

Text Book:

1. Electric and Hybrid Vehicles: Design Fundamentals Iqbal Hussein, CRC Press, 2003 second edition.
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Design, CRC Press 2004.
3. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley 2003.

Reference Books:

1. Super capacitors- Materials, Systems, and Applications F. Beguin and E. Frackowiak Wiley- VCH Verlag GmbH & Co. 2013.
2. Fuel Cells and Hydrogen: From Fundamentals to Applied Research V. Hacker, S. Mitsushima (sdE.) Elsevier 2018.

E-Books: https://www.bookzz.ren/bookzz/11957441/e6652f,
https://www.bookzz.ren/bookzz/593773/9a0d8b,
https://www.bookzz.ren/bookzz/877602/d96ffb,
https://www.bookzz.ren/bookzz/2156353/5de76c,
https://www.bookzz.ren/bookzz/5765430/bdf983

NPTEL/MOOC: https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf,
https://nptel.ac.in/content/storage2/courses/108103009/download/M3.pdf

Course Code	Professional Elective-III Advanced Control Systems	L	T	P	C
1002204134		3	0	0	3

COURSE OBJECTIVES:

- To review the state space representation of a control system
- To understand the State feedback controller and State observer
- To analyze nonlinear system using Describing function approach and Phase plane analysis, and Lypanov's method of stability analysis of a system.
- To formulation of Euler Lagrange equation for the optimization of typical functional and solutions.
- To formulation of linear quadratic optimal regulator problem and its design.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Model the different systems (electrical, mechanical and electro mechanical systems) in terms of various state models.
CO2	Design the state feedback controller and observer for different systems.
CO3	Explain the different nonlinearities and stability of the system
CO4	Formulate and solve the different optimal control problems

UNIT I: State space analysis:

General State Space Representation, Canonical forms – Controllable canonical form – Observable canonical form, Diagonal Canonical Form and Jordan Canonical Form. Solution of state equation, State transition matrix (no derivations and problems) –

UNIT II: Design of State Feedback controller & Observer:

Tests for controllability and Observability for continuous time systems – Time invariant case – Principle of duality -controllability and observability from Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement. state observers-Design of full order state observer

UNIT III: Nonlinear systems

Introduction to nonlinear systems, Concept of singular points and Limit cycle, Types of nonlinearities, describing functions, Introduction to phase–plane analysis.

Stability in the sense of Lyapunov – Lyapunov stability and Lypanov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.

UNIT IV: Introduction to optimal control - Calculus of variations:

Optimal control problem formulation- Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler-Lagrange equation.

UNIT V: Optimal control of LTI systems:

Linear Quadratic Optimal Regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by Continuous Time Algebraic Ricatti equation (CARE).

Text Books:

1. Automatic Control Systems by B.C. Kuo, Prentice Hall Publication
2. Modern Control System Theory – by M. Gopal, New Age International Publishers,2nd Edition,1996
3. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

Reference Books:

1. Modern Control Engineering – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2. Systems and Control by Stainslaw H. Zak, Oxford Press, 2003.
3. Optimal control systems by D S Naidu, CRC publications.

Course Code	Professional Elective-III Switch Gear and Protection	L	T	P	C
1002204135		3	0	0	3

COURSE OBJECTIVES:

- To provide the basic principles and operation of various types of circuit breakers.
- To study the classification, operation, and application of different types of electromagnetic protective relays.
- To explain protective schemes, for generator and transformers and various protective schemes used for feeders and bus bars.
- To explain the principle and operation of different types of static relays.
- To study different types of overvoltage's in a power system and principles of different protective schemes for insulation coordination.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the principles of Arc Interruption for application to high voltage circuit breakers of air, oil, vacuum, and SF6 gas Circuit breakers
CO2	Describe the working principle and constructional features of different types of electromagnetic protective relays and static relays with a view to application in the system.
CO3	Illustrate various types of faults that occur in transformers, alternators, feeders, and bus bars, and apply suitable protection schemes for different types of faults.
CO4	Summarize the different types of over voltages appearing in a system including existing protective schemes required for insulation coordination.

UNIT–I

Circuit Breakers **L:8**

Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– **Components of a protection system-** CB ratings and specifications - Introduction to oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers–Miniature Circuit Breaker (MCB), MPCB, ELCB, RCCB– Selection of MCB based on Curves – Concept of Auto reclosing

UNIT–II

Electromagnetic Protection **L:8**

Relay connection: Relays classification – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation.

Applications of relays: Over current and under voltage relays– PSM, TMS - Numerical examples - Directional relays– Differential relays and percentage differential relays

Distance relays: Universal torque equation– Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.

UNIT–III

Generator Protection **L:11**

Protection of generators against stator faults, Differential Protection for generator– Rotor faults and abnormal conditions–restricted earth fault and inter turn fault protection– Numerical examples.

Transformer Protection

Percentage differential protection– Design of CT's ratio– Buchholz relay protection– Numerical examples.

Protection of Transmission lines

Types of Transmission line protection- Over current Protection schemes– Distance Protection of Transmission lines- Pilot wire differential protection scheme- Carrier current and three zone distance relay using impedance relays–Protection of bus bars by using Differential protection.

UNIT–IV

Static and Digital Relays **L:5**

Static relays: Static relay components– Static over current relays– Static distance relay– Microprocessor based digital relays, Numerical Relays (Basic Operation Only).

UNIT–V

Grounding and Protection against over voltages **L:8**

Grounded and ungrounded neutral systems–Effects of ungrounded neutral on system performance– Methods of neutral grounding: Solid–resistance–Reactance–Arcing grounds and grounding Practices.

Generation of over voltages in power systems– Standard impulse test wave– volt-time characteristics – Protection against lightning over voltages and switching over voltages– Valve type and zinc oxide lightning arresters– Insulation coordination– BIL– impulse ratio.

Text Books:

1. Power System Protection and Switchgear by Badari Ram and D. N. Viswakarma, TMH Publications
2. Power system protection- Static Relays with microprocessor applications.by T.S. Madhava Rao,TMH

Reference Books:

1. Fundamentals of Power System Protection by Paithankar and S. R. Bhide.,PHI, 2003.
2. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd.
3. Protection and SwitchGear by BhaveshBhalja, R.P. Maheshwari, NileshG.Chothani, Oxford University Press, 2013

Nptel/MOOCS:

https://nptel.ac.in/courses/108/101/108101039/

https://nptel.ac.in/courses/108/107/108107167/

Course Code	Professional Elective-III Micro grids and Smart grids	L	T	P	C
1002204136		3	0	0	3

COURSE OBJECTIVES:

- To understand distributed generation concepts and interconnection issues of DGs
- To understand operation of various types of DG systems
- To study power electronics application to DG systems
- To study and understand operation and control of Microgrids
- To understand the concept of smart grid and developments on smart grid.
- To study micro grids and distributed energy resources.
- To know power quality & ICT aspects of smart grid.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain topologies, interconnection issues of DGs and features of grid connected DG systems
CO2	Design power converter topologies for DG applications and implement the control of Microgrid
CO3	Explain the concept of Resilient and Self-Healing Grid.
CO4	Discuss Micro Grids (MGs) and Distributed Energy Resources (DERs) and also PQ issues with RES and also ICT for Smart Grid.

UNIT- I

DG and Grid Connected DG System [8 Hours]

Concept of distributed generations (DG), distributed energy resources (DERs), dependence on storage facilities, standards for interconnecting DGs to electric power systems: IEEE 1547. DG installation classes. Grid code and Islanding & non-islanding system. Grid interconnection issues for grid connected operation of various types of DG systems. Constraints on operational parameters: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues.

