Academic Regulations

Program structure & Detailed Syllabus

For

Under Graduate Programme (B.Tech)

ELECTRICAL AND ELECTRONICS ENGINEERING

(Applicable For Batches Admitted From 2019 – 2020)

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)

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ACADEMIC REGULATIONS

(VR 19)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)

VISAKHAPATNAM

ACADEMIC REGULATIONS for B. Tech. (Regular)

(Applicable for the batches admitted from 2019-20)

The Admission of students into B.Tech. program shall be as per 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 the award of a degree, regular candidate has to register for 160 credits and shall secure 160 credits.
c. For lateral entry scheme admission: A program of study for not less than three academic years and not more than six academic years. Candidate has to register for 120 credits and shall secure 120 credits.

2. Programs of Study

The following programs of study are offered at present for specialization in the B. Tech. Program.

Program Code	Program & Abbreviation
01	Civil Engineering (CE)
02	Electrical and Electronics Engineering (EEE)
03	Mechanical Engineering (ME)
04	Electronics and Communication Engineering (ECE)
05	Computer Science and Engineering (CSE)
12	Information Technology (IT)
19	Electronics and Computer Engineering (ECOME)
54	*Artificial Intelligence and Data science (AID)

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

*code will be assigned later

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 & laboratory hours, industry experience and to develop technical skills required for a career in the industry or a career in research.

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 and 50 marks for practical course.

ii) For courses involving laboratory with theory as **integrated course**

Theory and practical will be evaluated for 100 and 50 marks respectively

The credits will be awarded only if a student gets 50% marks independently in theory part as well as practical part

For theory course (including all types of electives), the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Examinations.

5.1. 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 examination shall be conducted for 30 marks.

5.1.2. **Constitution of India** course will be totally internal evaluation

5.1.3. **Extra-Curricular Activities, sports & games:** Though this course has no credits, it is mandatory to satisfy minimum attendance of 80%.

5.2. Mini project–I (Societal relevant project): 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 for 20 marks ii) External assessment for 30 marks

5.3. Mini project-II: It is carried out during the third year. The students have an option to choose their own area of interest which may be related to the course work. Evaluation procedure is same as Mini project-I.

5.4. Main Project/Internship

Main project/Internship shall be carried out in the IV-year and evaluated for 200 marks.

Internship is to create a platform for a job or further research in the chosen area. Eligible students based on merit may opt for a full semester Internship during the fourth year in the industry of same discipline.

5.5. MOOCs: A massive open online course (MOOC) is an online course aimed at large-scale interactive participation and open access via the web. In addition to traditional course materials such as videos, readings, and problem sets, MOOCs provide interactive user forums that help

build a community for the students, professors, and teaching assistants (TAs). MOOCs are a recent development in distance education. Up to 40% of credits per semester as per recent UGC circular in the curriculum may be taken as MOOC course. 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 when offered. If the same course is not available an alternate course decided by department level committee may be registered and successfully passed. The internal marks secured earlier are 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.

5.6. Technical seminar: Technical seminar is carried out during the Thirdyear. For Technical seminar, the student shall present on an emerging/specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated through presentation by the Departmental Committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

5.7. Audit courses: List of audit courses will be notified from time to time. An indicative list of the courses is as shown below.
i) Environmental science, ii) Constitution of India, iii) Extra-curricular activities, sports & games, iv) Professional ethics & Human values

All audit courses will be "Pass/Fail" courses with no specific credit point 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.
Note: Audit course will be totally internal evaluation (paper setting as well as valuation will be done by internal expert). Mid and End semester examinations shall be conducted for all Audit courses. It is mandatory to pass all Audit Courses**.**

6. Attendance Requirements:

Aggregate 75% of the attendance is required for promotion to next 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 Monitoring Committee shall review the situation and take appropriate decision.

Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee based on genuine medical

grounds. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study***.

A stipulated fee shall be payable towards condonation of shortage of attendance.

Shortage of attendance may be considered for the students who participate in sports at National/International level, co and extra-curricular activities if their attendance is in the minimum prescribed limit.

Note-1: Special cases for students having extraordinary performance at National and International level will be considered by the Academic monitoring committee.

Note -2: Shortage of Attendance below 65% in aggregate shall not be considered for promotion.

7. Academic Requirements:

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

For all courses**,** 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.

Note: For courses where there is no internal evaluation or no external evaluation, pass mark is 50%.

8. Promotion Policy

For Regular Students:

i. For promotion to II Year from I Year, a student has to secure minimum 50% of total credits in the I year courses.
ii. For promotion to III Year from II Year, a student has to secure minimum 50% of total credits in the II Year courses.
iii. For promotion to IV Year from III Year, a student has to secure minimum 50% of total credits in the III Year.

For Lateral Entry Students:

i. For promotion to III Year from II Year, a student has to secure minimum 50% of total credits from II Year courses.
ii. For promotion to IV Year from III Year, a student has to secure minimum 50% of total credits in the III Year.

9. Supplementary examinations: Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa.

In case of failure in any course, a student may be permitted to register for the same course when offered.

In case of integrated courses, student has to reappear for failed part only (Theory part/Laboratory part), but credits will be awarded only after both parts are successfully completed.

Advance supplementary examination shall be conducted for IV Year, I semester courses during the study of IV Year, II semester.

Note: Instant Supplementary Examination will be conducted for one course from IV B. Tech- II Semester courses at the end of the program after declaration of results.

10. Grading System and award of class

10.1. 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
		Absent	-1
		Withheld	-2
		Malpractice	-3

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.

$SGPA\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$

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 program, 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.

- Equivalent Percentage = (CGPA – 0.75) X 10

10.2. 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 shall be placed in one of the following four classes:

Class Awarded	**CGPA to be secured**	**From the CGPA secured from 160 Credits.**
First Class with Distinction	≥ 7.75 without course failures during entire duration of study	
First Class	≥ 6.75 to<7.75	
Second Class	≥ 5.75 to < 6.75	

11. 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.

12. 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

13. Transitory Regulations: If a student is detained and has to get Re-admitted and follow the same regulation of year of admission.

Transfer cases:

- Transfer from other institutions is permitted as up to II Yr Second semester.
- A committee will be constituted for mapping the courses and credits.
- Student should not have any backlogs at the time of applying.

14. 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.

15. Withholding of Results

If the student has not paid the fee 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.

16. 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	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the

	examination.	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	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.

	other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any 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.	

17. 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.

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VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY: VISAKHAPATNAM

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAM STRUCTURE (VR-19)

I Year- I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1000191100	Mathematics-I	3	1*	0	3
2.	1000191122	Solid State Physics	3	1*	3	4.5
3.	1000191101	Mathematics-II	3	1*	0	3
4.	1003191100	Engineering Mechanics	3	1*	0	3
5.	1005191120	Problem solving and Programming using C	3	1*	3	4.5
6.	1000191130	Constitution of India	2	0	0	0
7.	1000191131	Extra-curricular Activities, Sports & Games	0	0	4	0
Total Credits :						**18**

I Year – II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1000191200	Transforms and Vector Calculus	3	1*	0	3
2.	1000191123	Applied Chemistry	3	0	3	4.5
3.	1002191221	Electrical Circuit Analysis-I	3	1*	3	4.5
4.	1003191101	Engineering Drawing	1	0	4	3
5.	1000191121	Technical English Communication	2	0	3	3.5
6.	1003191210	Engineering Workshop	0	0	3	1.5
7.	1000191110	Engineering Exploration	0	0	4	2
Total Credits :						**22**

Total Credits =18 + 22 = 40

II Year- I Semester

S.No	Course Code	Name of the Course	L	T	P	Credits
1	1002192100	Fundamentals of signals and systems	3	1*	0	3
2	1002192120	Electrical Machines-I	3	1*	3	4.5
3	1002192101	Electro Magnetic Fields	3	1*	0	3
4	1004192122	Basic Electronic Devices and Circuits	3	1*	0	4.5
5	1000192110	Communication skills Lab	0	0	2	1
6	1002192102	Electrical Circuit Analysis-II	3	1*	0	3
Total Credits :						**19**

II Year- II Semester

S.No	Course Code	Name of the Course	L	T	P	Credits
1	1002192220	Electrical Machines-II	3	1*	3	4.5
2	1004192203	Analog Electronics	3	1*	0	3
3	1002192201	Power Generation Engineering And Economics	3	1*	0	3
4	1002192221	Control Systems	3	1*	3	4.5
5	1099192200	Management Science	2	0	0	2
6	1000192130	Environmental Science	2	0	0	0
7	1020192100-1020192102	Open Elective-1	3	0	0	3
8	1002192170	Mini Project-I (EPICS/Societal Relevant Project)	0	0	2	1
Total Credits :						**21**

Open Elective-I		
S. No.	**Course Code**	**Course Title**
1	1020192100	Employability Readiness Program-I
2	1020192101	Public Administration
3	1020192102	Foreign Linguistic - French

III Year- I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002193100	Power transmission engineering	3	0	0	3
2	1002193120	Electrical Measurements and Instrumentation	3	0	3	4.5
3	1002193121	Power Electronics	3	0	3	4.5
4	1004193102	Digital Electronics	3	0	0	3
5		**Professional Elective-I**	3	0	0	3
	1002193150	Digital control systems				
	1002193151	Energy audit conservation and management				
	1002193152	Special Electrical Machines				
6		**Open Elective-II**	3	0	0	3
	1012193161	Fundamentals of Python Programming				
	1003193162	Mechatronics				
	1004193161	Signal Processing				
7	1099193131	IPR & Patents	2	0	0	0
8	1002193180	Technical Seminar	0	0	0	1
Total Credits:						**22**

Program Structure

&

Detailed Syllabus

I Year- I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1000191100	Mathematics-I	3	1*	0	3
2.	1000191122	Solid State Physics	3	1*	3	4.5
3.	1000191101	Mathematics-II	3	1*	0	3
4.	1003191100	Engineering Mechanics	3	1*	0	3
5.	1005191120	Problem solving and Programming using C	3	1*	3	4.5
6.	1000191130	Constitution of India	2	0	0	0
7.	1000191131	Extra-curricular Activities, Sports & Games	0	0	4	0
Total Credits :						**18**

Course Code: 1000191100	MATHEMATICS – I	L	T	P	Credits
		3	1	0	3

Course Overview:

This course deals with differential equations and its application with more focus on Engineering Mathematics. This course helps the students to learn relevant mathematical tools which are required in the analysis of problems in engineering and scientific professions. Topics included in this course are functions of two variables, higher order linear differential equations, Laplace Transforms, Inverse Laplace transforms, Partial differential equations of first order.

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 solve first order partial differential equations by analytical methods.

Course Outcomes: The student will be able

	Course outcome	Level as per Bloom's Taxonomy	PO number mapped
CO1	To understand the mean value theorems and evaluate maxima and minima of functions of two variables without constraints.	L2, L4	PO1 PO2
CO2	To understand different analytical methods to solve higher order linear differential equations.	L2, L3	PO1 PO2
CO3	To understand Laplace transform technique to solve initial and boundary value problems arising in engineering stream.	L2, L3	PO1 PO2
CO4	To understand solution of first order linear partial differential equations.	L2, L3	PO1 PO2

UNIT- I **L: 08**

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

Outcome: The student is able to find stationary point of a curve and extreme values of a given function.
Activity/Event: Finding Extreme value of functions of two variables.

UNIT II **L: 08**

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 typee^{ax},sin ax, cos ax, x^k, method of variation of parameters.

Outcome: The student will be able to solve higher order linear differential equations with constant coefficients.
Activity/Event: Finding current in LCR circuits

UNIT -III **L: 08**

Laplace Transforms: Introduction - Laplace transforms of standard functions – Shifting Theorems - Transforms of derivatives and integrals - multiplication by t^n - division by t – Unit step function, Unit impulse function.

Outcome: The student will be able to Understand Laplace transform of standard functions.
Activity/Event: Seminar by student.

UNIT -IV **L: 08**

Inverse Laplace Transforms: Introduction - Properties – Inverse Laplace by using partial fractions and Convolution theorem (without proof)-solving initial and boundary value problems by using Laplace Transform.

Outcome: The student is able to apply Inverse Laplace transform of standard functions.

Activity/Event: The student will be able to apply Inverse Laplace transform technique to solve differential equations with given initial conditions.

UNIT-V: **L: 08**
Partial Differential Equations of first order: Solutions of first order linear (Lagrange) equation and nonlinear (standard type $f(p,q)=0, f(z,p,q)=0, f(x,p)=g(y,q)$&$claurits$) equations.

Outcome: Student is able to solve first order partial differential equation by different analytical methods.

Activity/Event: Modeling the linear first order PDE and solving.

Text Books:

1. Higher Engineering Mathematics by H.K. Dass, S.Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, TataMcGrawHill 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		L	T	P	Credits
1000191122	**SOLID STATE PHYSICS**	**3**	**1**	**3**	**4.5**

The course covers the topics of crystal structures, crystal systems, X-ray diffraction and their applications. Further, deals with the concepts of semiconductor, superconductivity, magnetic and dielectric materials.

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:

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

	Course outcome	Level as per Bloom's Taxonomy	PO number mapped
CO1	Apply the basic knowledge of crystal structures to characterize the materials using X-ray diffraction techniques.	L2 L3	PO-1, PO-2 PO-9, PO-12
CO2	Discuss the magnetic and electrical properties of materials.	L2 L3	PO-1, PO-2, PO-9
CO3	Describe the important properties of superconductors and their utilization in different engineering applications.	L2 L3	PO-1, PO-2, PO-9, PO-12
CO4	Make use of the basic concepts of energy bands in crystalline solids to understand semiconductor physics.	L2 L3	PO-1, PO-2, PO-9, PO-12

UNIT- I **L: 08**

CRYSTAL STRUCTURES:

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.

Outcome: Student will be able to understand crystal structures and basic concepts of crystal systems.

Activity:

(Virtual lab experiment) To study various crystals structures

UNIT II **L: 10**

CRYSTAL PLANES AND X-RAY DIFFRACTION:

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

Outcome: Student will able to identify various planes in a crystal and understand the structural determination of crystals using X-ray diffraction.

Activity:

- Building models of simple cubic (SC), face centered cubic (FCC) and bodycentered cubic (BCC) using commercially available wooden sticks

Experiments:

- Determination of lattice constant by powder X-ray diffraction pattern

Unit-III **L: 13**

MAGNETIC MATERIALS:

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

Outcome: Student will be able to understand the basic concepts of magnetic materials and their classifications and apply the concepts for use of magnetic materials for device applications.

Activity:

(Virtual lab) Calculate coercivity, saturation magnetisation, retentivity of a given sample from B-H curve

Experiments:

Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)

SUPERCONDUCTIVITY:

Introduction – Properties of superconductors - Meissner effect – Type-1 and Type-2 superconductors – Applications.

Outcome: Student will be able to understand the concepts of superconductivity. Gain the knowledge of applications of superconductors in modern technology

Activity:

Seminar on Necessity for Room Temperature Superconductors by Students.

Unit-IV **L: 07**

DIELECTRICS:

Introduction to Dielectrics – Types of polarizations - Electronic polarization - Lorentz (internal) field- Claussius - Mossotti equation.

Outcome: Student will be able to understand the properties of dielectric materials and the types of polarizations

Activity:

Seminar on Role of Ferroelectric Materials in Engineering
Dielectric and curie temperature measurement of Barium titanate from the given data

Experiments:

Determination of dielectric constant of solids
Determine time constant from CR circuit

Unit-V **L: 12**

SEMICONDUCTORS:

Classification of solids based on energy bands – 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.

Outcome: Student will be able to understand the principles of semiconductor physics and make use of these concepts to understand the applications of semiconductors

Activity:

To identify the resistance of diode according to colour banding on diode
(virtual lab experiment) - To determine the resistivity of semiconductors by Four probe Method
Seminar on Necessity for Room Temperature Superconductors by Students.

Experiments:

To study the V-I Characteristics of solar cell.
Plot V-I and P-I characteristics of light emitting diode.
V-I characteristics of P-N junction and Zener diodes.
Thermistor characteristics

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)

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. Elements of X-Ray Diffraction, B. D. Cullity Pearson Education India; 3 edition (2014)
4. Introduction to Quantum Mechanics, David J. Griffiths · Darrell F. Schroeter, Cambridge University Press; 3 edition, (2018).
5. Introduction to Electrodynamics, David. J. Giffiths, Pearson Education India Learning Private Limited; 4 edition (2015).
6. Physics Vol 1& 2 (5ed), Resnick , Halliday, Krane, Wiley; Fifth edition (2007)

Course Code:
1000191101 **MATHEMATICS – II**

L	T	P	Credits
3	1	0	3

Course Overview:

This course focuses on basic theoretical concepts and Engineering Mathematics. This course helps the students to understand mathematical tools required in the analysis of problems in Engineering and Scientific Professions. Topics included in this course are iteration methods, finite difference operators, interpolation, Numerical differentiation and integration, system of linear equations, Eigen values and Eigen vectors and quadratic forms.

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: The student will be able

	Course outcome	Level as per Bloom's Taxonomy	PO number mapped
CO1	To understand to solve approximate rootsof an equation by using different numerical methods.	L2, L3	PO1 PO2
CO2	To understand different operators and find the relation among operators and apply forward and backward formulas for compute interpolating polynomial.	L2, L3	PO1 PO2
CO3	To understand different numerical methods to solve integrations and ordinary differentialequations.	L2, L3	PO1 PO2
CO4	To 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 ofQuadratic form.	L2, L3	PO1 PO2

UNIT- I **L: 08**

Solution of Algebraic and Transcendental Equations: Introduction: The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

Outcome: The student will be able to understand numerical linear methods to solve non-Linear equation

Activity/Event: Solving zero of the polynomials by using different numerical methods (Ex. Spherical storage tank & floating ball problems).

UNIT-II **L: 08**

Interpolation: 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.

Outcome: The student will be able to understand different numerical methods to compute the polynomial for the given data.

Activity/Event: Interpolating of an approximate curve for collecting data.

UNIT-III **L: 08**

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- Euler's - Runge-Kutta 4^{th} order.

Outcome: The student will be able to understand numerical techniques to solve definite integrals and first order IVPs

Activity/Event: Solving an approximate solution of first order IVP and numerical integrations.

UNIT-IV **L: 08**

Linear system of equations: Introduction-Rank-Echelon Form-Normal Form - Solution of Linear systems - Gauss elimination - Gauss Seidel method.

Outcome: Student will be able to understand to solve the system of Linear equations by analytical &numerical methods.

Activity/Event: Real-world problems can be formulated in terms of systems of linear equations and solving by using analytical and iterative methods.

UNIT-V: **L: 08**

Eigen values, Eigen vectors: Introduction - Eigen values - Eigen vectors - Properties (without

proofs) - 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.

Outcome: The student will able to find the Eigen values and Eigen vectors of a matrix.

Activity/Event: Finding inverse and powers of a matrix using Cayley Hamilton theorem. Study the nature of the Quadratic forms.

Text Books:

1. Higher Engineering Mathematics by H.K. Dass, S.Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, TataMcGrawHill 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	Credits
1003191100		3	1	0	3

Course Overview:

This course introduces the principles required to solve engineering mechanics problems. It addresses the modeling and analysis of static equilibrium problems with an emphasis on real-world engineering applications and problem solving.

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:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO number mapped
CO1	Analyze the force systems for equilibrium conditions and able to draw free body diagram.	Analyzing	PO1,PO2,PO3
CO2	Evaluate the frictional forces between contact surfaces.	Applying	PO1,PO2,PO3
CO3	Able to differentiate between centroid and centre of gravity and determine Centroid, centre of gravity and second moment of area for composite sections.	Applying	PO1,PO2,PO3
CO4	Analyse the motion and calculate trajectory characteristics.	Analyzing	PO1,PO2,PO3

Unit-I: **No.of lecture hours: 13**

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.

Outcome :

Able to draw Free Body Diagram and analyze the force systems for equilibrium conditions.

Activity/Event :

Demonstration of Lami's theorem and Free Body Diagrams can be done by the students.

Unit-II: **No. of lecture hours: 13**

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

Outcome:

Identify the areas of friction and find the frictional forces between contact points and surfaces.

Activity/Event :

Calculating the coefficient of friction for different materials

UNIT III : **No. of lecture hours: 13**

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.

Outcome:

Able to differentiate between centroid and centre of gravity and determine Centroid and CG for composite sections

Activity/Event :

Different plane areas and solids will be given to students to identify centroid and centre of gravity.

Unit-IV: **No. of lecture hours: 13**

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.

Outcome:

At the end of the unit, the student should be able to
Find MI of various composite sections based on related theorems.

Activity/Event :

Different plane areas and solids will be given to students to calculate area and mass moment of inertia

Unit-V: **No.of lecture hours: 13**

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.

Outcome:

At the end of the unit, the student should be able to solve problems related to kinematics and kinetics applying laws of motion, Apply the work energy concept to solve the kinetic problems.

Activity/Event :

Demonstration of the concepts of Kinematics through videos.

Text Books:

1. Engineering Mechanics - S. Timoshenko & D. H. Young., 4th Edn ,McGraw Hill publications.
2. Engineering Mechanics: Statics and Dynamics,N H Dubey,McGraw Hill publications.

Reference Books:

1. Engineering Mechanics, Tayal. Umesh Publications.
2. Engineering Mechanics statics and dynamics – R. C. Hibbeler, 11th Edn – Pearson Publ.

Course Code		L	T	P	Credits
1005191120	**PROBLEM SOLVING AND PROGRAMMING USING C**	3	1*	3	4.5

Course Overview:

C is a basic building block for every language. It is a general Purpose Language. To develop the programming skills 'C' is the only platform to develop programming techniques for any type languages.
Programming is an increasingly important skill, whether you aspire to a career in software development, or in other fields. This is because programming is fundamentally about figuring out how to solve a class of problems and writing the algorithm, a clear set of steps to solve any problem in its class. This course will introduce you to a powerful problem-solving process. In this course, you will learn how to develop an algorithm, and then progress to reading code and understanding how programming concepts relate to algorithms.

Course Objectives:

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

Course Outcomes:

	Course outcome	Skill	PO
CO1	Write compile and debug Programs in C language	Understand	PO1,PO2, PO3
CO2	Use operators, data types and write programs	Understand	PO1,PO2
CO3	Select the best loop construct for a given problem	Analyzing	PO3,PO5
CO4	Design and implement C programs	Analyzing	PO1,PO2 PO3,PO4, PO12

Unit-I: **L-6 T-1**

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.

Outcome:

- ✓ Illustrate flowchart and algorithm to the given Problem.
- ✓ Outline the Basic Structure of Computer.
- ✓ Explain the Structure of C Program

Activity/Event:

Design a flow chart and develop an algorithm for a real time application.

Unit-II: **L-10 T-3**

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.

Outcome:

- ✓ Explain basic Structure of the C-PROGRAMMING, declaration and usage of variables.
- ✓ Build C programs using operators and control structures.

Activity/Event:

- ✓ Build a C Program which has Linear Solution.

Unit-III: **L-8 T-1**

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.

Outcome:

- ✓ Build C programs to access arrays, strings and functions.
- ✓ Compare Array and Strings.
- ✓ Understand & Applying Various Library Functions

Activity/Event:

- ✓ Build apreprocessor directive for strings

Unit-IV: **L-7 T-1**

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.

Outcome:

- ✓ Explain modular Programming
- ✓ Identify Categories of Functions.

Activity/Event:
Simulate how function calls are handled in turbo c with a suitable example using structure chart

Unit-V: **L-9 T-2**

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.

Outcome:

- ✓ Explain the Concept of Dynamic memory allocation
- ✓ Develop C programs using pointers
- ✓ Outline basic concepts on files

Activity/Event :

Create array of structure dynamically for real-time application

Text Books:

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

Reference Books:

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

PROBLEM SOLVING AND PROGRAMMING USING C LAB

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
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.
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
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 n
   i)Prime Number ii) Armstrong Number
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
   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. 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.
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
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
9. a)Write a C Program to Store Information of a student UsingStructures
   b) Write a C program to create memory for int, char and float variable at run time.
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

Course code		L	T	P	Credits
1000191130	**CONSTITUTION OF INDIA**	3	0	0	0

Course Overview: This course introduces students to the Constitution of India. It begins by providing an overview of the history of the making of Indian Constitution. It then discusses the preamble and the basic structures of the Constitution. The fundamental rights, duties and the directive principles of state policy will be discussed thoroughly, followed by a discussion of the legislature, the executive and the judiciary. Some of the important sections of the Constitution that have influenced the history of India since independence will also be taken up for study. These include emergency powers and special provisions.

Course Objectives:

1. To Enable the student to understand the importance of constitution
2. To understand the structure of executive, legislature and judiciary
3. To understand philosophy of fundamental rights and duties
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative

	Course outcome	**Bloom's cognitive level**	**PO**
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations.	Understanding	PO-6 PO-8 PO-9
CO2	Understand state and central policies, fundamental duties.	Understanding	PO-6 PO-8 PO-9
CO3	Understand Electoral Process, special provisions.	Understanding	PO-6 PO-8 PO-9
CO4	Understand powers and functions of Municipalities, Panchayats and Cooperative Societies	Understanding	PO-6 PO-8 PO-9

Unit-I: **No. of lecture hours: 6**

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

Outcome: 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: **No. of lecture hours: 6**

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

Outcome: 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 court

Activity: role play of model parliament

Unit-III: **No. of lecture hours: 6**

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

Outcome: 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

Activity: Quiz role play of model assembly.

Unit-IV: **No. of lecture hours: 6**

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

Outcome: 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 organization

Activity: Debate on pros and cons of local governance

Unit-V: **No. of lecture hours: 6**

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

Outcome: 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

Activity: Debate on election system in India

Text Books:

1. Civics, Telugu Academy

References:

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

Course Code		L	T	P	Credits
1000191131	**Extra Curricular Activity (Audit Course)**	0	0	4	0

Extra-Curricular Activities, sports & games: Though this course has no credits, it is mandatory to satisfy minimum attendance of 80%.

I Year- II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1.	1000191200	Transforms and Vector Calculus	3	1*	0	3
2.	1000191123	Applied Chemistry	3	0	3	4.5
3.	1002191221	Electrical Circuit Analysis-I	3	1*	3	4.5
4.	1003191101	Engineering Drawing	1	0	4	3
5.	1000191121	Technical English Communication	2	0	3	3.5
6.	1003191210	Engineering Workshop	0	0	3	1.5
7.	1000191110	Engineering Exploration	0	0	4	2
Total Credits :						**22**

Course Code:	TRANSFORMS AND VECTOR CALCULUS	L	T	P	Credits
1000191200		3	1	0	3

Course Overview:

The entire course is divided into 5 modules covering duly recognized areas and the main aim of this course is to provide a platform to the students to think, design, formulate and derive any problem encountered in real life situation. Topics included in this course are Fourier series, Fourier transform, multiple integrals and vector differentiation and integration.

Course Objectives:

- To enlighten the learners in the concept of multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:

	Course outcome	Level as per Bloom's Taxonomy	PO number mapped
CO1	Formulate any period function in terms of sine and cosine	L6	PO1,PO2
CO2	Simplify a non periodic function as integral representation	L4	PO1,PO2
CO3	Apply multiple integration techniques in evaluating areas and volume bounded by region.	L3	PO1,PO2
CO4	Explain Gradient, divergence and curl operations in vector and scalar fields.	L2	PO1,PO2
CO5	Apply Green's, Gauss and Stokes theorem as the generalisation of fundamental theorem of integral calculus.	L3	PO1,PO2

UNIT- I **L: 08**

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

Outcome: The student will be able to understand to construct Fourier series expansion for different periodic functions.

Activity/Event: Fourier series representation of piecewise continuous functions.

UNIT II **L: 08**

Fourier transforms: Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – properties (without proofs).

Outcome: The student will be able to find Fourier Integral and Transform of a function.

Activity/Event: Finding Fourier Transforms and Finite Fourier Transforms.

UNIT-III **L: 08**

Multiple integrals: Double and triple integrals – change of order of integration - Areas and Volumes (Cartesian coordinates).

Outcome: The student will able to evaluate areas by double integrations and volume by double and Triple integration.

Activity/Event: Finding areas and volumes in Cartesian systems.

UNIT-IV **L: 08**

Vector Differentiation: Scalar point function – vector point function – Vector differential operator – Gradient – directional derivative, angle between two surfaces- Divergence- Curl - scalar potential.

Outcome: The student will be able to understand the physical interpretation of Gradient, Divergent and Curl.

Activity/Event: Find the angle between the surfaces and work done by the force.

UNIT-V: **L: 08**

Vector Integration - Line integral – surface and volume integrals, Green's, Stoke's and Gauss Divergence theorems (without proofs).

Outcome: The student can able to apply Green's, Stoke's and Divergence theorem in evaluation of double and triple integrals.

Activity/Event: Find the work done by the force on a particle and flux through a surface.

Text Books:

1. Higher Engineering Mathematics by H.K. Dass, S.Chand Publications.
2. Higher Engineering Mathematics 2e, B. V. Ramana, TataMcGrawHill 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		L	T	P	Credits
1000191123	APPLIED CHEMISTRY	3	1	3	4.5

Course Overview:

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Course Objectives:

- **Importance** of usage of plastics in household appliances and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells.
- **Understand** the mechanism of corrosion and how it can be prevented.
- **Express** the increase in demand as wide variety of advanced materials are introduced which have excellent engineering properties.
- **Explain** the structures, bonding and shapes of various octahedral complexes.

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Identification of different polymers and their functionalities	Level-2	PO1,PO2, PO10
CO2	Recognize the different types of electrochemical cells and its applications	Level-3	PO1, PO2
CO3	Analysis of corrosive environments and protection of precious metal	Level-3	PO1, PO2, PO9
CO4	Adoption of different green methodologies and acquire knowledge on different advanced materials	Level-4	PO1, PO2, PO9

UNIT- I

Polymer Chemistry:

Introduction to polymers, Classification of polymers, Types of Polymerization (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.

Outcome: After the completion of Unit I, the student will be able to

- Explain the different types of polymers and their applications.
- Explain the preparation, properties and applications of Bakelite & PVC.

Activity:

- Identification and collection of various thermo and thermosetting plastics.

Experiments:

1. Preparation of a polymer (phenol-formaldehyde resin)

UNIT II:

Structure and Bonding Models:

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.

Outcome: After the completion of Unit II, the student will be able to

- Illustrate the molecular orbital energy level diagram of different molecular species
- Calculate the bond orders of different molecules.
- Calculate CFSE for different complexes.

Activity:

- Calculation of CFSE for different Complexes (Virtual lab).

Experiments:

1. Determination of Copper by using standard EDTA solution.
2. Determination of Iron (II) by using standard $KMnO_4$ solution.

Unit-III:

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

Batteries: Primary cell – Dry cell (Leclanche cell) and applications, Secondary cells – lead acid battery & applications.

Outcome: After the completion of Unit III, the student will be able to

- Differentiate between p^Hmetry and conductometric titrations
- Explain the construction of batteries and their applications.