UNIT- II

POWER ELECTRONICS AND DG SYSTEMS [8 Hours]

Relevance of power electronics in DG applications, Power quality requirements and source switching using SCR based static switches, Distribution system loading, line drop model, series voltage regulators and on-line tap changers, power converter topologies, model and specifications for DG applications, issues filter designs, harmonic reduction, Control of DG inverters, phase locked loops, current control and DC voltage control for standalone and grid parallel operations.

UNIT- III

Operation, Control and Modelling of Microgrid [8 Hours]

Concept and definition of microgrid, review of sources of microgrids, microgrid implementation in Indian and international scenario, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids, communication infrastructure, modes of operation and control of microgrid: grid connected and islanded mode operation, anti-islanding schemes. Control techniques for voltage, frequency, active and reactive power control of microgrid system. Protection andstability analysis of microgrid,microgrid reliability, LVDC Microgrid.

UNIT- IV

Introduction to Smart Grid and Smart Grid Technologies: [8 Hours]

Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Smart Grid Initiatives. Automatic Meter Reading (AMR), Outage Management System (OMS), Electric Vehicle to Grid, Wide Area Measurement System (WAMS) and Phasor Measurement Unit (PMU).

UNIT- V

Power Quality and Communication Technology for Smart Grid [10 Hours]

Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Information and Communication Technology for Smart Grid: Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).

Text Books:

1. Renewable Energy- Power for a sustainable future, third edition, Edited by Godfrey Boyle, Oxford University Press, 2013.
2. Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2009.
3. Dorin Neacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor& Francis, 2006. New Delhi.
4. Microgrids: Architectures and Control, Nikos Hatziargyriou (Editor), ISBN: 978-1-118-72068-4, 340 pages, December 2013, Wiley-IEEE Press
   Microgrids and Active Distribution Networks, S. Chowdhury, S.P. Chowdhury and P.Crossley, The Institution of Engineering and Technology, London, U.K, 2009
5. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green And Renewable Energy in Electric Power Systems", Wiley
6. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press

Reference Books:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley

2. Jean Claude Sabonnadière, NouredineHadjsaïd, “Smart Grids”, Wiley Blackwell19

E-Books:

- https://www.bookzz.ren/bookzz/3418855/86c378
- https://www.bookzz.ren/bookzz/2866187/b307e9
- https://www.bookzz.ren/bookzz/1307157/abb066
- https://www.bookzz.ren/bookzz/2332249/c20c3a
- https://www.bookzz.ren/bookzz/3401743/724bfc
- https://www.bookzz.ren/bookzz/6037555/e48969

NPTEL/MOOC:

- https://nptel.ac.in/courses/108/107/108107113/
- https://onlinecourses.nptel.ac.in/noc19_ee64/preview

Course Code	Professional Elective-III Advanced optimization techniques	L	T	P	C
1002204137		3	0	0	3

COURSE OBJECTIVES:

- To present basic principles of metaheuristic techniques.
- To describe local search algorithms in GA, Simulated Annealing and PSO.
- To describe global search algorithms.
- To present examples of metaheuristics for globalmulti-criteria and dynamic optimization.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To identify the metaheuristic technique appropriate for a specific problem.
CO2	To implement and validate a computational model based on Genetic algorithms.
CO3	To solve a real-world problem using computational intelligence tools.
CO4	To use software tools which are specific for computational intelligence.

UNIT-I [10 Hours]

INTRODUCTION TO META-HEURISTIC AND EVOLUTIONARY ALGORITHMS

Searching the Decision Space for Optimal Solutions, Definition of Terms of Meta-Heuristic and Evolutionary Algorithms, Objective Function, Simulation Model, Constraints, Fitness Function, Principles of Meta-Heuristic and Evolutionary Algorithms.

Classification of Meta-Heuristic and Evolutionary Algorithms, Meta-Heuristic and Evolutionary Algorithms in Discrete or Continuous Domains, Generating Random Values of the Decision Variables, Dealing with Constraints, Fitness Function, Selection of Solutions in Each Iteration, Generating New Solutions, Best Solution in Each Algorithmic Iteration, Termination Criteria

UNIT-II [8 Hours]

PATTERN SEARCH

Pattern Search (PS) Fundamentals, Generating an Initial Solution, Generating Trial Solutions, Pattern Move, Updating the Mesh Size, Termination Criteria, User-Defined Parameters of the PS, Pseudocode of the PS.

UNIT-III [8 Hours]

GENETIC ALGORITHM

Mapping the Genetic Algorithm (GA) to Natural Evolution, Creating an Initial Population, election of Parents to Create a New Generation, Population Diversity and Selective Pressure,

Reproduction, Termination Criteria, User- Defined Parameters of the GA, Pseudocode of the GA.

UNIT-IV [8 Hours]

SIMULATED ANNEALING

Introduction, Mapping the Simulated Annealing (SA) Algorithm to the Physical Annealing Process, Generating an Initial State, Generating a New State, Acceptance Function, Thermal Equilibrium, Temperature Reduction, Termination Criteria, User- Defined Parameters of the SA, Pseudocode of the SA.

UNIT-V [8 Hours]

APPLICATIONS OF HEURISTIC OPTIMIZATION

Application of PS, GA, SA in -Tuning of PI controller in Load Frequency Control of single-Area system, Economic Load Dispatch without losses.

Text Books:

1. Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga, "Meta-heuristic and Evolutionary Algorithms for Engineering Optimization", Wiley Series, 2017.
2. Sean Luke: Essentials of Metaheuristics, Lulu, second edition, 2013 [Unit 3]

Reference Books:

1. Michaël Baudin and Vincent Couvert, Optimization in Scilab, 2010 (available online at www.scilab.org)

2. http://web.info.uvt.ro/~dzaharie/ma2017/lab

E-Books: http://cs.gmu.edu/~sean/book/metaheuristics/

NPTEL/MOOC: https://nptel.ac.in/courses/112/103/112103301/

Course Code	Professional Elective-IV Neural Networks and Fuzzy Logic	L	T	P	C
1002204138		3	0	0	3

COURSE OBJECTIVES:

- To understand artificial neuron models & learning methods of ANN.
- To utilize different algorithms of ANN.
- To distinguish between classical and fuzzy sets.
- To understand different modules of fuzzy controller.
- To understand applications of neural networks and fuzzy logic.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand different architectures of ANN models of artificial neuron, learning strategies and algorithms
CO2	Classify between classical and fuzzy sets.
CO3	Use different modules of Fuzzy logic controller
CO4	Apply Neural Networks and fuzzy logic for electrical engineering

UNIT- I

INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS [8 Hours]

Organization of the Brain, Biological Neuron, Artificial Neuron Model, Characteristics of ANN, Types of Neuron Activation Functions, Credit Assignment Problem, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, ANN Architectures.

UNIT-II

ANN PARADIGMS [10 Hours]

Derivation of Back propagation (BP) algorithm, Radial basis function network (Architecture, radial basis function, Cover's theorem, XOR problem), Kohonen's self-organizing feature maps (Architecture, Algorithm).

Application: Application of neural networks to load forecasting.

UNIT-III

ASSOCIATIVE MEMORIES AND HOPFIELD NETWORKS [8 Hours]

Bidirectional Associative Memories (BAM): Architecture, Discrete BAM, Algorithm, testing a BAM network to associate letters with simple bipolar codes.

Hopfield Network: Discrete Hopfield Neural Network, Architecture, Algorithm, testing a discrete Hopfield networks with a mistake in the components of the stored vector.

UNIT-IV

CLASSICAL & FUZZY SETS [7 Hours]

Introduction to classical sets: Properties, Operations and Relations; Fuzzy sets: Operations, Properties; Fuzzy relations: Operations on fuzzy relations, Properties of fuzzy relations, Fuzzy Cartesian product and composition, Features of the membership function.