Activity:

- Identification and collection of various types of batteries.

Experiments:

1. p^Hmetric titrations of (i) strong acid vs. strong base.
2. Conductometric titrations - (i) strong acid vs. strong base.
3. Construction & working of Galvanic cell (Virtual lab).
4. Determination of strength of an acid in Pb-Acid battery.

Unit-IV:

Corrosion:

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.

Outcome: After the completion of Unit IV, the student will be able to

- Discuss different types of protecting methods of metals.
- Demonstrate the corrosion prevention methods.

Activity:

- Collection of various types of corrosive & non corrosive products.

Experiments:

1. Determination of Iron (II) by using standard $K_2Cr_2O_7$ solution.
2. Determination of Zinc (II) by ferrocyanide method.

Unit-V:

Chemistry of Advanced engineering materials:
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

Outcome: After the completion of Unit V, the student will be able to

- Explain the different types of Nanomaterials and their applications.
- Apply the principles of polymers in reinforced materials like CFRP & GFRP.
- Acquire knowledge of advanced materials and their applications.

Activity:

- Implementation of any one green principle

Experiments:

1. Preparation of nano materials

Text Books:

1. Engineering Chemistry by Jain and Jain; DhanpatRaiPublicating Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

Reference Books:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by PrasanthRath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM

Applied Chemistry - Laboratory

Course objectives:

The student with the knowledge of the basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence. The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with new technologies.

List of Experiments:

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of Hardness of a groundwater sample**.**
2. Determination of alkalinity of Water.
3. Determination Copper using standard EDTA solution.
4. Determination of Zinc (II) by ferrocyanide method.
5. Determination of Iron (II) by using standard $KMnO_4$ solution.
6. Determination of the Concentration of HCl using Sodium Hydroxide (by pH - metry method).
7. Determination of the Concentration of strong acid vs strong base (by conductometric method)
8. Determination of Iron (II) by using standard $K_2Cr_2O_7$ solution.
9. Preparation of a polymer (phenol-formaldehyde resin).
10. Preparation of Nano materials (Demonstration only)
11. Construction of Galvanic cell (Virtual lab).
12. Determination of strength of an acid in Pb-Acid battery.

*Of the above experiments at-least 10 assessment experiments should be completed in a semester.

Course outcomes:

After the completion of the course the student will be able to:

CO1: Analyze& generate experimental skills.
CO2: Enhance the thinking capabilities in the modern trends of engineering & technology.
CO3: learn and apply basic techniques used in chemistry laboratory for preparation of Organic Compounds.
CO4: Learn safety rules in the practice of laboratory investigation.

Course code		L	T	P	C
1002191221	**ELECTRICAL CIRCUIT ANALYSIS-I**	3	1*	3	4.5

Course Overview:

The aim of this course is to introduce the methods of analyzing linear electric circuits.

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:

By the end of the course, the students shall be able to

	Course outcome	**Cognitive Level as per Bloom's Taxonomy**	**PO**
CO1	Solve various electrical networks in presence of active and passive elements.	Apply	PO1, PO3, PO 12
CO2	Find response of any R, L, C network with sinusoidal excitations.	Apply	PO1, PO3, PO12
CO3	Illustrate any magnetic circuit with various dot conventions	Analyze	PO1, PO 3, PO4, PO12
CO4	Analyze AC networks in presence of active and passiveelements.	Analyze	PO1, PO 3, PO 4, PO 12

Unit-I:

Introduction to Electrical Circuits: Circuit concept, 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, Nodal Analysis, Mesh Analysis, concept of Super node and Super mesh (The source is DC and passive element is resistor in all cases).

Outcome: : Analyze electric circuits containing active (both dependent & independent) and passive elements (resistors)

Activity/Event: Practically verify basic electrical laws and basic methods of analysis of electrical circuits in the laboratory.

Unit-II:

Network theorems:
Source Transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem.

Outcome: State network theorems and analyze electrical networks using the principles of network theorems.

Activity/Event: Practically verify some network theorems in the laboratory.

Unit-III:

Single Phase AC Systems: 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.

Outcome: Find response of circuits containing R, L, C with sinusoidal excitations

Activity/Event: Determine the response of RL / RC with sinusoidal excitation in the laboratory.

Unit-IV:

Analysis of AC networks: Extension of node and mesh analysis to AC networks, Problems on the steady state analysis. Applying network theorems to analyze AC circuits, series and parallel resonance, concept of band width and Quality factor. Locus diagrams for various combination of R, L and C.

Outcome: Solve AC networks containing active and passive elements.

Activity/Event: Practically study the series and parallel resonance on a laboratory kit.

Unit-V:

Magnetic Systems: Basic definition 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

Outcome: Illustrate any magnetic circuit with various dot conventions.

Activity/Event: Practically determine the Self & Mutual Inductance and coefficient of coupling of two coils in the laboratory.

Electrical Circuit Analysis -1 Laboratory:

The following experiments will be conducted

1. Verification of KCL and KVL.
2. Verification of Nodal and Mesh analysis methods.
3. Verification of Thevenin's theorem.
4. Verification of Norton's theorem.
5. Verification of Superposition theorem.
6. Verification of Maximum power transfer theorem.
7. Sinusoidal analysis of RL and RC circuits.
8. Study of Series and Parallel Resonance.
9. Determination of Self, Mutual Inductances and Coefficient of coupling.

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

Course Code	ENGINEERING DRAWING	L	T	P	Credits
1003191101		1	0	4	3

Course Overview:

This course deals with the principle method of communication for engineers, the objective to introduce the students, the techniques of constructing the various types of polygons, curves. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

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:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO number mapped
CO1	Understand the use of drawing instruments to construct the polygons and curves	Understanding	PO1,PO2,PO3
CO2	Learn the principle of orthographic projections. Draw Orthographic projections of points, lines.	Analyzing	PO1,PO2,PO3,PO12
CO3	Draw the various types of planes and solids its views in different Positions	Analyzing	PO1,PO2,PO3,PO12
CO4	Draw isometric views of simple objects	Analyzing	PO1,PO2,PO3,PO12

Unit-I: **No.of lecture hours: 13**

Introduction to Engineering Drawing, Polygons: Construction of regular polygons, Curves used in Engineering Practice: Ellipse (General method and oblong Method only), Parabola

&Hyperbola (General method only),Introduction to Scales: Vernier& Diagonal Scales.

Outcome :

The students able to learn the use of drawing instruments to construct the polygons, curves and various types of scales.
To enlarge or reduce the size of objects in representing them.

Activity/Event :

Demonstration of Ellipse ,Parabola , Hyperbola & polygons.

Unit-II: **No. of lecture hours: 13**

Introduction to orthographic projections: Projections of points - Projections of straight lines: 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.

Outcome:

At the end of the unit, the student should be able to
The students able to learn the principle of orthographic projections.
Draw the projections of the lines inclined to both the planes H.P & V.P.

Activity/Event :

Demonstration of straight lines and its views.

UNIT III :No.of lecture hours: 13

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

Outcome:

At the end of the unit, the student should be able to
Draw the various types of planes and its views in different Positions .

Activity/Event :

Demonstration of Pentagon ,Hexagon, Heptagon& octagon.

Unit-IV: **No.of lecture hours: 13**

Projections of Solids: Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the plane only.

Outcome:

At the end of the unit, the student should be able to...
Draw the various types of solids and its views in different Positions .

Activity/Event :
Demonstration of cylinder, cone , prism & pyramids.

Unit-V: **No.of lecture hours: 13**

Conversion of isometric views to orthographic views.
Conversion of orthographic views to isometric views.

Outcome:

At the end of the unit, the student should be able toDraw 3D view through isometric views & 2D view through orthographic views.

Activity/Event :

Demonstration of Isometric objects & views of the Isometric objects.
Demonstration of Auto CAD software & drawing & editing basic figures.

Text Books:

1. Engineering Drawing, N. D. Butt, Chariot Publications.
2. Engineering Drawing, K. L. Narayana& P. Kannaiah, Scitech Publishers.

Reference Books:

1. Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers.
2. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age.

Course Code		L	T	P	Credits
1000191121	TECHNICAL ENGLISH COMMUNICATION	2	0	3	3.5

Course Overview:

In this course students will read, analyze, and interpret material from general and technical fields, and will practice reading, writing, listening and speaking skills on a variety of contemporary topics.

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 outcome	Cognitive Level as per Bloom's Taxonomy	PO number mapped
CO1	The students will be able to read, understand and interpret material on Environment, Science and Technology, tourism, Energy Sources, Social Awareness	Understanding (L2) and Applying (L3)	PO7, PO10, PO6, PO12
CO2	The students will be able to analyze the functions of language and grammar in spoken and writtenforms.	Applying (L3) and Analyzing (L4)	PO10, PO12, PO5
CO3	The students will be able to write effectively on variousdomains.	Applying (L3) and Creating (L5)	PO10, PO12
CO4	The students will be able to prepare and exhibit oralpresentation skills by using ICT.(Individual/Team)	Applying (L3) and Creating (L5)	PO10, PO12, PO9, PO5

UNIT- I **No. of lecture hours: (T+L)7+4 =11**

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

Outcomes: The student will be able to :

read, understand and interpret material on Environment.

speak about himself/herself.

listen to an audio and take notes from the audio clip.

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

Letter Writing

Experiments:

1. Just A Minute –Tell about oneself
2. Note taking while listening to the TED talk
3. Interactions

UNIT-II **No. of lecture hours: : (T+L) 6+4=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

Outcomes: The student will be able to:

read, understand and interpret material on Space Technology

analyze the functions of language and grammar in spoken and written forms

write formal letters and paraphrase the text.

prepare and exhibit oral presentation skills by using ICT(Individual/team)

Activities:

- Reading Comprehension
- Letter Writing-Formal

Experiments:

1. Making a mini presentation

Unit-III **No. of lecture hours: : (T+L)8+4=12**

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

Outcome: The students will be able to :

read, understand and interpret material on Travel.

write Paragraph and Essays with proper coherence.

pronounce the words with apt pronunciation

maintain proper telephonic etiquette.

Activities:

Reading Comprehension
Paragraph writing
Essay writing

Experiments:

1. Letters and Sounds- Some pronouncing Patterns
2. Telephonic Skills

Unit-IV: **No. of lecture hours: : (T+L) 7+4=11**

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

Outcome: The students will be able to:
read, understand and interpret material on Energy Sources.
write formal Email.
participate in Group Discussion without hesitation.

Activities:

Reading Comprehension
Email Writing

Experiments:

1. Group Discussion
2. Mock-Interview

Unit-V: **No. of lecture hours: : (T+L) 8+4=12**

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.

Outcome: The students will be able to:
read, understand and interpret material on Media.
interpret graphical data
present PPT without hesitation.
listen to a situation and respond

Activity:
Information Transfer

Experiment:
Oral Presentation

Suggested Books:

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

Reference Books:

- Balasubrmanyam 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	ENGINEERING WORKSHOP	L	T	P	Credits
1003191210		0	0	3	1.5

Course Objective:

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

Note: At least two exercises to be done from each trade.

Trades:

Carpentry	1. T-Lap Joint 2. Cross Lap Joint 3. Dovetail Joint 4. Mortise and Tenon Joint
Fitting	1. Vee Fit 2. Square Fit 3. Half Round Fit 4. Dovetail Fit
Black Smithy	1. Round rod to Square 2. S-Hook 3. Round Rod to Flat Ring 4. Round Rod to Square headed bolt
House Wiring	1. Parallel / Series Connection of three bulbs 2. Stair Case wiring 3. Florescent Lamp Fitting 4. Measurement of Earth Resistance
Tin Smithy	1. Taper Tray 2. Square Box without lid 3. Open Scoop 4. Funnel

Course Code		L	T	P	Credits
1000191110	**Engineering Exploration**	0	0	4	2

Course Overview:

This course aims in teaching the Inter disciplinary engineering knowledge to students with the help of activity-based learning. This course teaches "Engineering Design, Mechanisms, Platform based development & Data acquisition and analysis" concepts to cover the basic knowledge & practices of multiple engineering disciplines.

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 Outcome	Cognitive Level as per Bloom's Taxonomy	PO number mapped
CO1	Realize the purpose/Role of Engineer for solving social problems	Understand (Level 1)	PO6, PO7, PO8, PO9, PO12
CO2	Learn to Design a component/system in an engineering way	Apply and Analyze (Level 2 & 3)	PO1, PO3, PO5, PO9
CO3	Learn to use mechanisms, Arduino, sensors,motors.	Understand (Level 1)	PO1, PO3, PO5, PO9
CO4	Integrating different systems (mechanical/Electrical/computer) to work as a unit	Apply and Analyze and Create (Level 3, 4 & 5)	PO2, PO3, PO5, PO9

Unit-I: **No.of lecture hours: 6**

Introduction to Engineering and Engineering Study: 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.

Outcome: Student will learn about Engineering & it's evolution in solving social problems. Will also learn about Variety of engineering branches and their contributions to society.

Activity theme: Activities aimed to understand Engineering

Activities: (only for integrated theory and lab course)

1. Identifying Various Engineering disciplines involved in a project/system

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

Unit-II: **No. of lecture hours: 12**

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

Outcome: Student will be able to understand the Engineering Design procedure & applying the same knowledge for making / creating a new product/model.

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

Activities: (only for integrated theory and lab course)

1. Converting 230V of AC to 5V of DC power.
2. Making of a Bridge Structure.
3. Preparing a Full Adder circuit using IC's
4. Creating a mobile App using MIT app inventor

Unit-III: **No.of lecture hours: 6**

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

Outcome: Student will be able to understand the importance & working of mechanisms.

Activity theme: Creating a model which illustrate any mechanism

Activities: (only for integrated theory and lab course)

1. Determining the Degree of Freedom for a given structure
2. Assembling of Scissor jack mechanism

Unit-IV: **No.of lecture hours: 8**

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

Outcome: Student will be able to gain knowledge about the various sensors, transducers, actuators &Arduino device. To Program Arduino for any inter-disciplinary project.

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

Activities: (only for integrated theory and lab course)

1. Obstacle detection using IR sensor on Arduino Platform
2. Measuring distance using Ultrasonic sensor on the Arduino Platform
3. Measuring Temperature and Humidity using DHT sensor on Arduino Platform

Unit-V: **No. of lecture hours: 8**

Data Acquisition and Analysis: 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.

Outcome: Student will be able to understand the importance of data collection & analysis. Able to use various sensors with Arduino, acquires data from sensors and analyzing the data through a computer

Activity theme: Acquiring data from sensors using Arduino

Activities: (only for integrated theory and lab course)

1. Data Analysis through Arduino programming for multiple sensors

II Year- I Semester

S.No	Course Code	Name of the Course	L	T	P	Credits
1	1002192100	Fundamentals of signals and systems	3	1*	0	3
2	1002192120	Electrical Machines-I	3	1*	3	4.5
3	1002192101	Electro Magnetic Fields	3	1*	0	3
4	1004192120	Basic Electronic Devices and Circuits	3	1*	0	4.5
5	1000192110	Communication skills Lab	0	0	2	1
6	1002192102	Electrical Circuit Analysis-II	3	1*	0	3
Total Credits :						**19**

Course Code		L	T	P	Credits
1002192100	**Fundamentals of Signals and Systems**	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 orthgonality.
- 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: At the end of the course, the student will be able to

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Distinguish between various types of signals and systems.	Understanding	L2	PO-1 PO-2 PO-4 PO-6 PO-7 PO-9 PO-10 PO-11 PO-12
CO2	Understand the conversion of continuous time signals to discrete time signals and vice versa.	Understanding	L2	PO-1 PO-2 PO-4 PO-5 PO-6 PO-7 PO-9 PO-10 PO-11 PO-12

CO3	Analyze continuous time LTI systems	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-9 PO-10 PO-11 PO-12
CO4	Analyze discrete time LTI systems	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-5 PO-6 PO-7 PO-9 PO-10 PO-11 PO-12

UNIT- I **L: 08**

Introduction to Signals

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. Analogy between vectors and signals, orthogonal signal space.

Outcome: To be able to understand the signals and systems and Concept of orthgonality

Activity:

- Arthimatic operation on signals**,**to find the energy and power of few signals

UNIT II **L: 10**

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

Outcome: Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.

Activity:

- Apply Fourier series to any periodic signal and observe different frequency sinusoids using MATLAB software.

Unit-III **L: 10**

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

Outcome:

- Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
- Able to Understand the Concepts of convolution, correlation

Activity:

- design low pass and high pass filters with a specific bandwidth

Unit-IV **L: 10**

Analysis of continuous time systems:

Review of Laplace transforms, Partial fraction expansion, 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.

Outcome: can apply Laplace Transforms to continuous time signals and systems

Activity:

- Finding stability of continuous time signals

Unit-V **L: 12**

Analysis of Discrete time systems:

Discrete time signal representation- using complex exponential and sinusoidal, Periodicity of discrete time signals, properties of Z-transforms, 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.

Outcome: can apply Z Transforms to discrete time signals and systems.

Activity:

- Finding stability of few discrete time signals.

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, 3rd Edition.
3. Signals and Systems – K Raja Rajeswari, B VisweswaraRao, PHI, 2009 1st Edition.
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
5. Signals and Systems – T K Rawat , Oxford University press, 2011,1st Edition.

Course Code		L	T	P	Credits
1002192120	ELECTRICAL MACHINES-I	3	1	3	4.5

Course Overview:

This is a basic course on electrical machines. This course covers the topics related to principle of operation, performance, testing methods and applications of DC machines and transformers.

Course Objectives

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

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Describe the construction and operation of a DC Machines, Starters, single phase and poly-phase transformers and auto-transformers.	Understanding Applying	L2 L3	PO-1 PO-2 PO-4 PO-6 PO-8 PO-9 PO-10 PO-12
CO2	Analyze the performance of DC machines and transformers.	Understanding	L2	PO-1 PO-2 PO-4 PO-6 PO-8 PO-9 PO-10 PO-12
CO3	Discuss the speed control methods of dc motors, working of starters and losses in DC machines and transformers.	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-6 PO-8 PO-9

				PO-10 PO-11 PO-12
CO4	Calculate efficiency of DC machines and transformers and also achieve three phase to two phase conversion in poly-phase transformers	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-6 PO-8 PO-9 PO-10 PO-11 PO-12

UNIT- I **L: 08**

Introduction to DC machines

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 equations of DC motors.

Outcome: Discuss the basic principles of dc machines.

Activity:

- Prepare a report on classification of DC machines based on excitation
- Show the cut section of a DC machine.

Experiments:

- Determination of critical field resistance and critical speed using magnetization characteristics of DC shuntgenerator
- Draw external characteristics of the shunt generator by conducting the Load test

UNIT II **L: 10**

Performance and testing of D.C. Machines

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 .

Outcome: Classify the various characteristics and speed control methods of DC machines

Activity:

- To make Collage on a chart by students on DC machine characteristics.

Experiments:

- ConductBrake test on DC shuntmotor.
- Speed control of DC shuntmotor by field and armature control.
- Swinburne'stestto predetermine the efficiency as DCgenerator and motor.
- Separation of losses in DC shunt motor
- Retardation test on DC shunt motor. Determination of losses at rated speed.
- Filed test on two identical series motor –generator set.

Unit-III **L: 10**

Single-phase Transformers

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

Outcome: Analyze the equivalent circuit of single phase transformer.

Activity:

- To see the cut section of a transformer

Unit-IV **L: 10**

Single-phase Transformers Testing

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.

Outcome: Identify the conditions of parallel operation and distinguish various types of losses that occur in single phase transformer

Activity:

- Implementation of open circuit and short circuit tests using Virtual labs / MATLAB.

Experiments:

- OCandSCtestonsinglephasetransformer.
- Sumpner'stestonapairofsinglephasetransformers.
- Separationofcorelossesinatransformer.
- Paralleloperationoftwosinglephasetransformers.

Unit-V **L: 12**

Auto transformers and 3-Phase Transformers

Basic principle of operation of Auto transformers, Construction of 3-Phase Transformers-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.

Outcome: Classify the various auto transformers, poly phase connections and analyze tap changers.

Activity:

- Prepare a report on different connections of the transformer and their applications.

Experiments:

- Scott connection oftransformers.

Text Books:

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

Reference Books:

7. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition
8. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH
9. Electrical Machinery by AbijithChakrabarthi and SudhiptaDebnath, McGraw Hill education 2015
10. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
11. Electric Machines by Mulukutla S. Sarma&Mukeshk. Pathak, CENGAGE Learning.
12. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons

Course Code		L	T	P	Credits
1002192101	**ELECTROMAGNETIC FIELDS**	**3**	**1**	**0**	**3**

Course Overview:

Electromagnetic field theory is the most fundamental course in the curriculum of electrical engineering education. Electromagnetic field theory defines capacitors, inductors and resistors in terms of their primary electric and magnetic quantities like electric charge, electric potential, electric current, electric and magnetic flux. Electromagnetics explains universal concepts in three-dimension real world, i.e., electro-magnetic wave propagation in free-space

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 behavior of materials in Electric Field and to study the magnetic force.
- To do inductance and capacitance calculations.
- To study Maxwell's equations and EM wave propagation.

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

	Course outcome	**Bloom's taxonomy**	**Bloom's Taxonomy Level**	**PO**
CO1	Calculate electric field from various charge distributions and find magnetic field from various current distributions.	Understanding Applying	L2 L3	PO-1 PO-2 PO-4 PO-5 PO-9 PO-10 PO-12
CO2	Understand polarization in dielectrics, electric current density, and resistance of conductors and also Calculate force in electric and magnetic fields and torque in magnetic fields.	Understanding	L2	PO-1 PO-2 PO-3 PO-9 PO-10 PO-12
CO3	Determine inductance, capacitance of different physical configurations.	Understanding Applying	L2 L3	PO-1 PO-3 PO-9 PO-10 PO-12
CO4	Apply Faraday's Law to calculate induced Emf and understand the effect of Electromagnetic radiation.	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-6 PO-7 PO-12

UNIT- I L: 12

Electrostatic Fields:

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.

Outcome: Calculate electric field, force, potential, energy from various charges and charge distributions

Activity:

- Observe the Electric field in PN diode using FEM or COMSOL software.
- Prepare a report on Applications of Static Electric Fields and magnetic fields.

UNIT II L:

Static magnetic fields:

Biot-Savart's law *&Oersted'*sexperiment-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.

Outcome: Calculate magnetic field and energy due to various current distributions.

Activity:

- Determine the maximum flux density to avoid saturation of different cores.
- Prepare a report on application of magnetic levitation.

Unit-III L: 10

Materials in Electric Field

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.

Outcome: Calculate polarization in dielectrics, electric current density, electric current and

resistance of conductors.Calculate forces in electric and magnetic fields and torque in magnetic fields.

Activity:

- Determining the suitable conductor size for a given transmission line to withstand maximum current density.

Unit-IV **L: 10**

Capacitance Calculations

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.

Outcome: Calculate inductances, capacitance of different structures.

Activity:

- Prepare a report on different inductors and capacitors that are used in Electrical and Electronics Applications.

Unit-V **L: 10**

Time varying fields

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. EM wave equation and uniform plane waves in free space. Effects of Electromagnetic radiation

Outcome: Apply Faraday's Law to calculate induced Emf.

Activity:

- Observe the production of induced emf with different types of cores (i.e silicon steel, CRGO…) and make a report.
- Make a Report on Effects of Electromagnetic Interference on communication lines, on power lines and on human**...**

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. SadikuMN,"Principles of Electromagnetics", 4th Edition, Oxford University PressInc, NewDelhi,2001

Reference Books:

1. "Introduction to Electro Dynamics", by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd Edition.
2. "Electromagnetic Field Theory"-1st edition by Shankar Prasad ,Ghosh,LipikaDattaTata McGraw Hill.
3. "Fundamentals of Engineering Electromagnetics"- 1st edition by Sunil Bhooshan,Oxford higher Education
4. " Electromagnetic Field Theory"-2nd edition by Gangadhar, Khanna publications.
5. "Elements of Electromagnetic Fields"- 1st edition by SP Seth, DhanpatRai&co .
6. " Problems and solutions of Engineering Electromagnetics", CBS Publications.

Course Code	BASIC ELECTRONIC DEVICES AND CIRCUITS	L	T	P	Credits
1004192122		3	1	0	4.5

Course Overview:
This course introduces the operation of various semi-conductor devices. Realization of rectifiers, amplifiers and oscillators using semi-conductor devices and their analysis is also introduced in this course.

Course Objectives:

1. To study the construction details, operation and characteristics of junction diode and special diodes
2. To understand the operation and analysis of rectifiers with and without filters.
3. To learn biasing stabilization and compensation methods and to analyze transistor amplifiers using h-parameters.
4. To understand the concepts of positive and negative feedbacks and their role in amplifiers and oscillators.

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Distinguish the characteristics of different diodes and choose appropriate diode for an application based on the operation	Understanding	L2	**PO1, PO2, PO3, PO12.**
CO2	Explain the operation and design aspects of rectifiers, and filter.	Understanding	L2	**PO1, PO2, PO3, PO12.**
CO3	Design different biasing and stabilization circuits and explain compensation techniques for a transistor.	Understanding Applying	L2 L3	**PO1, PO2, PO3, PO12.**
CO4	Explain the merits and demerits of positive and negative feedback and the role of feedback in oscillators and amplifiers.	Understanding Applying	L2 L3	**PO1, PO2, PO3, PO4, PO12.**

Unit-I:
Junction Diode Characteristics [T1] L8

Operation and characteristics of p-n junction diode, Current components in p-n diode, diode equation, Temperature dependence on V–I characteristic, Diode capacitance and diode resistance (static and dynamic), energy band diagram of p-n diode.

Special Diodes: Avalanche and Zener breakdown, Zener diode, tunnel diode, Varactor diode, LED, Photo diode(Qualitative explanation only)

Unit-I Outcome: Students will be able to explain the operation and characteristics of PN junction diode and special diodes.

Activity/Event on Unit-1: Plot the characteristics of diode

Lab
Experiment 1 :PN Junction Diode V-I Characteristics
Experiment 2 : Zener Diode V-I Characteristics

Unit-II:

Rectifiers, Filters T1 L8

Half wave rectifier, full wave rectifier, Bridge rectifier , rectifier circuits and operation
Filters: inductor filter, capacitor filter .

Unit-II

Outcome: Students will be able to explain operation and design aspects of rectifiers .

Activity/Event on Unit-II: construct a rectifier circuit.

Lab
Experiment 3 : Half Wave Rectifier Without And With Filter
Experiment 4 : Full Wave Rectifier Without And With Filter

Unit-III:

Transistors T2 L8
Junction transistor, transistor current components, transistor as an amplifier and switch. Characteristics of transistor (CE, CB and CC configurations)
FET: FET types ,JFET Characteristics, MOSFET Characteristics–static and Transfer (enhancement and depletion mode) (Qualitative explanation only)
Unit-III

Outcome: Students will be able to explain the characteristics of various transistor configurations

Activity/Event on Unit-III: Plot the characteristics of transistor

Experiment 5: Transistor CE Characteristics (Input & Output).

Experiment 6: FET Characteristics.

Unit-IV:

Biasing and Small signal Amplifiers T2 L8

Need for Transistor biasing and biasing methods (to fixed bias, collector to base bias, self bias), thermal runaway, thermal stability. Compensation against variation in base emitter voltage and collector current. Analysis of transistor amplifier using h-parameters.

Unit-IV Outcome: Students will be able to explain the design procedure of different biasing, stabilization and compensation techniques used in transistor circuits

Activity/Event on Unit-IV: Construct a fixed bias circuit

Experiment 7: CE Amplifier.

Experiment 8 : Measurement Of H- Parameters Of Transistor In Ce And Cb Configurations

Unit-V:

Negative feedback amplifier and oscillators T2 L8

Feedback Amplifiers -classification, feedback concept, transfer gain and general characteristics of negative feedback amplifiers, effect of feedback on input and output resistances. Methods of analysis of feedback amplifiers.
Oscillators – barkhausen criteria, RC phase shift oscillator and wein bridge oscillator using BJT and FET

Unit-V

Outcome: Students will be able to explain the merits and demerits of positive and negative feedback and analyze the role of feedback in oscillators and amplifiers.

Activity/Event on Unit-V: Construct a RC-phase shift oscillator

Experiment 9 : Voltage Series Amplifier
Experiment 10 :RC Phase Shift Oscillator.

Text Books:

1 S.Salivahanan,N.Sureshkumar. “Electronic Devices &Circuits , TATA McGraw Hill 2nd ed”(2011)

2. Millman, Jacob, and Cristos C. Halkias. "SatyabrataJit; Electronic Devices and Circuits." TATA McGraw Hill 2nd ed”(2011).

Reference Books:

1. Boylestad, Robert L., and Louis Nashelsky. "Electronic Devices and Circuit Theory Pearson/Prentice Hall, 9thEdition, 2006

2.Electronic Devices and Circuits by David A. Bell, Oxford University Press

Course Code		L	T	P	Credits
1000192110	**COMMUNICATION SKILLS LAB**	0	0	2	1

Course Overview: In this course will develop the English proficiency of students and enable them to function effectively in different professional contexts, which enhance their employability skills.

Course Objectives:

- To impart employability skills like resume preparation and facing interviews
- To enable trainees to develop interpersonal and leadership skills
- To train them on work place skills like making presentations, participating in group discussions etc.

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Analyze the functions of language and grammar in spoken and written forms with an emphasis on LSRW Skills.	Understanding	L2	PO5 PO10 PO12
CO2	Disseminate the relevant skills while performing GDs, interviews, oral presentations with a focus on Non verbal communication.	Understanding	L2	PO5 PO10 PO12
CO3	Prepare and exhibit oral presentation skills by using ICT.(Individual/Team)	Understanding Applying	L2 L3	PO5 PO10 PO12
CO4	Organize proper life skills for their employability.	Understanding Applying	L2 L3	PO5 PO10 PO12

Experiments:

Expt.1: JAM (Just A Minute)

Expt.2: Interactions

Expt.3: Group Discussion

Expt.4: Reading Comprehension

Expt.5: Listening Comprehension

Expt.6: Presentation Skills

Expt.7: Resume Preparation and Covering Letter

Expt.8: Mock Interviews

Suggested Books:

Interact- Orient Blackswan,2019

FURTHER REFERENCES:

- *Elaine Kirn,Pamela Hartmann-**Interactions,** McGraw Hill,2007*
- *Edward Holffman, **Ace the corporate personality**, McGraw Hill,2001*
- Adrian Furnham, ***Personality and intelligence at work***, Psychology Press, 2008.
- John Adair Kegan Page, "***Leadership for innovation"*** 1st edition, Kogan, 2007.
- Krishna Mohan & NP Singh, "***Speaking English effectively"*** 1st edition, Macmillan, 2008.
- Dr. S.P. Dhanvel***, English and Soft skills,*** Orient Blackswan, 2011
- Rajiv K. Mishra, Personality ***Development***, Rupa& Co. 2004.