UNIT-V

FUZZY LOGIC MODULES [10 Hours]

Fuzzification: Membership value assignment, Defuzzification to crisp sets: Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Inference System.

Fuzzy logic applications: Fuzzy logic control for DC-DC converter, Tuning of PID controller gains using fuzzy logic controller

Text Books:

1. Neural Networks-A Comprehensive Foundation – Simon Hakin, Pearson Education, 2nd Edition, 1997.
2. Fuzzy Logic with Engineering Applications – Timothy J. Ross, 3rd Edition, John Wiley & Sons Ltd.

Reference Books:

1. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene Fausett, Pearson Education, 2004.
2. Introduction to Neural Networks using MATLAB 6.0 – S. N. Sivanandam, S. Sumathi, S. N. Deepa, The McGraw-Hill.
3. Introduction to Fuzzy Logic using MATLAB – S. N. Sivanandam, S. Sumathi, S. N. Deepa, Springer, 2007.
4. Introduction to Artificial Neural Systems – Jacek M. Zuarda, Jaico Publishing House, 1997.
5. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Pai – PHI Publication.
6. Artificial Neural Network – B. Yegnanarayana, PHI, 2012.

E-Books:

Text book-1:

https://www.pdfdrive.com/neural-networks-a-comprehensive-foundationpdf-e18774300.html

Text book-2:

https://www.pdfdrive.com/fuzzy-logic-with-engineering-applications-e40345033.html

Reference Book-1:

https://dl.matlabyar.com/siavash/Neural%20Network/Book/Fausett%20L.-Fundamentals%20of%20Neural%20Networks_%20Architectures,%20Algorithms,%20and%20Applications%20(1994).pdf

Reference Book-3:

http://chiataimakro.vicp.cc:8880/%E6%9D%82%E9%A1%B9/matlab/[MATLAB%E5%9B%BE%E4%B9%A6%E5%90%88%E9%9B%86].Introduction.to.Fuzzy.Logic.using.MatLab.-.Sivanandam.Sumathi.and.Deepa.%E6%96%87%E5%AD%97%E7%89%88.pdf

Reference Book-4:

https://www.pdfdrive.com/29721562-zurada-introduction-to-artificial-neural-systems-wpc-1992-e40080476.html

Reference Book-6:

https://kupdf.net/downloadFile/5ab9885ae2b6f523273f5edb

NPTEL/MOOC:

Neural Networks and Applications: https://nptel.ac.in/courses/117/105/117105084/

Fuzzy Logic and Neural Networks: https://nptel.ac.in/courses/127/105/127105006/

Course Code	Professional Elective-IV High Voltage Direct Current	L	T	P	C
1002204139		3	0	0	3

Preamble:

This course deals with the importance of HVDC Transmission system, analysis of HVDC converters, faults and protection, harmonics and filters. This also covers reactive power control and converter control characteristics.

Course Objectives:

- To compare HVDC and AC transmission.
- To understand the control of HVDC systems and MTDC systems.
- To discuss various protection schemes of HVDC transmission.
- To learn about the design of filters.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Compare HVDC and AC transmission system w.r.t. economical, technical and reliability aspects.
CO2	Analyze the six pulse and twelve pulse converter configurations and describe converter control characteristics and MTDC systems.
CO3	Describe various converter faults and protection methods in HVDC transmission system.
CO4	Explain generation of harmonics and design suitable filters to eliminate them.

UNIT–I **L:6**

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC & DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

UNIT–II **L:10**

Analysis of HVDC Converters:

Choice of converter configuration – Effect of source inductance on the system -Graetz bridge –-analysis with grid control without overlap and with overlap for less than and more than 60 º, Equivalent circuit of converter- Cases of two 3 phase converters in star –star mode – their performance-characteristics of 6 pulse & 12 pulse converters

UNIT–III **L:8**

Converter Control & Introduction to MTDC systems:

Principle of DC Link Control – Converters Control Characteristics – Firing angle control – Current and extinction angle control – Starting and stopping of DC link - Power Control.

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies-Introduction to MTDC systems-Types of MTDC systems-series, parallel, ring systems

UNIT–IV **L:8**

Converter Fault & Protection:

Converter faults – protection against over current and over voltage in converter station – surge arresters –smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

UNIT–V **L:8**

Harmonics & Design of Filters

Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics.
Types of AC filters, Design of Single tuned filters –Design of High pass filters

Text Books:

1. K. R. Padiyar, HVDC Power Transmission Systems: Technology and System Interactions, New Age International (P) Limited, and Publishers.

Reference Books:

1. J. Arrillaga, 'High voltage Direct Current Transmission', Peter Peregrinus Ltd., London, UK, 1983.
2. E.W. Kimbark, 'Direct current Transmission', Wiley& sons, NewYork,1971
3. E. Uhlmann, Power Transmission by Direct Current, B.S. Publication.
4. S. Kamakshaiah and V. Kamaraju, HVDC Transmission, Tata McGraw–Hill

MOOCS/NPTEL : https://nptel.ac.in/courses/108/104/108104013/

Course Code	Professional Elective-IV Flexible alternating current transmission system	L	T	P	C
1002204190		3	0	0	3

COURSE OBJECTIVES:

Learning Objectives:

- To learn the basics of power flow control in transmission lines using FACTS controllers
- To explain the operation and control of voltage source converter.
- To understand the compensation methods to improve stability and reduce power oscillations of a power system.
- To learn the method of shunt compensation using static VAR compensators.
- To learn the methods of compensation using series compensators
- To explain the operation of Unified Power Flow Controller (UPFC).

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Explain power flow control in transmission lines using FACTS controllers.
CO2	Compare voltage sourced converter (VSC) and current sourced converter (CSC)
CO3	Analyze Shunt compensation methods to improve transient stability and reduce power oscillations in the transmission lines.
CO4	Discuss operation and control of SVC and STATCOM and describe series compensators and combined compensators used in enhancing the performance of transmission lines.

UNIT- I

INTRODUCTION TO FACTS [6 Hours]

Power flow in an AC System – Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers.

UNIT-II

VOLTAGE SOURCE AND CURRENT SOURCE CONVERTERS [7 Hours]

Concept of voltage source converter (VSC) – Single phase bridge converter – Square–wave voltage harmonics for a single–phase bridge converter – Three–phase full wave bridge converter– Three–phase current source converter – Comparison of current source converter with voltage source converter.

UNIT-III

SHUNT COMPENSATORS–1 [7 Hours]

Objectives of shunt compensation – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping.

UNIT-IV

SHUNT COMPENSATORS–2 [9 Hours]

Thyristor Switched Capacitor (TSC)–Thyristor Switched Capacitor – Thyristor Switched Reactor (TSC–TCR).

Static VAR compensator (SVC) and Static Compensator (STATCOM): Operation of STATCOM-The regulation and slope transfer function and dynamic performance – Transient stability enhancement and power oscillation damping– Operating point control

UNIT-V

SERIES COMPENSATORS & COMBINED (SERIES-PARALLEL) COMPENSATORS [10 Hours]

Series Compensators

Static series compensators**:** Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping. GTO thyristor-controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC).

Combined (Series-Parallel) Compensators

Schematic and basic operating principles of Unified Power Flow Controller (UPFC).– Application on transmission lines.

Text Books: 1. N. G. Hingorani and L. Guygi, "Understanding FACTS", IEEE Press. Indian Edition is available: Standard Publications, 2001.

Reference Books:

1. Yong Hue Song and Allan T Johns "Flexible ac transmission system (FACTS)" Edited by, Institution of Electrical Engineers, London.