Course Code		L	T	P	Credits
1002192102	ELECTRICAL CIRCUIT ANALYSIS-II	3	1	0	3

Course Overview:

This course aims at study of three phase systems, transient analysis, network synthesis for the future study and analysis of power systems.

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Analyze the three phase circuits under balanced condition.	Understanding Applying	L2 L3	PO-1 PO-2 PO-4 PO-6 PO-7 PO-9 PO-10 PO-12
CO2	Analyze the three phase circuits under unbalanced condition and acquire the knowledge of graph theory.	Understanding Applying	L2 L3	PO-1 PO-2 PO-4 PO-6 PO-7 PO-9 PO-10 PO-12
CO3	Analyze the transient behaviour of the electrical circuits for different type's excitations.	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-5 PO-6 PO-9 PO-10 PO-11

				PO-12
CO4	Find parameters for different types of networks and realize electrical equivalent network for a given network transfer function.	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-5 PO-6 PO-7 PO-9 PO-10 PO-11 PO-12

UNIT- I **L: 08**

Balanced Three phase circuits

Phase sequence- star and delta connection - relation between line and phase voltages and currents - analysis of balanced three phase circuits - measurement of active and reactive power.

Outcome: Analyze the three phase circuits under balanced condition.
Activity:

- Activity on Three phase power Measurement for different types of loads.

UNIT II **L: 10**

Unbalanced Three phase circuits

Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique, Two wattmeter methods for measurement of three phase power.

Introduction to graph theory (Elementary treatment only)

Basic definitions, Incidence matrix, basic tie set matrix, basic cutest matrix.
Outcome: Analyze the three phase circuits under unbalanced condition and acquire the knowledge of graph theory

Activity:

- Activity on Three phase power Measurement for unbalanced loads. and solving higher order matrices using MATLAB software

Outcome: Analyze the transient behavior of the electrical circuits for different types excitations.
Activity:

- Analyze the transient response of R-L, R-C, R-L-C circuits using MATLAB software.

Unit-IV **L: 10**

Two Port Networks

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

Outcome: Able to determine the parameters for different types of networks.

Activity:

- Conduct an experiments on finding network parameters for the different types of networks

Unit-V **L: 12**

Network synthesis

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.

Outcome: Able to Realize electrical equivalent network for a given network transfer function.

Activity:

- Realize electrical equivalent network for a given network transfer function using MATLAB software

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.

II Year- II Semester

S.No	Course Code	Name of the Course	L	T	P	Credits
1	1002192220	Electrical Machines-II	3	1*	3	4.5
2	1004192200	Analog Electronics	3	1*	0	3
3	1002192201	Power Generation Engineering And Economics	3	1*	0	3
4	1002192221	Control Systems	3	1*	3	4.5
5	1099192200	Management Science	2	0	0	2
6	1000192130	Environmental Science	2	0	0	0
7	1020192100-1020192102	Open Elective-1	3	0	0	3
8	1002192170	Mini Project-I (EPICS/Societal Relevant Project)	0	0	2	1
Total Credits :						**21**

Course Code	ELECTRICAL MACHINES-II	L	T	P	Credits
1002192220		3	1	3	4.5

Course Overview:

This is a course on rotating electrical machines. This course covers the topics related to principles, performance and applications of three-phase induction motor, synchronous generators and synchronous motors.

Course Objectives

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

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Describe the construction and operation of 3-phase induction motor and synchronous machines	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-8 PO-9 PO-10 PO-11 PO-12
CO2	Elaborate starting methods of induction motor and synchronous motors	Understanding	L2	PO-1 PO-2 PO-3 PO-4 PO-6 PO-7 PO-8 PO-9 PO-10 PO-11 PO-12
CO3	Calculate torque in induction motors and synchronous machines	Understanding Applying	L2 L3	PO-1 PO-2 PO-3

				PO-4 PO-8 PO-9 PO-10 PO-11 PO-12
CO4	Design equivalent circuit of induction motors and analyze the performance characteristics	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-8 PO-9 PO-10 PO-11 PO-12

UNIT- I **L: 08**

3-phase Induction Motors

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

Outcome: At the end of the unit, students will be able to Discuss the operation of three-phase induction motor at various conditions.

Activity:

- Show the cut section of a small three-phase induction motor to the students, to enable them to identify the parts**.**

UNIT II **L: 10**

Characteristics and testing methods of Induction Motors

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

Outcome: At the end of the unit, students will be able toClassify the various testing methods of 3-phase induction motors and determine the efficiency.

Activity:

- Show animated video on three phase induction motor.

Experiments:

- Brake test on Three phase induction motor
- No–load & Blocked rotor tests on three phase Induction motor
- Speed control of induction motor by V/f method.

Unit-III **L: 10**

Starting methods of 3 phase Induction Motors and Single Phase IM Motors:

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

Outcome: At the end of the unit, students will be able to Analyze the starting methods of 3 phase Induction Motors and Single Phase IM

Activity:

- Seminar on " Introduction on Special Electrical Machine"

Experiments:

- Equivalent circuit of single phase induction motor
- Power factor improvement of single phase induction motor by using capacitors and load test on single phase induction motor.
- Performance characteristics of BLDC motor

Unit-IV **L: 10**

Construction, Operation and Voltage Regulation of Synchronous generator
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..

Outcome: At the end of the unit, students will be able to Classify the regulation methods of Synchronous generators.
Activity:

- Show the cut section of a three-phase synchronous machine to the students, to enable them to identify the parts..

Experiments:

- Regulation of a three–phase alternator by synchronous impedance
- Regulation of a three–phase alternator by MMF method
- Regulation of three phase alternator by potiermethod.

- Determination of efficiency of three phase alternator by loading with three phase induction motor.

Unit-V **L: 12**

Parallel operation of Synchronous generator, Synchronous motor – operation, starting and performance

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– Phasor diagram – Starting torque– Variation of current and power factor with excitation –Synchronous condenser – Mathematical analysis for power developed– Hunting and its suppression – Methods of starting – Applications

Outcome: At the end of the course, students will be able to Analyze the performance of Synchronous motor.

Activity:

- Group discussion on starting methods of Synchronous motor.

Experiments:

- Determination of X_d and X_q of a salient pole synchronous machine
- V and Inverted V curves of a three—phase synchronous motor

Text Books:

1. Electrical Machines – P.S. Bhimbra, Khanna Publishers,7^{th} 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, 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

Course Code	ANALOG ELECTRONICS	L	T	P	Credits
1004192203		3	1	-	3

Course Overview:

Course Objectives:

- To understand the basic operation of linear and Non-Linear wave shaping.
- To understand the basic operation of differential amplifiers.
- To learn the linear and non-linear applications of operational amplifiers.
- To learn the internal structure, operation and applications of different analog IC's
- To understand the analysis & design of different types of active filters using op-amps.

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Diagnose and trouble-shoot linear and non-linear electronic circuits.	Understanding	L2	PO-1 PO-2 PO-3 PO-4 P12
CO2	Design circuits using operational amplifiers for various applications.	Understanding	L2	PO-1 PO-2 PO-3 PO-4 P12
CO3	Understand thoroughly the operational amplifiers with linear integrated circuits	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 P12
CO4	Analyze the design amplifiers and active filters using op-amp.	Applying	L3	PO-1 PO-2 PO-3 PO-4 P12

Unit-I: Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, ramp, and square inputs.
Non - Linear Wave Shaping: Diode clippers – Series and Shunt, clipping at two independent
levels, clamping operation, types of clampers.

Unit-I

Outcome: Understand the linear and non-linear circuits with characteristics.
Activity/Event on Unit-1: Note the different types of signals as input signals and the corresponding outputs for liner and non-linear circuits.

Unit-II: Characteristics of Op-Amp
DC analysis and AC analysis of DIBO, DIUO, SIBO and SIUO modes, Op-amp Block Diagram, ideal and practical Op-amp Specifications, Op-Amp parameters: Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift, Output voltage Swing.

Unit-II

Outcome: Understand the characteristics of the Differential amplifiers.

Activity/Event on Unit-II: Able to analyze the basic operation of the Op-Amp.

Unit-III: Applications of Op-Amp:Modes of operation of Op-Amp, DC and AC characteristics of Op-amp, Basic application of Op amp – Inverting and Non-Inverting amplifiers, differentiator, Integrator, Instrumentation amplifier using 1, 2, 3 Op-Amps, Comparators, Voltage Follower, V to I and I to V converters.

Unit-III

Outcome: Understand the applications of linear and non-linear applications using Op-Amp.
Activity/Event on Unit-III: Design the any one of the linear / non-linear Op-Amp applications.

Unit-IV: Timer 555: IC 555 Pin Discretion, Functional block diagram of IC 555, Mono-stable and astable multivibrators using IC 555 and it's Applications.

Phase Locked Loops: Introduction to PLL, Principles and description of individual blocks of
PLL; Applications of PLL – AM, FM and frequency synthesizer

Unit-IV

Outcome: Able to understand the analog IC 555 internal operation with applications.
Activity/Event on Unit-IV: Develop the any one of the real-time application using IC 555.
Unit-V: Active Filters: 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-V

Outcome: Understand the working principle of different types of active filters
Activity/Event on Unit-V: Design the real-time application of any of the active filters

Text Books:
01. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987.
02. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003

Reference Books:

01. Design with Operational Amplifiers &Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
02. OP AMPS and Linear Integrated Circuits, Dr. Sanjay Sharma, New Age International Ltd.
03. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin& Fredrick Driscoll,
PHI, 6th Edition.
04. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition

Course Code		L	T	P	Credits
1002192201	POWER GENERATION ENGINEERING AND ECONOMICS	3	1	0	3

Course Overview:

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 Objectives

- To study the layout of Thermal Power Stations.
- To study the concept of Nuclear and Hydroelectric Power Stations
- To understand the PV cell characteristics.
- To understand the concept of Wind, Ocean energy.
- To understand the concept of Economics of Power Generation and Tariff Methods.

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Explain the operation of thermal and nuclear power stations, and their components.	Understanding Applying	L2 L3	PO-1 PO-2 PO-6 PO-10 PO-12
CO2	Analyze the operation of PV cells.	Understanding	L2	PO-1 PO-2 PO-6 PO-9 PO-10 PO-12
CO3	Understand the operation of Hydro, Wind, Tidal, Wave Power Plants.	Understanding Applying	L2 L3	PO-1 PO-2 PO-6 PO-7 PO-10 PO-12
CO4	Interpret various load curves and compare different methods of tariff.	Understanding Applying	L2 L3	PO-1 PO-2 PO-3 PO-4 PO-5 PO-8 PO-10 PO-11 PO-12

UNIT- I **L: 08**

Thermal Power Stations

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.

Outcome: To explain the operation of different components of thermal power stations.

Activity:

- Activity on various motors used in Thermal plant operation for coal and ash handling, ID,FD fans..

UNIT II **L: 10**

Nuclear and Hydroelectric Power Plants

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.

Outcome: To explain the operation of different components of Nuclear, hydro Power Stations.

Activity:

- Activity on Nuclear and hydro Power Stations components

Unit-III **L: 10**

Photovoltaic cells

Solar photovoltaic cell, I-V characteristics, Equivalent circuit of solar cell, Efficiency of solar cells, module, array, Series and Parallel connection, PV system sizing – Maximum power point techniques: Perturb and observe (P&O) technique.

Outcome: To analyze the operation of PV cells.

Activity:

- Activity on various PV Cell generations, PV datasheets.

Unit-IV **L: 10**

Wind, Ocean and Tidal energy:

Wind Energy, Nature of wind, Types of forces acting on wind turbines, Betz Criteria (no proof), 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.

Outcome: To illustrate the concepts of wind energy, ocean thermal,tidal and wave energy

Activity:

- Activity on wave and tidal power plants & their ratings in India.

Unit-V **L: 12**

Economics of Power Generation and Tariff Methods
Load curve, load duration and integrated load duration curves-load, Demand, diversity, capacity, utilization and plant use factors- (No Numerical Problems).
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.

Outcome: To interpret various load curves and compare different methods of tariff.

Activity:

- Activity on tariff methods in various states.

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.

Course Code		L	T	P	Credits
1002192221	CONTROL SYSTEMS	3	1	3	4.5

Course Overview:

This course introduces the elements of linear control systems and their analysis. Classical methods of design Controllers using frequency response. The state space approach for design and modeling. Analysis of simple PD, PID controllers

Course Objectives

- To learn the mathematical modeling 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: At the end of the course, the student will be able to

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Derive the transfer function and state space models for electrical,mechanical and electro-mech systems	Understanding Applying	L2 L3	PO-1 PO-2 PO-4 PO-5
CO2	Analyze the Transient & Steady State Performance of a different system.	Understanding Analyzing	L3 L4	PO-1 PO-2 PO-4 PO-10 PO-12
CO3	Determine the stability of different Linear Time invariant systems.	Analyzing Evaluating	L4 L5	PO-1 PO-2 PO-4 PO-6 PO-12 PO-12
CO4	Design lag,lead and lag-lead compensators for different systems to improve system performance.	Designing	L6	PO-1 PO-2 PO-3 PO-4 PO-5

UNIT- I **L: 12**

Mathematical Modeling of Control Systems:

Classification of control systems, Open Loop and closed loop control systems and their differences, 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 –Feed Back Characteristics- Effects of proportional derivative, proportional integral systems, proportional derivative integral systems – Physical realization of PID controller with OP-AMPs.

Outcome: Analyze the Transient & Steady State Performance for first and second order system

Activity:

- Finding the time domain response & time domain specifications for any Given systems using MATLAB Software.

Experiments:

- Time response of Second order system- MATLAB Simulation and Experiment using CRO.
- Effect of P, PD, PI, PID Controller on a second order systems- MATLAB Simulation & Experiment.
- Temperature control using PID - MATLAB Simulation &Experiment..

Unit-III **L: 12**

Stability Analysis:

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.
Introduction-Sinusoidal transfer function - Frequency domain specifications – Minimum and Non-minimum phase systems - 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 (rootlocous,bode plots, polar plots &Nyquist plots).

Activity:

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

Experiments:

- Drawing Bode plot, Root Locus, and Nyquist plot of a system in MATLAB.

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,PDcontrollers for any given system.

Activity:

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

Experiments:

- Design of Lag and lead compensators for a system in frequency domain using MATLAB.

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 Analize their response. Also understanding the concepts of controllability and observability.

Activity:

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

Experiments:

- Conversion of State space model to transfer function and transfer function to state space model using MATLAB.

Additional Experimental Activities/Events on Control System Course:

- Characteristics of magnetic amplifiers.
- DC position control system.

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, ManikDhanesh 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	MANAGEMENT SCIENCE	L	T	P	Credits
1099192200		2	0	0	2

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. Management Science is an approach to management decision-making that makes extensive use of quantitative methods
2. This course aims to introduce students to the application of quantitative techniques to problems where models capture problem structure and use it to help optimize the decision outcome.
3. The classes demonstrate how advances in imputing power have made these techniques more accessible to managers and how the techniques can be applied to a range of different situations.
4. Provide a basic understanding of management science and engineering principles, including analytical problem solving and communications skills.
5. Prepare for practice in a field that sees rapid changes in tools, problems, and opportunities.

Course Outcomes:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Illustrate basic insights of management principles	Understand	PO6, PO11, PO12
CO2	Summarize Production process, Quality control and Inventory techniques	Analyze	PO8, PO10, PO11, PO12
CO3	Apply Strategies and policies to functional areas	Apply	PO8, PO10, PO11, PO12
CO4	Understand Contemporary management Practices	Understand	PO6, PO11, PO12

Unit-I:

Introduction to Management: Concept –nature and importance of Management – Generic Functions of Management – Principles of Management managerial roles and skills

– Evolution of Management thought- Theories of Motivation (Maslow's, hertz berg and X-Y Theory) – Decision making process-Designing organization structure- Principles of organization.

Unit-I Outcome: Illustrate basic insights of management principles
Activity/Event on Unit-1: Case study on motivation
Unit-II: Operations Management: Plant location, Principles and Types of plant layout, production methods (job, batch mass production) – Work study- Statistical Quality Control- Control Charts (X Bar chart &R-charts, P-chart and C-chart) Simple problems- Material Management: Need for Inventory control- Tools and techniques of Inventory Control - EOQ, ABC analysis, HML, SDE, VED, and FSN analyses
Unit-II Outcome: Summarize Production process, Qualitycontrol and Inventory techniques
Activity/Event on Unit-II: Group discussion
Unit-III: Strategic Management: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process –Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy, Alternatives. **Project Management**: (PERT/CPM): Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability (Problems)
Unit-III Outcome Apply Strategies and policies to functional areas
Activity/Event on Unit-III: SWOT analysis
Unit-IV Functional Management: Concept of HRM, HRD and PMIR- Functions of HR Manager- Wage payment plans (Problems) – Job Evaluation and Merit Rating – Salient features of The Factories Act 1948 - Marketing Management, Marketing Mix strategies – Product, Price, Place and Promotion
Unit-IV Outcome: Apply Strategies and policies to functional areas
Activity/Event on Unit-IV: case study and role-play
Unit-V: Contemporary Management Practices: Basic concepts of MIS, MRP, Justin-Time(JIT) system, Total Quality Management(TQM), Six sigma and Capability Maturity Model(CMM) Levies, Supply Chain Management ,Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card
Unit-V Outcome: Understand Contemporary management Practices
Activity/Event on Unit-V: debate on Contemporary Management Practices
Text Books: 1. 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. KanishkaBedi: Production & Operations Management, Oxford Publications, 2011

5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications

6. BiswajitPatnaik: Human Resource Management, PHI, 2011

Course Code	ENVIRONMENTAL SCIENCE (Audit Course)	L	T	P	Credits
1000192130		2	0	0	0

Course Overview:

Environmental Studies is a specialized course that is meant to train the students in various fields related to the environment like Natural Resources Conversation, Ecology, Environment Impact Assessment, Pollution Management Techniques, and Environmental Protection Laws

Course Objectives:

1. Classify, describes and explains the concept of Ecosystems and Environmental Engineering
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 environmental impact of developmental activities and the importance of environmental management and Awareness on the social issues, environmental legislations and global treats

Course Outcomes:

	Course outcome	Blooms Cognitive level	PO
CO1	Gain a higher level of personal involvement and interest in understanding and solving environmental resource problems and its sustainable conservation practices.	Understand	PO 7 and 12
CO2	Overall understanding of the relationship between man and ecosystem & biodiversity	Understand	PO 6, 7, 8, 9 and 12
CO3	Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century	Understand	PO 2, 6, 7, 8, 9 and 12
CO4	Recognize the interconnectedness of human dependence on the earth's ecosystems and Influence their society in proper utilization of goods and services.	Understand	PO 6, 7, 9 and 12

Unit-I:

Environmental Science: Definition Scope and its importance, Multidisciplinary nature of Environmental science.

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

Unit-I Outcome:

- Learn about the basics of environment, natural resources and its conservation

Activity/Event on Unit-1: Collects the case studies on Natural resources

Unit-II:

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Energy flow in the ecosystem – Ecological pyramids - Ecological succession.

BIODIVERSITY AND ITS CONSERVATION: Definition: genetic, species and ecosystem diversity –Value of biodiversity, Threats to biodiversity, –Biodiversity conventions-Conservation of biodiversity.

Unit-II Outcome:

- Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century

Activity/Event on Unit-II: Prepares the models of food chain, web and pyramids

Unit-III:

Social Issues and the Environment

Human population growth: Impacts on environment.– Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people; Case studies Climate change, Global warming, Acid rain, Ozone layer depletion. 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.

Unit-III Outcome:

- Understand the concept of climate change, its mitigation and environmental legislations

Activity/Event on Unit-III: prepares the models on green house effect and watershedestablishmentinthe college campus

Unit-IV:

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

1. Air Pollution,
2. Water pollution,
3. Soil pollution,
4. Noise pollution,

5. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies.

Unit-IV Outcome:

- Understand the harmful effects of human activities on environment and their solution

Activity/Event on Unit-IV: collects case studies on different pollution

Unit-V:

Environmental Management

EIA and EA: Introduction, definition, scope, objectives and methodology.Disaster management: Definition, floods, earthquake, cyclone and landslides.Ecotourism: Definition, advantages and disadvantagesEnvironmental 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.

Unit-V Outcome:

Understand the importance of EIA and EA, various disasters and its mitigation measures

Activity/Event on Unit-V: Environmental diary preparation and field trip

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by ErachBharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

Reference Books:

1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies byJ.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book 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	Employability Readiness Program-I	L	T	P	Credits
1020192100	(Open Elective-1)	3	0	0	3

Course Overview:

In this course students get knowledge of analytical thinking,standard operation methods, verbal ability, career-oriented skills, numerical ability, mensuration, data interpretation,arithmetical ability, logical ability and reasoning

Course Objectives:

1. To encourage the all-round development of students by focusing on verbal ability
2. To perform better during Campus Recruitment and variousinterviews they face in their career.
3. To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of competitive examinations.
4. Toenhance the problemsolving skills in the area of‘Quantitative Aptitude’ and ‘Reasoning’ which will enable the students to achieve in Campus Placements and competitive examinations.

Course Outcomes:

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

	Course Outcome	Cognitive level as per Bloom’s Taxonomy	PO
CO1	Students have the adequate writing **skills** that are needed in an organization	Understanding (L2)	PO-9 PO-10
CO2	Understand the core competencies to succeed in professional and personal life	Understanding (L2)	PO-9 PO-10
CO3	Solve various Basic Mathematics problems by following different methods and to perform well in various competitive exams and placement drives.	Understanding and applying (L2&L3)	PO-1 PO-4
CO4	Follow strategies in minimizing time consumption in problem solving 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.	Understanding and applying (L2&L3)	PO-1 PO-2

Unit-I:

Verbal:
English Grammar and Vocabulary, Noun &Pronoun,Verbs (Lexical& Auxiliary),Verb Tenses,Adjectives& Adverb Preposition,Conjunction, Phrases and Clause

Aptitude/ Logical Reasoning:
Number System: Speed maths, Numbers, Factors, prime & Co primes, LCM;HCF, Divisibility rules, finding unit place digit and last two digits of an expression.
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.

Unit-I Outcome:
1. Demonstrate the knowledge of all parts of speech's
2. Apply shortcut methods to solve mathematical problems

Activity/Event on Unit-I:
Activity 1. Quiz on Parts of Speech
Activity 2. Brain Teasers (Number System) and Puzzles on Blood Relations

Unit-II:

Verbal: Sentence Types, Transformations, Word meanings, synonym, Antonym,Root words, one word substitutes, Phrasal Verbs, Idioms,Word games – Vocabulary development

Aptitude/ Logical Reasoning:
Percentages: Converting fractions and decimal into percentages, successive percentage, populations, expenditure and savings
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.

Unit-II Outcome:
1.Understand the vocabulary and grammar
2.Follow strategies in minimizing time consumption in problem solving and to perform well in various competitive exams and placement drives.

Activity/Event on Unit-II:
Activity 1: Stock Market Game
Activity 2 : Class Business
Activity 3 : Budget Tracking
Activity 4 :Role Play on : (Sentence Transformations ;Types of Sentence)
Activity 5: Semantic Maps (Vocabulary Development).
Activity 6: Eye Spy

Unit-III:

Verbal:

Reading Comprehension, Comprehension: The Goal of Reading, General strategies for Reading Comprehension, Strategies for Reading Comprehension: Narrative Text, Strategies for Reading Comprehension: Expository Text, Main Idea/Summarization

Aptitude/ Logical Reasoning:

Partnership:Relation between partners, period of investment and shares

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

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

Unit-III Outcome:

1. Understand the core competencies to succeed in personal life
2.Utilize these mathematical skills both in their professional as well as personal life

Activity/Event on Unit-III:

Activity 1: Box Plots
Activity 2 : Brain Teaser/Puzzle
Activity 3: KWL Chart & Story Map

Unit-IV:

Verbal:

Sentence Correction/ Improvement/ Completion, Subject-verb agreement, Repetition, Error in modifiers, Parallelism, Error in diction, Wrong comparisons

Aptitude/ Logical Reasoning:

Time and Work: Men and Days, Work and Wages, hours andwork, 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

Unit-IV Outcome:

1.Understand the core competencies to succeed in professional and personal life
2.Solve various Basic Mathematics problems by following different methods

Activity/Event on Unit-IV:

Activity 1.: Brain Teaser/Puzzle
Activity 2: Use sticky notes
Activity 3:Tic-tac-toe

Unit-V:

Verbal: E-mail,Essay Writing, Tips on Writing an Effective Essay, Cloze Test, Cloze Test – Introduction to the Concept, Tips and Tricks to Solve Cloze Test

Aptitude/ Logical Reasoning:

Series &Progressions: Arithmetic, Geometric and Harmonic Progressions, Arithmetic Mean, Geometric Mean and Harmonic Mean and their relations.

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

Probability: Definition of probability, notations and formulae, problems on probability.

Unit-V Outcome:

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

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

Activity/Event on Unit-V:

Activity 1 : Picture Stories(PPDT Images)

Activity 2 :Word Grab

Activity 3: Brain Teaser/Puzzle

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. **Arun Sharma and MeenakshiUpadhyay for verbal ability**
4. A Modern Approach to Verbal Reasoning by R S Agarwal, S Chand Publications

Reference Books:

1. Quantitative Aptitude – AbhijitGuha, McGraw Hills.
2. Logical Reasoning, Arun Sharma, McGraw Hill.
3. Analytical & Logical Reasoning, Peeyush Bhardwaj, Arihant Publications

Course Code	PUBLIC ADMINISTRATION	L	T	P	Credits
1020192101		3	0	0	3

Course Overview:

The course will provide an overview of the field of public administration by focusing on its development and importance in modern government operations at the local, state, and federal levels. It will familiarize the students with the basic principles, concerns, and methods of public administration.

Course Objectives:

Students will be able to:

- Understand definition, scope, approach and theories of public administration.
- Identify the process and technique of decision making and also understand the concept of administrative behaviour and control.
- Will be able to understand the process and technique of personnel and financial administration.
- Discuss the tools that modern public administrators use to pursue public goals and public policy, along with the pros and cons of those tools.
- Explain the major administrative techniques and values that public administration has and illustrate how those affect the work of government and also understand the process of administrative improvement.

Course Outcomes:

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

	Course Outcome	Cognitive level as per Bloom's Taxonomy	PO
CO1	Students will be able to understand definition, scope, approach and theories of public administration.	Remembering and Understanding (L1 &L2)	PO-2 PO-6 PO-12
CO2	Students will be able to identify the process and technique of decision making and also understand the concept of administrative behaviour and control.	Understanding and Analyzing (L2&L4)	PO-6 PO-12
CO3	Students will be able tounderstand the process and technique of personnel and financial administration.	Understanding and applying (L2&L3)	PO-06 PO-09 PO-11 PO-12

CO4	Students will be able to Discuss the tools that modern public administrators use to pursue public goals and public policy, along with the pros and cons of those tools.	Understanding, Applying Evaluating (L2, L3&L5)	PO-06 PO-09 PO-12
CO5	Students will be able to understand and explain the major administrative techniques and values that public administration has and illustrate how those affect the work of government and also understand the process of administrative improvement.	Understanding, Applying Evaluating (L2, L3&L5)	PO-06 PO-08 PO-09 PO-12

UNIT I. Introduction:

Meaning, scope and significance of Public Administration; Wilson's vision of Public Administration; Evolution of the discipline and its present status; New Public Administration; Public Choice approach; Challenges of liberalization, Privatization,Globalization; Good Governance: concept and application; New Public Management. Organization Theories

UNIT II Accountability and control & AdministrativeBehaviour

Process and techniques of decision-making; Communication; Morale; Motivation Theories – content, process and contemporary; Theories of Leadership: Traditional and Modern. Legislative, Executive and Judicial control over administration; Citizen and Administration; Role of media, interest groups, voluntary organizations; Civil society; Citizen's Charters; Right to Information; Social audit.

UNIT-III Personnel and Financial Administration:

Importance of human resource development; Recruitment, training, career advancement, position classification, discipline, performance appraisal, promotion, pay and service conditions; employer- employee relations, grievance redressal mechanism; Code of conduct; Administrative ethics. Monetary and fiscal policies; Public borrowings and public debt Budgets - types and forms; Budgetary process; Financial accountability; Accounts and audit.

UNIT-IV: Public Policy:

Models of policy-making and their critique; Processes of conceptualization, planning, implementation, monitoring, evaluation and review and their limitations; State theories and public policyformulation. Women and development - the self-help group movement.

UNIT-V Techniques of AdministrativeImprovement:

Organization and methods, Work study and work management; e-governance and information technology; Management aid tools like network analysis, MIS, PERT, CPM.

Reference Books

1. The Politics of Public Health in the United States (2004)
2. The Public Administration Theory Primer (2011)
3. Ethics and Integrity in Public Administration (2009)
4. Social Equity and Public Administration (2010)

Course Code	Foreign Linguistic - FRENCH	L	T	P	Credits
1020192102		3	0	-	3

Course Overview:

In this course students get knowledge of active communication in beginning French. including listening, speaking, reading, writing, pronunciation, structure, vocabulary and culture.

Course Objectives:

1. Express him/herself effectively and accurately in simple French about him/herself and pronounce French reasonably well.
2. Construct simple sentences in French using accurate rudiments of syntax and grammar, Time, Weather and Structures used in a restaurant
3. Write short paragraphs on simple topics, e.g., (food, past memories, vacations, daily routines, shopping, health, love and hopes, etc.)
4. Demonstrate an elementary knowledge of French sentence structure while expressing themselves in French.
5. Compare and contrast the similarities and differences between his/her own culture and those of various French-speaking cultures

Course Outcomes:

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

	Course Outcome	Cognitive level as per Bloom's Taxonomy	PO
CO1	Students have the adequate reading and speaking skills and will be able to express himself in French.	Understanding(L2)	PO-10 PO-12
CO2	Understand the grammar and use them in their personal and professional life.	Understanding (L2)	PO-10 PO-12
CO3	Students will be able to write proficiently in French.	Understanding and applying (L2&L3)	PO-10 PO-12
CO4	Studentswill be able to compare and contrast world culture and it will expand his knowledge about various culture.	Understanding and applying (L2&L3)	PO-6 PO-10 PO-12

UNIT-1 French Alphabet and Typical Sounds in French – I

Recognize the French letters; Pronounce these letters, Identify the differences and similarities between the English and French alphabet Spell one's name and other names in French; Discover simple words that begin with these letters; Identify the letter-combinations that are characteristic of the French language; Pronounce these letter-combinations: Recognize the different pronunciations of certain letter-combinations; Learn the various letter-combinations that produce the same sounds; Discover simple words that are constructed from these letter-combinations;

UNIT-2 Typical Sounds in French – II,Liaison and Silent Letters

Identify the remaining letter-combinations that are characteristic of the French language; Pronounce these letter-combinations; Combine various letter-combinations to produce a variety of different sounds; Recognize the various accents and diacritical marks used in French; Discover simple words that have these letter-combinations, accents and diacritical marks; Understand when to pronounce the final consonant; Recognize when to connect the first and last letters of two adjacently placed words; Differentiate between a silent 'E' and a pronounced 'E; Distinguish the difference between a mute 'H' and an aspirated 'H'; Discover simple words that begin with 'H' and those that have silent letters;

UNIT-3 Numbers

Count the numbers from 0 - 100; Write the numbers from 0 – 100 in French; Ask someone his age; Tell one's age and phone number in French; Distinguish between the formal 'you' and informal 'you';

UNIT-4 Basic Grammar

Pronouns, Verbs, Definite and Indefinite Articles, Adjective, Prepositions, Tenses, ArticlesNegation, Closed Questions

,

UNIT-5 Time, Weather and Structures used in a restaurant

Say the time in French;Learn how to say the time in numerals; Learn how to say the time in fractions; Learn how to write the time in French; Learn a few prepositions associated with time; Talk about the weather in French; Use different phrases to express different types of weather conditions; Describe a weather condition in different ways; Understand the difference between French and Native cultures; Learn the various words and phrases related to weather;Learn the different prepositions used with weather and seasons; Structures used in a restaurant; Place an order in a restaurant; Take an order from a client at a restaurant; Identify the different courses of a meal; Identify basic expressions and structures associated with French gastronomy;

Review partitive articles and expressions of quantity.