2. R. Mohan Mathur and Rajiv K. Varma, 'Thyristor-based FACTS Controllers for Electrical Transmission Systems', Wiley.

E-Books:

https://drive.google.com/file/d/160_uDT88Rsikq4cim0ZB7clSnJeT-gxJ/view

NPTEL/MOOC:

https://nptel.ac.in/courses/108/107/108107114/

Course Code	Professional Elective-IV Electric vehicles	L	T	P	C
1002204191		3	0	0	3

Course Overview: This course deals with the fundamental concepts, principles, analysis and design of electric vehicles. It also discusses various aspects of electric and hybrid electric drive trains, their configuration, types of electric machines, power electronics, energy storage devices, charging infrastructure, etc.

Course Objectives:

The objective of the course is to understand general aspects of Electric and Hybrid Electric Vehicles, including architectures, modeling, sizing, sub-system design and hybrid vehicle control. It will cover vehicle dynamics, energy storage sources, electric propulsion systems, power electronics design, and vehicle control and communication.

- To understand the concepts and drive train configurations of electric drive vehicles
- To understand different electric propulsion systems and energy storage devices.
- To understand the technology, design methodologies and control strategy of electric and hybrid electric vehicles
- To understand battery charger topologies for plug in hybrid electric vehicles

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

CO's	At the end of the course, the student will have the ability to:
CO1	Explain the concepts and drive train configurations of electric drive vehicles.
CO2	Describe different electric propulsion systems and energy storage devices
CO3	Discuss the technology, design methodologies and control strategy of electric vehicles.
CO4	Explain battery charger topologies for electric vehicles and discuss how the sizing of the drive system is done and energy management strategies used in electric.

UNIT-I: **L:6**

Introduction to Conventional and Electric Vehicles:

Conventional Vehicles: Basics of vehicle performance, Vehicle power source characterization, Transmission characteristics, Mathematical models to describe vehicle performance.

Electric Vehicles: Environmental and Social impact of Electric Vehicles (EVs), History of EVs, Impact of modern drive-trains on energy supplies. Different Motors suitable for of Electric and Hybrid Electric Vehicles.

UNIT-II: **L:8**

Hybrid and Electric Drive-Trains:

Basic concept of hybrid traction, Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, Introduction to various electric drive-train topologies, power Flow control in electric drive-train topologies, Fuel efficiency analysis.

UNIT-III: **L:9**

Electric Propulsion Unit:

Introduction to electric components used in electric and hybrid electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, Configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, Drive system efficiency.

UNIT-IV:

Sizing the Drive System: **L: 5**

Matching the Electric Machine and the Internal Combustion Engine (ICE), Sizing the propulsion motor, Sizing the power electronics, Selecting the energy storage technology, Communications, Supporting subsystems

UNIT-V: Energy Storage and Energy management:
L:12

Introduction to Energy Storage Requirements in Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Energy Management Strategies: Introduction to energy management strategies used in electric and hybrid electric vehicles, Classification of different energy management strategies, Comparison of different energy management strategies, Implementation issues of energy management strategies.

Text Books:

1. Iqbal Hussain, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design’, CRC Press, 2004.
3. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003.
4. NPTEL Web Course Material on ‘Hybrid and Electric Vehicles”.

Reference Books:

1. Gianfranco, “Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure and The Market”, Pistoia Consultant, Rome, Italy, 2010.

2. Chris MI, M. Abul and David Wenzhong Gao, “Hybrid Electrical Vehicle Principles and Application with Practical Perspectives”, John Wiley & Sons Ltd., 2011.
3. John M. Miller, “Propulsion System for Hybrid Vehicle”, 2nd Edn.
4. Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012.
5. Seref Soylu “Electric Vehicles - The Benefits and Barriers”, In Tech Publishers, Croatia, 2011.
6. Jack Erjavec and Jeff Arias, “Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles”, Cengage Learning Pvt. Ltd., New Delhi, 2007
7. Seth Leitman, “Build Your Own Electric Vehicle”, McGraw hill, NewYork, USA 2013.

NPTEL/MOOC:

- https://nptel.ac.in/courses/108/106/108106170/
- https://nptel.ac.in/courses/108/103/108103009/
- https://nptel.ac.in/courses/108/102/108102121/

Course Code	Professional Elective-IV MOOCS	L	T	P	C
1002204170		3	0	0	3

Course Code	Professional Elective-V Power System operation and control	L	T	P	C
1002204192		3	0	0	3

COURSE OBJECTIVES:

- To determine optimal scheduling of Hydrothermal Systems and to solve unit commitment problem.
- To analyse single area and two area load frequency control.
- To investigate reactive power control problem in transmission systems.
- To analyze restructuring models, independent system operation,short term and long term forecasting.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Solve optimal scheduling of Hydrothermal Systems and unit commitment problem, using various algorithms
CO2	Inspect single area and two area load frequency control
CO3	Regulate reactive power in transmission systems.
CO4	Analyze restructuring models, independent system operation, short term and long term forecasting.

UNIT–I: ECONOMIC OPERATION OF POWER SYSTEMS

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve – coordination equations without and with loss (No derivation of loss coefficients) – solution by direct method and λ-iteration method. Optimal scheduling of Hydrothermal System-Problems.

UNIT–II: UNIT COMMITMENT

Optimal unit commitment problem – Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming- Deviation Settlement Mechanism (DSM).

UNIT III: P-F CONTROL

Basics of speed governing mechanism and modelling – speed-load characteristics – load sharing between two synchronous machines in parallel – control area concept – LFC control of a single-area system – static and dynamic analysis of uncontrolled and controlled cases – two-area system – modelling – static analysis of uncontrolled case – tie line with frequency bias control.

UNIT IV: Q-V CONTROL

Overview of Reactive Power control – Reactive Power compensation in transmission systems –Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – Uncompensated and compensated transmission lines: Shunt and series compensation – Need for FACTS controllers.

UNIT V: POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT

Introduction to deregulation-short and long term load forecasting and energy pricing forecasting–Restructuring models–Independent System Operator (ISO)–Power Exchange-Market operations – Market Power.

TEXT BOOKS:

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", Tata Mc-Graw Hill Publishing Company, 3rdEdition, 2008.

REFERENCES:

1. C.L.Wadhwa, "Electrical Power Systems", New Age International Publishers, 6thEdition, 2009.
2. O. I. Elgerd, "Electric Energy Systems Theory", Tata McGraw-Hill Publishing Company, Second Edition, 2007.
3. A. J. Wood and B.F. Wollenberg, "Power Generation, Operation and Control", John-Wiley & Sons, Second edition,2006.
4. T.J.E.Miller, "Reactive Power Control in Electric Systems", John Wiley & Co, 1982.
5. PrabhaKundur, "Power System Stability and Control", McGraw Hill Education, 2005.
6. Mohammad Shahidepour and Muwaf faqalomoush, "Restructured Electrical Power Systems", 1st Edition, Marcel Decker Inc., 2001.

NPTEL/MOOC: (Specify Links)

https://nptel.ac.in/courses/108/101/108101040/

Course Code	Professional Elective-V Wind energy conversion systems	L	T	P	C
1002204193		3	0	0	3

COURSE OBJECTIVES:

To introduce the basic concepts of a Wind turbine, to understand control principles of a Wind turbine, to understand fixed speed and variable speed wind energy conversion systems and analyze their grid connection issues.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To understand the design and control principles of Wind turbine.
CO2	To understand the concepts of fixed speed wind turbines.
CO3	To understand the concepts of variable speed wind turbines.
CO4	To analyze the grid integration issues.

WIND ENERGY CONVERSION SYSTEMS

UNIT-I [9 Hours]

INTRODUCTION

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin's theory, Betz criteria-Aerodynamics of Wind turbine.

UNIT-II [8 Hours]

WIND TURBINES

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations- Tip speed ratio-No.of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control- stall control-Schemes for maximum power extraction.