BOOKS AND REFERENCES

Alter Ego - Méthode de Français, A1 (2006): Berthet, Hugot et al., Hachette

Alter Ego – Cahier d'activités, A1 (2006): Berthet, Hugot et al., Hachette

Écho - Méthode de Français, A1 (2013): Girardet, Pecheur, CLE International

Écho - Cahier personnel d'apprentissage, A1 (2013): Girardet, Pecheur, CLE International

A votre service – 1, A1 (2011): Chanderasekar, Hanga et al., Hachette

Course Code	Mini Project – 1 EPICS/Societal relevant project	L	T	P	Credits
1002192170		0	0	2	1

Course Overview:

Course will explain the importance of engineers in the society. Itwill give a brief understanding of various social and global issues of the world. Course reminds that every engineer has a responsibility to solve the social problems of world, to make the world a better place to livein. In the process of serving the society, students need to identify a community problem for which a community project needs to be developed. After successful completion of project, the Project needs to be submitted to community for their benefit. For the effective development of the project, concepts like 'Design thinking' & 'Project management' will be taught in the course. In addition to that, various platforms like IoT, 3D Printing, Mobile app etc. will be explained which will be useful for effective project development.

EPICS means **- Engineering Projects In Community Service**

Course Objectives

Course objective is to remind students, that every engineer has a responsibility to serve the society. As part of fulfilling the responsibility, Students will create an Engineering project in the service of community. Students will learn the necessary concepts & technologies to developeffective projects

Course Outcomes with Bloom's Taxonomy level and PO mapping:

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	**Understand** the various social problems present in the world & they will be able to identify and select a community problem to develop a technological project.	Understanding, Identifying	L2 L3	PO-1, PO-2 PO-6, PO-9 PO-10
CO2	**Learn** the concepts of Design Thinking and Project management. **Learn** the technologies like Internet of Things, 3D Printing, Mobile App Creation, Thinker CAD, and Web page development.	Understanding	L2	PO-3, PO-5, PO-11
CO3	**Apply** the engineering knowledge, mathematics, design thinking and project management to **develop** a	Applying, Testing Summarize,	L3, L4 L5, L6 L6	PO-1, PO-2, PO-3, PO-5

	community project.	Develop Validate		PO-6, PO-7, PO-9, PO-10 PO-11,
CO4	Students will submit the project to the intended community and feedback to be collected from community. Any future support also will be provided by the students.	Understanding	L2	PO-1, PO-6, PO-8 PO-12

UNIT- I **L: 08**

ENGINEER'S CONTRIBUTION TO SOCIETY:

Major roles played by engineers in building a society – Importance of engineers to society – Variousglobal issues, social problems & problems faced by different communities in the world – Engineering inventions which reduced the impact of many social problems.

EPICS:

Introduction to EPICS – Learning pedagogies - History of EPICS – Case studies of various EPICS projects of Purdue university – Case studies of various EPICS projects in India– Community visit – Selection of a community project by visiting a community / Studying about a community.

Outcome: Students will be able to understand the importance of Engineers in the society &will also recognize various ways by which engineerscan contribute to society.Students will realize the need of Community projects.

Activity:

- Visiting a Community / Studying about a community to understand their Problems. Analyzing their problems and Identifying problems which can be solved through technology.
- Selecting one Social / Community problem from the identified problems to develop a technological solution/project.

UNIT II **L: 08**

DESIGN THINKING & PROJECT MANAGEMENT:

DESIGN THINKING:

Introduction to Design Thinking – Case study for design thinking process(IDEO)–Requirement & Specifications from Users and community partners – Ideation and Concept generation – Design and Prototyping – Testing & Redesign – Detailed design and delivery.

PROJECT MANAGEMENT:

Introduction to Project & Project Management – Project Management Process – Stake Holders – AgilePractices in Project Management – Project management tools (Checklist, Precedence Table, Timeline using Gantt Chart) – Advanced project management tools – Significance of Documentation.

Outcome: Students will be able to understand process of 'Design' for any kind of project. Students will be able to learn the project management techniques. Students will apply this knowledge for developing projects.

Activities:

- Studying the Design thinking process of Shopping cart developed by IDEO
- Creating a project plan for the community project.

Unit-III **L: 10**

PLATFORMS FOR DEVELOPING COMMUNITY PROJECTS:
Various platforms are used for developing projects. Some of the platforms used for project development are

a. Internet of Things (IoT)& Embedded Systems
b. 3D Printing
c. Thinker CAD
d. Mobile App creation
e. Web Development

Internet of Things (IoT)& Embedded Systems:

Introduction to Internet of Things (IoT) & Embedded systems – Difference between IoT& Embedded systems - Before IoT vs. After IoT - Stages of IoT - Components of IoT&Embedded systems (boards, sensors, actuators) - Programming of IoT& interfaces to hardware- Cloud integration & Data collection - Application of IoT& future scope

3D Printing:

Introduction to 3D Printing - Before and After 3D Printing - Components for 3D Printing - Types of 3D Printing - Steps for creating a 3D Model - Scope of 3D Printing - 3D Milling, Laser cutting, 3D Carving machine using 3D Printing technology

Thinker CAD:

Thinker CAD circuit making: Circuit Design - Programming – Simulate

Thinker CAD 3D Modelling: Place – Adjust – Combine - 3D Print

Mobile App Creation:

1. Applications and Scope of Mobile Apps in society
2. Tools for creation of mobile apps (MIT APP, AppsGeyser&AppyBuilder)

Web Development:

1. Applications / Need for Webpage
2. Tools (various websites) for creation of Web pages (Wix, Weebly&GoDaddy)

Outcome: Students will be able to learn various platforms and apply the knowledge for developing social projects

Activities:

- Based on the requirements of community projects, students will select one or more platforms for project completion. Corresponding online courses will be learnt by students.

Unit-IV **P: 12**

PROJECT DESIGN& PROTOTYPING:

Defining the Problem – Requirements & Specifications from Users / Community partners – Detailed Design – Creating a Prototype by considering key parameters.

Outcome: Students will be learning the fundamental process of Design. They will learn how to make use of customer requirements to the effective design process and the process of making a prototype.

Activities:

- Developing the Community Project

Unit-V **P: 12**

PROJECTTESTING& SUBMISSION:
Prototype testing – Analyzing the performance of prototype – Redesign (in case of testing failure) – Submission to community partners / beneficiaries – taking the feedback for improvement of the project.

Outcome: Students will be able to learn the importance of testing and redesign in the real time projects.

Activity:

- On testing, if results are positive, project needs to be submitted to the community.

Reference Papers:

1. **EPICS:** Engineering projects in community service*, Edward j. Coyle, Leah H. Jamieson and William C. Oakes, International Journal of Engineering Education, 2005

Web links:

1. https://en.wikipedia.org/wiki/List_of_global_issues
2. https://engineering.purdue.edu/EPICS/purdue/role-specific/purdue/team-documents/design-documents - For Design thinking
3. https://www.coursera.org/learn/uva-darden-project-management
4. https://www.coursera.org/specializations/project-management
5. https://www.coursera.org/learn/introduction-iot-boards - Learn IoT.
6. https://en.wikipedia.org/wiki/3D_printing
7. https://www.coursera.org/learn/3d-printing-applications
8. https://www.tinkercad.com/ - For Thinker CAD
9. https://appinventor.mit.edu/- For creating MIT Mobile APP
10. http://appybuilder.com/ - For Creating own mobile app
11. https://www.weebly.com/in - For creating own websites
12. https://www.wix.com/ - For Creating own websites

III Year- I Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1002193100	Power transmission engineering	3	0	0	3
2	1002193120	Electrical Measurements and Instrumentation	3	0	3	4.5
3	1002193121	Power Electronics	3	0	3	4.5
4	1004193102	Digital Electronics	3	0	0	3
5		**Professional Elective-I**	3	0	0	3
	1002193150	Digital control systems				
	1002193151	Energy audit conservation and management				
	1002193152	Special Electrical Machines				
6		**Open Elective-II**	3	0	0	3
	1012193161	Fundamentals of Python Programming				
	1003193162	Mechatronics				
	1004193161	Signal Processing				
7	1099193131	IPR & Patents	2	0	0	0
8	1002193180	Technical Seminar	0	0	0	1
Total Credits:						**22**

Course Code	POWER TRANSMISSION ENGINEERING	L	T	P	Credits
1002193100		3	0	0	3

Course Overview:

This course is an extension of Power generation Engineering and Economics. It deals with basic theory of transmission lines modeling and their performance analysis. Transient in power system, improvement of power factor and voltage control are discussed in detail. It is important for the student to understand the mechanical design aspects of transmission lines, underground cables, insulators. These aspects are also covered in detail in this course.

Course Objectives

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

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.	Understanding Applying	L2 L3	PO-1, PO-2, PO-3
CO2	Analyze the performance of short, medium and long transmission lines.	Understanding Applying	L2 L3	PO-1, PO-2, PO-3, PO-4, PO-5
CO3	Summarize various factors related to charged transmission lines and underground cables.	Understanding	L2	PO-1, PO-2, PO-3, PO-4, PO-5, PO-6, PO-7, PO-8
CO4	Estimate sag/tension of transmission lines, performance of line insulators.	Understanding Applying	L2 L3	PO-1, PO-2, PO-3, PO-4, PO-5, PO-7, PO-8

UNIT-I: **L: 10**

Transmission Line Parameters

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 withtransposition –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.

Outcome: Student able to compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.

Activity: Calculate Inductance & Capacitance for a 500 Km line to deliver 1000 MW Power.

UNIT- II **L: 10**

Performance of Transmission Lines

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).

Outcome: Student able to study the short, medium and long length transmission lines, their models and performance.

Activity: Determine the Regulation and efficiency for a 500 Km line to deliver 1000 MW Power at 400 KV.

UNIT- III **L: 10**

Waves in Long Transmission Lines and Power System Transients

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.

Outcome: Student able to study the effect of travelling waves on transmission lines.

Activity: Calculate the Wave Length and Velocity for a 500 Km line to deliver 1000 MW Power.

UNIT- IV **L: 10**

Various Factors governing the Performance of Transmission line and Underground Cables

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.

Outcome: Student able to study the factors affecting the performance of transmission lines and underground cables

Activity: Calculate the corona power loss for a 500 Km line when it delivers 1000 MW Power at 400KV.

UNIT-V **L: 10**

Sag and Tension Calculations and Overhead Line Insulators

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.

Outcome: Student able to discuss sag and tension computation of transmission lines as well as to study the performance of overhead insulators.

Activity: Determine the height of tower and string efficiency for a 500 Km line when it delivers 1000 MW Power at 400KV.

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	Credits
1002193120		3	0	3	4.5

Course Overview: This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. Measurement of various physical quantities in terms of Electrical quantities like resistance, inductance and capacitance by using Transducers. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer

Course Objectives

- 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.
- To understand the principle of operation and working of dc potentiometers
- To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
- 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: At the end of the course, the student will be able to

1. Choose right type of instrument for measurement of voltage and current for ac and dc and measurement of power, energy and various physical quantities.
2. Calibrate ammeter voltmeter and potentiometer
3. Select suitable bridge for measurement of electrical parameters
4. Measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.
5.

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
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.	Evaluate	6	1,2,3
CO2	Calibrate ammeter voltmeter and potentiometer	Apply	3	1,2
CO3	Select suitable bridge for measurement of electrical parameters	Analyzing (4)	4	1,2,3,4
CO4	Measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements	Evaluate	6	1,2

UNIT- I **L:10**

Measuring Instruments

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 error and Phase angle error – Basic Numerical problems.

Outcome:
Able to Choose right type of instrument for measurement of voltage and current for ac and dc.

Activity/Event: Measure Voltage and Current For AC and DC

UNIT II **L: 10**
Measurement of Power & Power Factor, Potentiometers

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 CT and PT.

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

Outcome:

Able to choose right type of instrument for measurement of power - Able to calibrate ammeter voltmeter using potentiometer

Experiments:
- Calibration of LPF wattmeter using phantom loading
- Calibration of dynamometer wattmeter by direct loading.
- Calibration of PMMC ammeter and voltmeter using Crompton D.C. Potentiometer
- Measurement of 3 phase power with single watt meter and using two C.Ts.
- Measurement of Power by 3 Voltmeter and 3 Ammeter method
- Calibration and testing of single-phase energy Meter

Unit-III **L: 10**
Measurements of Electrical Parameters:

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.

Outcome:.
Able to select suitable bridge for measurement of electrical parameters

Experiments:
- Measurement of resistance using Kelvin's double Bridge.
- Inductance Measurement using Anderson bridge.
- Capacitance Measurement using Schering bridge

Unit-IV **L: 10**

Transducers

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

Outcome:

Able to Choose right type of instrument for measurement of physical Quantities.

Experiments:

- Measurement of displacement using LVDT
- Measurement of Strain using Strain Gauge
- Dielectric oil testing using H.T test Kit.

Unit-V L: 10

Digital Meters

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

Outcome:

Able to measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.

Activity/Event: Measure the speed by using digital Tachometer & measure voltage , current & resistance by using digital Multimeter.

Any 10 of the given experiments are to be conducted.

Text Books:

1. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney, DhanpatRai& 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:

1. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall
3. Electrical Measurements by Forest K. Harris. John Wiley and Sons, Willy Eastern PVT. LTD.
4. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers-1989.
5. Electrical and Electronic Measurements –by G.K.Banerjee, PHI Learning Private Ltd, New Delhi–2012.

Course Code	POWER ELECTRONICS	L	T	P	Credits
1002193121		3	0	3	4.5

Course Overview:

This course covers characteristics of semiconductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters. The importance of using pulse width modulated techniques to obtain high quality power supply (dc/ac converter) is also discussed in detail in this course.

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 Outcome:

	Course outcome	Cognitive Level as per Bloom's Taxonomy	PO
CO1	Explain the static and dynamic characteristics of various power semiconductor devices	Understand, apply	3 ,5
CO2	Distinguish the operation of single phase and three phase rectifiers.	Apply ,Create	3,5
CO3	Analyze the operation of different types of DC-DC converters.	Analyze	1,2,3,12
CO4	Analyze the operation of different types of AC-AC converters	Analyze	3,5

UNIT-I

Power Semi-Conductor Devices: [10]

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

Outcome: To be able to understand the the static and dynamic characteristics of various power semiconductor

Activity/Event: Write the different ratings of the power device (SCR, MOSFET, IGBT).