UNIT-III [8 Hours]

FIXED SPEED SYSTEMS

Generating Systems - Constant speed constant frequency systems -Choice of Generators-Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- single out put system with squirrel cage induction generator, semi variable speed system, double output system with current converters and with a voltage source inverters.

UNIT-IV [8 Hours]

VARIABLE SPEED SYSTEMS

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG – block diagram representation – Variable speed variable frequency schemes.

UNIT-V [9 Hours]

GRID CONNECTED SYSTEMS

Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on the power system.

Text Books:

1. N. Jenkins," Wind Energy Technology" John Wiley & Sons,1997
2. L. L. Freris "Wind Energy conversion Systems", Prentice Hall, 1990
3. S. N. Bhadra, D. Kastha, S. Banerjee, "Wind Electrical Sytems", Oxford University Press,2010.

Reference Books:

17. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
18. E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge,1976.
19. S.Heir "Grid Integration of WECS", Wiley 1998University Physics by Young and Freedman, Pearson Education (2012).

NPTEL/MOOC: https://nptel.ac.in/content/storage2/courses/121106014

https://www.ee.iitb.ac.in/~npsc2008/NPSC_CD/Data/Tutorial%202/Wind%20Energy%20Conversion%20Systems%20-%20Prof.%20S.B.%20Kedare.pdf

Course Code	Professional Elective-V Electrical distribution system	L	T	P	C
1002204194		3	0	0	3

COURSE OBJECTIVES:

To introduce basic knowledge about various types of distribution network systems and to calculate the voltage drops occurring in a distribution network and to study the distribution system protection and its coordination and also study the effect of compensation for power factor improvement.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To study different factors of Distribution system
CO2	To study and design the substations and distribution systems
CO3	To study the concepts of voltage drop and power loss& the effect of voltage control on distribution system
CO4	To study the distribution system protection and its coordination & the effect of compensation for power factor improvement

UNIT- I

General Concepts

Introduction to distribution systems, Load modeling and characteristics – Coincidence factor-Contribution factor loss factor – Relationship between the load factor and loss factor – Classification of loads (Residential, commercial, Agricultural and Industrial).

UNIT-II

Substations

Location of substations**:** Rating of distribution substation – Service area with 'n' primary feeders – Benefits and methods of optimal location of substations..

Distribution Feeders

Design Considerations of distribution feeders**:** Radial and loop types of primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.

UNIT-III

System Analysis

Voltage drop and power–loss calculations**:** Derivation for voltage drop and power loss in lines – Uniformly distributed loads and non-uniformly distributed loads – Numerical problems.

Voltage Control

Voltage Control**:** Equipment for voltage control- Effect of AVB/AVR – Line drop compensation, Basic Numerical problems.

UNIT-IV

Protection

Objectives of distribution system protection –Protective devices**:** Principle of operation of fuses-Circuit reclosures – Line sectionalizes and circuit breakers.

Coordination

Coordination of protective devices**:** General coordination procedure –Various types of coordinated operation of protective devices - Residual Current Circuit Breaker

UNIT-V

Compensation for Power Factor Improvement

Capacitive compensation for power factor control – Different types of power capacitors –shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction –Numerical problems.

Text Book:

1. Electrical Power Distribution Systems by V. Kamaraju, Right Publishers.
2. "Electric Power Distribution system, Engineering" – by Turan Gonen, McGraw–hill Book Company.

Reference Books:

1. Electrical Distribution Systems by Dale R. Patrick and Stephen W. Fardo, CRC press
2. Electric Power Distribution – by A.S. Pabla, Tata McGraw–hill Publishing company, 4th edition, 1997.
3. Electrical Power Distribution Systems by V. Kamaraju, Right Publishers.

E-Books: (Specify links)

NPTEL/MOOC:

http://nptel.ac.in/courses/108102047/23

https://www.youtube.com/watch?v=RDgyRQJsCU8

https://www.youtube.com/watch?v=iUx8a96rh_E

https://www.youtube.com/watch?v=2L7jnaXuOc8

https://www.youtube.com/watch?v=fQNQKkvGQL0&list=PLF223FE6A077ADC72

https://www.youtube.com/watch?v=FX7ybxrVNHA&list=PLF223FE6A077ADC72&index=2

https://www.youtube.com/results?q=distribution+system+analysis
https://www.youtube.com/watch?v=DG9R8_yLDag
https://www.youtube.com/watch?v=y-Ilp9STeMM

https://www.youtube.com/watch?v=RU6jtai4wys
https://www.youtube.com/watch?v=7LWBpIcU_M0

https://www.youtube.com/watch?v=TBixdOgRZ38

https://www.youtube.com/watch?v=opocYkK_oSA
https://www.youtube.com/watch?v=_FY1pZ8MPKM
https://www.youtube.com/watch?v=XjvefqfhT78

Course Code	Professional Elective-V POWER QUALITY	L	T	P	C
1002204195		3	0	0	3

COURSE OBJECTIVES:

1. To learn different types of power quality phenomena.
2. To identify sources for voltage sag, voltage swell, interruptions, transients, long duration over voltages and harmonics in a power system.
3. To describe power quality terms and study power quality standards.
4. To learn the principle of voltage regulation and power factor improvement methods.
5. To explain the relationship between distributed generation and power quality.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand significance of power quality and power quality parameters
CO2	Know types of transient over voltages and protection of transient voltages.
CO3	Understand harmonics, long voltage variation, flicker. their effects, harmonic indices and harmonic minimization techniques
CO4	Analyze power quality aspects in distributed generation

UNIT- I

OVERVIEW OF POWER QUALITY [8 Hours]

Concern about the Power Quality - General Classes of Power Quality Problems – Transients - Long-Duration Voltage Variations - Short-Duration Voltage Variations - Voltage Unbalance - Waveform Distortion - Voltage fluctuation - Power Frequency Variations - Power Quality Terms - Voltage Sags and Interruptions - Sources of Sags and Interruptions – Nonlinear loads.

UNIT-II

TRANSIENT OVER VOLTAGES [8 Hours]

Source of Transient Over Voltages - Principles of Over Voltage Protection - Devices for Over Voltage Protection - Utility Capacitor Switching Transients - Utility Lightning Protection - Load Switching Transient Problems - Computer Tools for Transient Analysis.

UNIT-III

HARMONIC DISTORTION AND SOLUTIONS [8 Hours]

Voltage vs. Current Distortion - Harmonics vs. Transients - Power System Quantities under Nonsinusoidal Conditions - Harmonic Indices – Sources of harmonics - Locating Sources of Harmonics – System Response Characteristics - Effects of Harmonic Distortion – Interharmonics - Harmonic Solutions Harmonic Distortion Evaluation - Devices for Controlling Harmonic Distortion - Harmonic Filter Design - Standards on Harmonics

UNIT-IV

LONG DURATION VOLTAGE VARIATIONS [8 Hours]

Principles of Regulating the Voltage - Device for Voltage Regulation - Utility Voltage Regulator Application - Capacitor for Voltage Regulation - End-user Capacitor Application - Regulating Utility Voltage with Distributed Resources – Flicker.

UNIT-V

DISTRIBUTED GENERATION AND POWER QUALITY [8 Hours]

Resurgence of Distributed Generation - DG Technologies - Interface to the Utility System - Power Quality Issues - Operating Conflicts - DG on Low Voltage Distribution Networks - Interconnection standards - Wiring and Grounding - Typical Wiring and Grounding Problems - Solution to Wiring and grounding Problems.

Text Books:

1. Electrical Power Systems Quality, Dugan R C, Mc Granaghan M F, Santoso S, and Beaty H W, Second Edition, McGraw-Hill, 2002.
2. Power Quality Primer, Kennedy B W, First Edition, McGraw-Hill, 2000.
3. Understanding Power Quality Problems: Voltage Sags and Interruptions, Bollen M H J, First Edition, IEEE Press; 2000.
4. Power System Harmonics, Arrillaga J and Watson N R, Second Edition, John Wiley & Sons, 2003.

Reference Books:

20. Electric Power Quality Control Techniques, W. E. Kazibwe and M. H. Sendaula, Van Nostrad Reinhold, New York.
21. Power Quality, C. Shankaran, CRC Press, 2001
22. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis)
23. Power Quality in Power systems and Electrical Machines-Ewald F. Fuchs, Mohammad A.S. Masoum-Elsevier.

NPTEL/MOOC: https://nptel.ac.in/courses/108/107/108107157/

Course Code	Professional Elective-V MOOCS	L	T	P	C
1002204171		3	0	0	3

Course Code	Open Elective-III COMPUTER NETWORKS	L	T	P	C
1012203100		3	0	0	3

COURSE OVERVIEW:

This course aims at hardware configuration of network and focusing on layer approach and their functionalities, connection establishment, data transfer, protocols, architectures and connection termination process. The detailed study help the student to settle their future in Hardware engineering.

COURSE OBJECTIVES:

- Building a firm foundation for understanding fundamentals of Data Communications and Computer Networks.
- Familiarize with the basic terminologies of Computer Networking area.
- Understand the state of art in Network protocols, Architecture and Applications.
- Acquire the knowledge of the basic protocols involved in wired communication process.
- Understand Process of Networking Research, Approach and Analysis

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Identify the different types of network topologies and protocols.
CO2	Enumerate the layers of the OSI model and TCP/IP models.
CO3	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation and understand routing and congestion control algorithms.
CO4	Understand how internet works.

UNIT- I

INTRODUCTION:

Network Topologies, Types of Networks: WAN, LAN, MAN.

Reference models: The OSI Reference Model, the TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models.

Physical Layer: Guided Transmission medium

UNIT-II

THE DATA LINK LAYER – DESIGN ISSUES:

Services provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection: Parity check, Checksum, CRC, Elementary Data Link Protocols: A Utopian Simplex Protocol, A Simplex Stop and Wait Protocol for an Error free channel, A Simplex Stop and Wait Protocol for a Noisy Channel,

Sliding Window Protocols: One Bit Sliding Window Protocol, A Protocol Using Go-Back-N, Selective Repeat

UNIT-III

THE MEDIUM ACCESS CONTROL SUB LAYER –

The Channel Allocation Problem: Static Channel Allocation, Dynamic Channel Allocation, Multiple Access Protocols: Aloha, pure ALOHA, Slotted ALOHA, CSMA: CSMA/CD, CSMA/CA Ethernet: IEEE 802.3

UNIT-IV

THE NETWORK LAYER- DESIGN ISSUES –
Store and Forward Packet Switching, Services provided to the Transport layer, Routing Algorithms: The Optimality principle, shortest path Algorithm, Congestion Control Algorithms: Approaches to Congestion Control, Traffic Throttling-Load Shedding

UNIT-V

Transport Layer: Transport Services, TCP and UDP protocols
Application Layer –The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services.

Text Books:

1. **Computer Networks** (5th Edition) – Andrew S. Tanenbaum. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010.
2. **Computer Networks**: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education.

Reference Books:

3. Computer Networking: A Top-Down Approach (6th Edition) – Kurose and Ross
4. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition) – Douglas E. Comer.

Course Code	Open Elective-III WEB DESIGN	L	T	P	C
1005201202		3	0	0	3

COURSE OBJECTIVES:

1. To understand computer programming and application software, package/ suites.
2. Design static web application development and Students will gain the skills and front designs.
3. Able to get project-based experience needed for entry into web application and development careers.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Understand the various applications and computer programming languages purpose.
CO2	Describe the basic concepts of client server application and WWW
CO3	Describe the basic concepts of HTML & CSS to design web pages and web site
CO4	Analyze a given problem and apply requisite appropriate tools for designing interactive web applications

UNIT- I

INTRODUCTION [8 Hours]

Types of computer applications (Console, Window, web based mobile and cloud applications). Brief History of Internet, What is World Wide Web, Why create a web site, Web Standards. About Client and server process.

Introduction to HTML: History of HTML, What are HTML Tags and Attributes? HTML Tag vs. Element, HTML Attributes. Basic Syntax, Standard HTML Document Structure

UNIT- II

HTML Tags: [10 Hours]

Basic Text Markup, Text formatting tags, Heading types, font tag, Images, image map, Hypertext Links, navigating web pages. What is Lists and various types of list, design the Tables using table tag.

UNIT- III

USER INTERACTIVE WEB PAGE [10 Hours]

Form tag, user interactive components, Text box, lable, text area, check box, radio button, drop down box, submit and reset. **Frames:** Importance of frames, divide the web browser window into different sections. Introduction to HTML5.

UNIT- IV

Cascading Style Sheets: **[8 Hours]**

Creating Style Sheet ,CSS Properties, Types of CSS, CSS Styling(Background, Text Format, Controlling Fonts) Working with block elements and objects, Working with Lists and Tables, CSS Id and Class.

UNIT- V

Scripting Languages: **[10 Hours]**

Introduction to Client side and server side scripting languages.

Java Script: Variables, arrays, decision control and loop statements, Functions.

Introduction to PHP script and working with get and post methods.

Text Books:

3. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson.
4. Web Technologies, Uttam K Roy, Oxford
5. The Web Warrior Guide to Web Programming, Bai, Ekedahl, Farrelll, Gosselin, Zak, Karparhi, Maclntyre, Morrissey, Cengage

Reference Books:

24. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, Dream Tech.
25. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage Learning

Course Code	Open Elective-III BIG DATA ANALYTICS	L	T	P	C
1005203233		3	0	0	3

COURSE OBJECTIVES:

1. Optimize business decisions and create competitive advantage with Big Data analytics
2. Introducing Java concepts required for developing map reduce programs
3. Derive business benefit from unstructured data
4. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
5. To introduce programming tools PIG & HIVE in Hadoop echo system.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Preparing for data summarization, query, and analysis.
CO2	Applying data modeling techniques to large data sets.
CO3	Creating applications for Big Data analytics.
CO4	Building a complete business data analytic solution.

UNIT- I

Working with Big Data: Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files. **[8 Hours]**

UNIT- II

Writing Map Reduce Programs: A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), Basic programs of Hadoop Map Reduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner. **[8 Hours]**

UNIT- III

Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators. **[10 Hours]**

UNIT- IV

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin. **[8 Hours]**

UNIT- V

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data. **[8 Hours]**

Text Books:

1. Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
2. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
3. Hadoop in Action by Chuck Lam, MANNING Publ.
4. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss

Reference Books:

1. Hadoop in Practice by Alex Holmes, MANNING Publ.
2. Hadoop MapReduce Cookbook, SrinathPerera, Thilina Gunarathne

Course Code	Open Elective-III MECHATRONICS	L	T	P	C
1003204135		3	0	0	3

COURSE OBJECTIVES:

To make the student

•Understand various elements of a mechatronic system and how theyintegrate.
•Understand the concept of signal conditioning and digital signalProcessing.
•Know various components of hydraulic and pneumatic systems.
•Know the working of electrical actuation systems.
•Learn how different types of control systems are used for various practical applications.

COURSE OUTCOMES:

COs	Course outcome
CO1	Understanding the different sensors, transducers, signal conditioning techniques
CO2	Design the mechatronic motion logic control system and the key elements in its design
CO3	Develop a PLC programming techniques with Microprocessor, ladder diagram for different logic Gates
CO4	Design and Implementation of Micro Mechatronics System

UNIT-I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT-III

Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-IV

Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and

Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives. Dynamic models and analogies, System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

Text Books:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan& MS Balasundaram/WILEY India Edition.