Experiments:

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.

UNIT-II:

AC-DC 1-Phase Controlled Converters: [10]

Applications of AC to DC converters- 1-Ph. half wave Uncontrolled rectifiers with resistive load-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.

Outcome: Able to sketch the wave forms of single phase converters with R and RL Loads

Activity/Event: Design the 1-Ph rectifier with RLE load.

Experiments:

1. Single -Phase Half controlled converter with R and RL load
2. Single -Phase fully controlled bridge converter with R and RL loads

UNIT-III:

AC-DC 3-Phase Converters: [9]

3-Ph. half wave-controlled rectifier with R and RL load & 3-Ph. fully and 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

Outcome: Able to understand the operation of three phase rectifiers and AC voltage Regulator

Activity/Event: Draw and explain the operation of the 3-Ph. Half controlled rectifier with firing angle 120 degrees.

Experiments:

1. Single -Phase AC Voltage Regulator with R and RL Loads
2. Three- Phase fully controlled converter with RL–load.

UNIT-IV:

Switched Mode DC–DC Converters: [10]

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

Outcome: Able to analyze the operation of different types of DC-DC converters
Activity/Event: Explain the operation regenerative braking of DC motor with boost Converter

Experiments:
1. Design and verification of voltages gain of Boost converter in Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode(DCM).
2 Design and verification of voltages ripple in buck converter in CCM and DCM operation.

UNIT -V:
DC–AC Converters: [9]

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. Application of DC-AC Converters
Outcome: Understand the operation of inverters and AC-AC regulators.

Activity/Event: Distinguish the Operation of 120^0 and 180^0 mode of inverter operation

Experiments:

1. Single -Phase square wave bridge inverter with R and RL Loads
2. Single -phase PWM inverter with sine triangle PWM technique.

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.
3. Power Electronics – by Daniel Hart, Published by McGraw-Hill, 2011

Reference Books:

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

Course Code	DIGITAL ELECTRONICS	L	T	P	Credits
1004193102		3	0	0	3

Course Overview: This course deals with the introduction of digital logic and circuits, logic families, Boolean algebra design procedure of combinational circuits and introduction to the basic integrated circuits.

Course Objectives

1. To understand the number systems and the Logic gates
2. To understand the minimization of logic functions.
3. To explain the realization of logic functions using combinational circuits.
4. To explain the design of counters, registers using Flip Flops.
5. To understand the different Logic families to produce different types of digital integrated circuits.

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Understand the conversion between different number systems, Binary Arithmetic and understand the logic gates and Minimization of Logic Functions.	Understanding, Applying	L2 L3	PO-1, PO-2, PO-3, PO-4
CO2	Realize Logic functions using multiplexers, encoders and decoders	Understanding. Applying	L2 L3	PO-1, PO-2, PO-3, PO-4, PO-5
CO3	Design the counters and sequential circuits using flip flops**.**	Understanding, Applying	L2 L3	PO-1, PO-2, PO-3, PO-4, PO-5.
CO4	Realize the different Logic Gates with different logic Families	Understanding , Applying	L2 L3	PO-1, PO-2, PO-3, PO-5

Unit-I **L: 10**

Number Systems, Codes and Logic Gates:

Number Systems-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, complement arithmetic; Digital Codes -Excess-3 code, Gray code, BCD code, code conversion, ASCII code, Error Detection Codes-Hamming code. Logic Gates-Basic Gates, Universal Gates and realization of other gates using universal gates.

Outcome: Able to do conversion between different number systems, Binary Arithmetic and understand the logic gates.

Activity / virtual lab: Using Diodes Realize AND, OR, NOT gates on bread board.

UNIT II **L: 8**

Minimization Techniques:

Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Min term and Max terms, Canonical representation, Duality Theorem, Minimization Techniques of Switching functions using Karnaugh Map(up to 4 variables) and Boolean algebra.

Outcome: Able to Minimize the Logic Functions.

Activity / virtual lab: Minimize Logic functions of 5 variables using K-maps

UNIT- III **L: 12**

Combinational Circuits-Part 1 :
Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Ripple Carry and Look-Ahead Carry Adders.

Combinational Circuits- Part 2:

Multiplexer, De-multiplexer, Encoder, Priority Encoder; Decoder, BCD to Seven segment Display Decoder, Parity Checker/Generator; Comparator, realization of Boolean functions using decoders and multiplexers.
Outcome: Able to Realize Logic functions using multiplexers, encoders and decoders.

Activity / virtual lab: List the IC manufacturers and IC numbers of MUX, De-MUX, Encoders, and Decoders.

Unit-IV **L: 12**

Sequential Circuits:
Introduction to Sequential Circuits, Latches, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Triggering of Flip Flops; Flip Flop conversions; Master-Salve JK. Shift Registers, types of shift registers, Bidirectional Shift Registers.
Counters: Types of Counters-Asynchronous and synchronous counters, Design of Mod-n synchronous counters.

Outcome: Able to Design different types of counters and different sequential circuits using flip flops.
Activity / virtual lab: List different types of analog to digital converters and manufacturers with IC numbers.

Unit-V **L: 8**
Logic Families:

Definition of parameters-current voltage parameters, Fan in, Fan out, Noise Margin, Propagation Delay, Power Dissipation;Transistor-Transistor Logic (TTL); Emitter Coupled Logic (ECL),C-MOS Logic; Comparison of Various Logic Families.

Outcome: Able to Realize Different Logic Gates with different logic Families.

Activity / virtual lab: List the Digital IC manufacturers and different Digital IC manufacturing processes.

Text Books:

1. Mandal, Digital Electronics: Principles and Applications, TMH.
2. M. Morris Mano, Digital Logic and Computer Design, Pearson Edu.
3. Digital electronics by RP jain, THM.

Reference Books:

1. Digital electronics principles, devices and applications, by Anil K Maini, john Wiley &sons limited.
2. Fundamentals Of Digital Circuits by A. Anand Kumar, 3rd edition, EEE, PHI publications

Course Code	DIGITAL CONTROL SYSTEMS	L	T	P	Credits
1002193150		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	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Modelling of Digital control Systems in frequency domain and time domain.	Understanding	L-2	1,6,7
CO2	Understand z–transformations and their role in the mathematical analysis of different systems	Understanding	L-2	1,6,7
CO3	Analyse stability criterion for digital systems	Application	L-3	1,6,7
CO4	Design of state feedback controller for Linear Discrete systems.	Application	L-3	1,6,7,11

Unit-I: **L:8**
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-I Outcome: Knows the difference between analog and digital signals

Activity/Event on Unit-1: Reconstruction of signal

Unit-II: L:8
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-II Outcome: Relation Between Laplace and Z-Transformation

Activity/Event on Unit-II: Applying Z-Transforms for different signals

Unit-III: L:10

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-III Outcome: To study the conventional method of analyzing digital control systems in the w–plane.

Activity/Event on Unit-III: Examine the stability of the system using different tests.

Unit-IV: L:10

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-IV Outcome: To represent the discrete–time systems in state–space model and evaluation of state transition matrix.

Activity/Event on Unit-IV: Determine the controllability and observability of the systems

UNIT–V L:9

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.

Unit-V Outcome: Design of state feedback control by "the pole placement method."

Activity/Event on Unit-V: Design a State Feedback Controller

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.

Subject code	ENERGY AUDIT CONSERVATION AND MANAGEMENT	L	T	P	Credits
1002193151		3	0	0	3

Course Overview:
This is an open elective course developed to cater the current needs of the industry.This course covers topics such as energy conservation act and energy conservation. It also covers energy efficient lighting design. The student will learn power factor improvement techniques, energy efficiency in HVAC systems. In addition The economic aspects such as payback period calculations, life cycle costing analysis is covered in this course.

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:
Students will be able to:
CO1: Apply principles of energy auditing and propose energy conservation schemes.
CO2: Demonstrate principle and organizing energy management program.
CO3: Analyze power factor improvement methods, and Demonstrate the operating principle of energy efficient motors.
CO4: to analyse about space heating and ventilation methods and demonstrate the operation of various energy instruments.
CO5: Analyze and compute the economic aspects of energy consumption.

Unit-I: BASIC PRINCIPLES OF ENERGY AUDIT
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-I Outcome: To be able to understand the basic energy audit principles and conservation schemes
Activity/Event on Unit-1: To conduct basic energy auditing in a industry or organization.

Unit-II: PRINCIPLES OF ENERGY MANAGEMENT
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-II Outcome: Demonstrate principle and organizing energy management program.

Activity/Event on Unit-II: To write a basic report on energy management schemes

Unit-III: POWER FACTOR IMPROVEMENT AND ENERGY EFFICIENT MOTORS.
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-III Outcome: Analyze power factor improvement methods, and Demonstrate the operating principle of energy efficient motors.

Activity/Event on Unit-III: To design a basic SIMULINK model on power factor improvement techniques

Unit-IV: SPACE HEATING, VENTILATION AND ENERGY INSTRUMENTS

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-IV Outcome: To analyse about space heating and ventilation methods and demonstrate the operation of various energy instruments.

Activity/Event on Unit-IV:

Unit-V: ECONOMIC ASPECTS, ANALYSIS & COMPUTATION

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

Unit-V Outcome: Analyze and compute the economic aspects of energy consumption.

Activity/Event on Unit-V:

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

Course Code	SPECIAL ELECTRICAL MACHINES	L	T	P	Credits
1002193152		3	0	0	3

Course Overview: This is an advanced course on electrical machines. Students will be exposed to various special machines which are gaining importance in industry. This course covers topics related to principles, performance and applications of these special machines including switched reluctance motors, stepper motors, permanent magnet dc motors, BLDC motors and linear motors

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

	Course outcome	Bloom's taxonomy	Bloom's Taxonomy Level	PO
CO1	Explain the performance and principle of operation of stepper motor, Switch d reluctance motor, PMDC, PM Materials and BLDC motors.	Understanding, Applying	L2 L3	PO-1, PO-2
CO2	Implement different control and switching circuits for stepper motor ,SRM, BLDC motors	Understanding, Applying	L2 L3	PO-1, PO-2
CO3	Designing the constructional features of Switched reluctance motor	Understanding, Applying, Analysing	L2 L3, L4	PO-1, PO-2, PO-3
CO4	Illustrating the theory of travelling magnetic field and applications of linear motors in electric traction	Understanding, Applying	L2 L3	PO-1, PO-3, PO-5, PO-12

UNIT-I:

Stepper Motors:

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

Outcome: Explain the performance and control of stepper motors, and their applications.

Activity/Event: Design a control circuit for stepper motor(Hardware)

UNIT-II:

Switched Reluctance Motors:

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.

Outcome: Explain theory of operation and control of switched reluctance motor.

Activity/Event: Simulate the different converter configurations for SRM in MATLAB/SIMULINK

UNIT-III:

Permanent Magnet Materials and PMDC Motors:

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**.**

Outcome: Describe the properties of different magnetic materials

Activity/Event: Collect different permanent magnet materials Unit-IV: BLDC Motors

UNIT-IV:

BLDC Motors:

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.

Outcome: Describe the operation of BLDC motors.

Activity/Event: Submit a brief report on control of BLDC motors

UNIT-V:

Linear Induction Motors (LIM):

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.

Outcome: Explain the theory of travelling magnetic field and applications of linear motors.

Activity/Event: Simulate the equivalent circuit of LIM in Matlab/Simulink

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:	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	C
1012193161		3	0	0	3

COURSE DESCRIPTION:

This course introduces computer programming using the Python programming language. ThisPython Programming course will help you master the Programming with Python byintroducing the ObjectOriented programming concepts, creation of Data Structures,Implementation of Functions, and Visualization libraries using the Python programminglanguage. Lastlyyouwillgetintodesign,code,test,anddebugPythonprogrammingLanguageScripts.

COURSE OUTCOMES:

CO	Courseoutcomes	CognitiveLevelasperBloom's Taxonomy	PO
CO1	InstallPythonIDEandrunbasicPythonscripts.	Understand	PO1
CO2	Understandtheoperators,functions,keyConcepts of Object OrientedProgrammingin python.	Understand	PO1,PO2
CO3	Access Python from various onlineresourcesandimportpackagestothecurrentworking environment.	Applying	PO5
CO4	Understand file handling operationsandimplementML/DSLibrariesusinginPython.	Implementation	PO12

UNIT-I

Introduction: HistoryofPython,NeedofPythonProgramming,Applications,BasicsofPython Programming, Using the REPL(Shell), Running Python Scripts, Variables,Assignment,Keywords, Input-Output, Indentation.

Types, Operators and Expressions: Types - Integers, Strings, Booleans; Operators-Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, LogicalOperators,BitwiseOperators,MembershipOperators,IdentityOperators,Expressionsandorderof evaluations..

Outcome:

- UnderstandingthePythonIDE.
- Learnthebasics buildingblocksofpython.
- Write thebasicprogramsinpython

A**ctivity:** InstallPythononPCs orthroughMobileapplicationsrunbasicPythonScriptsforagivendata.

UNIT-II

Control Flow- if, if-elif-else, for, while, break, continue, pass

Data Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.

Outcome

- Usage of different operators in conditional statements and flow of program.
- Understanding the sequences and dictionaries.

Activity

Identify Operators and types in Python. Implement Data Structure concepts by writing python Scripts.

UNIT-III

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.

Outcome:
- Understanding Functions implementation in Python.
- Learn the scope or life time of variables in a function.
- Usage of import statement in modules.
- Create a package, import and install PIP package in python.

Activity/Event
Using Functions develop simple scripts in Python Programming.

UNIT-IV
Object Oriented Programming in Python: Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, and Data hiding.
Error and Exceptions: Difference between an Error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.

Outcome:
- Implement the OOP concepts using python
- Understand the Exception handling in python.

Activity/Event
Implement OOP concepts in Writing Python Scripts

UNIT-V

File handling: Introduction to Files, Types of files, opening and closing a text file, file open modes, different methods to write the content into a text file, different method to read content from a text file. Programs using file operations.

IntroductiontoML/DSLibraries:IntroductiontoNumPy,PandasandMatplotlib

Outcome:
- Perform various Regular operation
- Perform various File handling operation
- Understand standard Libraries and GUI visualization in Python.

Activity/Event
Write various test cases and implement specific test for a given case study.

Text Books:

1. Python Programming: A Modern Approach, VamsiKurama, Pearson
2. Learning Python, Mark Lutz, Orielly

Reference Books:

1. Think Python, Allen Downey, Green Tea Press

2. Core Python Programming, W. Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage

Course Code:	MECHATRONICS	L	T	P	C
1003193162		3	0	0	3

Course Overview:

The course covers the knowledge of combined mechanical and electronics systems,and their significance in view of their importance in the current scenario and their potential future applications for industry automation.

Course Objectives:

The main objective of this course is to introduce the integrative nature of Mechatronics. To describe the different components and devices of mechatronics systems.

Unit-I:

Mechatronics systems – elements & levels of mechatronics system, Mechatronics designprocess, 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, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs forcontrol.

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.rsus computers, application of PLCs for control.

Unit-V:

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 VijayaRaghavan& MS Balasundaram/WILEY India Edition.

Reference Books:

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. 4thEdition/ W. Bolton/ Pearson, 2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indianprint

Course Code	TECHNICAL SEMINAR	L	T	P	C
1002193180		3	0	0	3

Technical seminar is carried out during the Thirdyear. For Technical seminar, the student shall present on an emerging/specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated through presentation by the Departmental Committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.