References:

1 Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
2 Mechatronics Source Book / Newton C Braga/Thomson Publications,Chennai.
3 Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4 Mechatronics System Design / Devdasshetty/Richard/Thomson.
5 Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6 Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/Pearson, 2012
7 Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

Course Code	Open Elective-IV MACHINE LEARNING	L	T	P	C
1054203100		3	0	0	3

COURSE OBJECTIVES:

1. Familiarity with a set of well-known supervised, unsupervised and semi-supervised learning
2. The ability to implement basic machine learning algorithms
3. Understanding of how machine learning algorithms are evaluated
4. Applying new concepts and solving problems using different machine learning techniques.

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	Recognize the characteristics of machine learning that make it useful to real-world Problems.
CO2	Characterize machine learning algorithms as supervised, semi-supervised, and Unsupervised.
CO3	Be able to use support vector machine, regularized regression algorithms.
CO4	Understand the concept behind neural networks for learning non-linear functions.

UNIT- I

INTRODUCTION TO MACHINE LEARNING:

Introduction to machine learning, Definition, traditional programming vs machine learning algorithms, learning a system, supervised learning, unsupervised learning and reinforcement learning, application areas**.** **[10 Hours]**

UNIT-II

CLASSIFICATION AND REGRESSION MODELS

Linear Separability and decision regions, linear discriminates, linear regression, logistic regression, decision trees-ID3 and C4.5, KNN.

[10 Hours]

UNIT-III

DIMENSIONALITY REDUCTION AND SUPPORT VECTOR MACHINES

Dimensionality reduction and Feature selection, Dimensionality reduction algorithms: LDA and PCA, Margin of a classifier, Support Vector Machine, learning nonlinear hypothesis using kernel functions. **[10 Hours]**

UNIT-IV

CLUSTERING AND ENSEMBLE METHODS

Introduction to clustering: K-means clustering, Gaussian mixture model, Ensemble Methods: bagging and boosting, Random forest and AdaBoost algorithms and Bayesian learning

algorithm.
[10 Hours]

UNIT-V

ARTIFICIAL NEURAL NETWORKS:
Introduction,The perceptron, the perceptron learning algorithm, Multilayer neural networks, activation functions, Back Propagation algorithm and introduction to Deep learning models: CNN. **[10 Hours]**

Text Books:

1. Tom Mitchell, *"Machine Learning"*, Mc GrawHill publications, 1997
2. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
3. Introduction to Machine Learning with Python by Andreas C. Müller, Sarah Guido O'Reilly Media.
4. Deep Learning by Josh Patterson, Adam Gibson, O'Reilly Media.

Reference Books:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge.
2. Machine Learning in Action, Peter Harington, 2012, Cengage.

Course Code	Open Elective-IV INDUSTRIAL ROBOTICS	L	T	P	C
1003202242		3	0	0	3

Course Overview:

The course covers the principles and working of robots and their significance in view of their importance in the current scenario and their potential future applications for industry automation.

Course Objectives:

1.To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.

2.The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.

3.Mathematical approach to explain how the robotic arm motion can be described.

4.The students will understand the functioning of sensors and actuators.

CO's	Course outcome
CO1	Understand the various robot configuration and components
CO2	Choose appropriate actuators and sensors for a robot based on specific application
CO3	Analyze the kinematic and dynamic analysis for simple serial kinematic chains
CO4	Explain trajectory planning for a manipulator by avoiding obstacles.

Unit-I:

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

Unit-II:

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

Unit-III:

MOTIONANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

Unit-IV:

Differential transformation and manipulators, Jacobians – problems Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

Unit-V:

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer - Material handling,loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1.Industrial Robotics / Groover M P /Pearson Edu. 2.Robotics and Control / Mittal R K &Nagrath I J / TMH.

Reference Books:

1.Robotics / Fu K S/ McGraw Hill.

2.Robotic Engineering / Richard D. Klafter, Prentice Hall

3.Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt.Ltd.

4.Introduction to Robotics / John J Craig / Pearson Edu

Course Code	Open Elective-IV	L	T	P	C
1019203200	IOT AND ITS APPLICATIONS	3	0	0	3

COURSE OBJECTIVES:

The main objective of course make student to understand the IoT basic concepts, standards, communication protocols, technological relation and real time applications and their design, implementation and deployment issues..

COURSE OUTCOMES:

CO's	At the end of the course, the student will have the ability to:
CO1	To Understand the Architecture, protocols and applications of IoT.
CO2	To Analyse the communication protocols and standards used in IoT
CO3	To analyse and design the simple IoT applications to monitor or control IoT devices using simulation or hardware
CO4	To implement the real time IoT applications.

UNIT- I **[10 Hours]**

Introduction to IoT:

Need of Internet of Things, Internet of Things ERA, Characteristics of Internet of Things, architectural view of Internet of Things, Technologies behind Internet of Things – Server-End Technology – Major Components of IoT system – Development Tools – API and device interfacing components

UNIT- II **[10 Hours]**

IoT Design: Physical Design of IOT, Things in IoT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels, Sources of IoT, Examples of IoT – Smart Watch – Smart Home – Smart Phone.

UNIT- III **[8 Hours]**

IoT Communication:

M2M communication – M2M to IoT – M2M architecture – software development tools, Communication Technologies – Wireless communication technologies – Wired Communication, IoT Protocols, IoT functional blocks – IoT communication models.

UNIT- IV **[8 Hours]**

IoT Physical Devices & Endpoints: Basic building blocks of IoT devices, Introduction to Raspberry Pi , About the Board , Operation System on Raspberry Pi , Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Interfacing LED, Sensor with raspberry pi.

UNIT- V **[8 Hours]**

Home Automation – Smart lighting – Home intrusion detection, Cities – smart parking, Environment – Weather monitoring system – Air Pollution Monitoring – Forest Fire Detection, Agriculture – smart irrigation system.

Text Books:

1. Internet of Things: A hands-On Approach, Arshdeep Bahga, Vijay Madisetti, 2014 edition, University Press.
2. The Internet of Things: Enabling technologies, Platforms and Use cases, Pethuru Raj and Anupama C. Raman, 2017 edition, CRC Press, Taylor and Francis Group.

Reference Books:

1. Internet of Things: Architecture and design Principles, Raj Kamal, Tata Mc-Graw hill Edition.

Course Code	Open Elective-IV DISASTER MANAGEMENT	L	T	P	C
1001204140		3	0	0	3

Course Overview:

Disastermanagement is an advanced skill that can minimize damage caused by earthquake, flood or storm. This course provides the understanding and ability to analyze different uncertain situation during the natural calamity. Through this course student can learn the stages of disaster in hydrological disaster. This course also develops the potential of new, evolving technologies to meet vulnerability mapping, modelling and emergency management needs for geological hazards, hydrological and coastal hazards.

Course Objectives:

1. Understand different types of disaster and its triggering features
2. Understand and analyses hydrological disaster
3. Understand and develop models for geological disaster
4. Able to understand the coastal hazard and shore defence structures
5. Capable to preparing vulnerability mapping and risk assessment and developing Emergency Management System.

Course Outcomes:

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

	Course Outcome
CO1	To know the basic concepts in Disasters and its triggering factures
CO2	To understand stages of hydrological disaster
CO3	To analysis the causes, effects, impacts and of hydrological, geological and coastal hazards.
CO4	To understand the mitigation procedure of uncertain events

Unit-I:

Disasters: Definition- Hazard Risk, Mitigation, Natural and human induced disasters types of hazards, disasters and catastrophes – Disaster Management.

Unit-II:

Hydrological Hazards: Flooding – PMP – PMF – Inundation mapping -flood prone area analysis and management. Dam breach analysis - Drought- types of drought - Factors influencing drought - delimiting drought prone areas - drought index, SPI and Palmer.

Unit-III:

Geological Hazards: Earthquakes; location, faults, causes, types, associated hazards and impacts, Richter scale and Modified Mercalli scale. Mass movements: Definition of landslide - types – causes - slope stability analysis.

Unit-IV:

Coastal Hazards – storm surge – Tsunami and floods – cyclone – coastal vulnerability – shore line erosion – shore defense structures.

Unit-V:

Mitigation and Management: Hazard, Risk and Vulnerability mapping and modelling using GIS. Case studies for earth quake zonation. Risk Assessment – Preparedness GIS case studies for earthquake, landslide–risk assessment–GIS, landslide and cyclones. Emergency Management Systems (EMS) in the Disaster Management Cycle.

Text Books:

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.

Reference Books:

1. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.
2. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.
3. Arnold M et.al Ed. (2006) Natural Disaster Hotspots: Case Studies. The World Bank Hazard Management Unit Washington, D.C.204p.

Course Code	INDUSTRIAL PROGRAMMABLE LOGIC CONTROLLERS	L	T	P	C
1002204180		1	0	2	2

COURSE OVERVIEW:

In most of the industry applications, computer control is gaining importance, PLC is an industry computer, and hence this course PLC makes the students to acquire knowledge required for industry.

COURSE OBJECTIVES:

- To have knowledge on Basic PLC Modules.
- To acquire the knowledge on programming of PLC.
- To understand ladder logic for timer and counter functions to PLC.
- To acquire knowledge on PLC hardware connections and programming to Develop prototype model and write a logic for any industrial control application.

COURSE OUTCOMES: At the end of the course, the student will be able to

CO's	At the end of the course, the student will have the ability to:
CO1	**Understand** the the PLCs and their I/O modules and **apply** the knowledge to connect devices to I/O modules.
CO2	**Understand** the basic concepts of Ladder Logic Programming and **Construct** the Logic for Industrial applications.
CO3	**Understand** the concepts of Timer and Counter Logic Blocks. Gain the knowledge to write ladder logic for timer and counter functions to PLC
CO4	**Understand** the Concepts of Math and Sequential instructions and **make use of** these concepts to able to write and develop logic for any industrial control application

UNIT-I

PLC BASICS: **[08 Hours]**

PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, devices connected to I/O modules.

Outcome: Students will be able to understand the basic Block Diagram of PLC. Also Devices Connected to I/O Modules.

Activity / virtual lab: Identification of different modules and its Specifications in Allen Bradley PLC.

UNIT II

PLC PROGRAMMING: [10 Hours]

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils.
Math instructions: Addition, subtraction, multiplication & division instruction. Data manipulation Instructions.

Outcome: Student will able to understand the basic programming Instructions and theDigital ladder logics using concept of digital gates.

Activity: Convert any one complex digital ladder logic to simple one using concept of Boolean algebra.

UNIT- III
PROGRAMMABLE TIMERS AND COUNTERS: [10 Hours
Timer instructions: On delay timer instruction, Off delay timer instruction, Retentive timer Counter instructions: Up counter, Down counter, Counter applications, Combining counter an timer functions.
Outcome: Student will able to write ladder logic for timer and counter functions to PLC.

Activity: Write a ladder logic for Industrial metal grinding application.

UNIT-IV

PROGRAM CONTROL AND OTHER INSTRUCTIONS: [08 Hou

Master control reset instruction, Jump instructions and sub routines, Immediate input and out instructions.
Data transfer operation, Data compare instruction, Data manipulationPrograms, Numerical c I/O interfaces. Sequential instructions, Sequence programs, ShiftRegisters, Word shift registe

Outcome: Student will able to understand the Operation of Program control, Data manipulat and other programming Instructions.
Activity/ Virtual lab: Develop prototype model and write a logic for the serial set for Arrow indication.

UNIT-V

APPLICATIONS: [10 Hours]

Control of water level, Alarm monitor, Conveyor motor control, Parking garage.

Outcome: Student will able to Develop prototype model and write a logic for any industrial control application.

Activity/ Virtual lab: Develop a photo type model of Water level control using PLC.

Text Books:

5. Programmable logic controllers by Frank D. Petruzella- McGraw Hill – 3rd Edition.
6. Programmable Logic Controllers – Principle and Applications by John W. Webb and
Ronald A. Reiss, Fifth Edition, PHI

Reference Books:

26. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.
27. Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.
28. Programmable Logic Controllers –W. Bolton-Elsevier publisher.

E-Books:

1.https://www.academia.edu/37028833/_Frank_D_Petruzella_Programmable_Logic_Controlle_BookSee_org_

2. https://hcu.on.worldcat.org/search?queryString=no%3A23383932#/oclc/23383932

NPTEL/MOOC:

1. https://nptel.ac.in/courses/108/105/108105088/

Course Code	Open Elective-IV IPR & Patents	L	T	P	C
1099204120		2	0	0	0

Course Overview: The aim of this subject is to introduce the basic concepts of Intellectual property laws to the students for first time and familiarize them with the kind of rights, remedies and licensing regime associated with each kind of intellectual property so that students can have a basic understanding of Intellectual Property laws.

COURSE OBJECTIVES:

Upon successful completion of this subject students should be able:

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3. To disseminate knowledge on copyrights and its related rights and registration aspects
4. To disseminate knowledge on trademarks and registration aspects
5. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
6. To aware about current trends in IPR and Govt. steps in fostering IPR

COURSE OUTCOMES:

To acquaint the students with:

CO's	At the end of the course, the student will have the ability to:
CO 1	Interpret the various aspects of IPR
CO 2	Conclude importance of Copyrights, Trademarks & Trade Secrets
CO 3	Obtain Patent Rights for New Innovations
CO 4	Elaborate on Privacy Issues

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration –Geographical indications- Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues- India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers **–** Copyright Formalities and Registration– Limitations – Infringement of Copyright – International Copyright Law - Semiconductor Chip Protection Act-Fair use and Fair Dealing concepts

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law - Invention Developers and Promoters-Non patentable inventions

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Concept of distinctiveness -Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law-Plant Variety Protection and Farmer's Right- Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime

Text Books

1. "Law Relating to Intellectual Property Rights" by V K Ahuja
2. "Intellectual Property Rights" by Neeraj Pandey and Khushdeep Dharni

Reference Books

3. "Intellectual Property Rights: Text and Cases" by R Radhakrishnan and S Balasubramanian
4. "Intellectual Property Rights-Infringement and Remedies" by Ananth Padmanabhan
5. "Intellectual Property Rights (IPRs): TRIPS Agreement and Indian Laws" by E T Lokganathan
6. .B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications Universal law Publishing Pvt. Ltd., India 2000
7. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi ,2010
8. Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford. P. Narayanan, Intellectual Property Law, Eastern Law House

E-Books and Online Resources

9. Intellectual Property Rights A general Introduction https://www.pdfdrive.com/intellectual-property-rights-a-general-introduction-e41126141.html

NPTEL/SWAYAMMOOCS:

10. https://www.my-mooc.com/en/mooc/intellectual-property-law-policy-part-1-pennx-iplaw1x/

Course Code	Industrial/Research Internship	L	T	P	C
1002204160		0	0	0	2

IV YEAR II SEMESTER

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
PROGRAM STRUCTURE – VR-20

IV Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002204260	**Main Project**	0	0	0	12
2	**SEMESTER LONG INTERNSHIP**					
	Total Credits:					**12**