Baba Ghulam Shah Badshah University
Rajouri (J&K)-185234

Syllabus I to VIII Semester
B. Tech. Degree Course

Department of Electrical Engineering
School of Engineering& Technology
Baba Ghulam Shah Badshah University
Rajouri (J&K)-18523

Dr. S. N. Mughal **(Head E.E.)**
Mr. Tasaduq Hussain **(A.P., EE)**
Dr. Ahmed Riyaz **(A.P., EE)**
Prof. Asif Husain **(Dean, SOET)**

Electrical Engineering Course structure 2022 onwards

Syllabus Content

Semester-I									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
BSC-EE-121	Mathematics-I	3	40	60	100	3	1	0	4
ESC-EE-121	Basic Electrical Engineering	3	40	60	100	3	1	0	4
HSMC-EE-121	Communication Skills	3	40	60	100	2	0	0	2
ESC-EE-122	Engineering Mechanics	3	40	60	100	2	1	0	3
ESC-EE-123	Computer Fundamentals	3	40	60	100	3	1	0	4
MC-EE-121	Indian Constitution*	3	40	60	100	2	0	0	0
Total			**200**	**300**	**500**				**17**
Laboratory Courses									
ESC-EE-131	Basic Electrical Engineering Lab	2	25	25	50	0	0	2	1
HSMC-EE-131	Communication Skills Lab	2	25	25	50	0	0	2	1
ESC-EE-132	Engineering Mechanics Lab	2	25	25	50	0	0	2	1
ESC-EE-133	Computer Fundamentals Lab.	2	25	25	50	0	0	2	1
ESC-EE-134	Workshop Practices	2	50	-	50	0	0	2	1
MC-EE-131	Induction Program**	-	-	-	-	0	0	0	0
Total			**150**	**100**	**250**				**5**
Total (Theory + Lab)			**350**	**400**	**750**	**Total Credits**			**22**

N.B: 1. * Indian constitution course is non-credits and the student has to get at-least minimum pass marks to qualify the subject. Non-credits course marks are not included in total marks

**2. ****Induction training is also non-credits and the student has to get at-least minimum pass marks to qualify the subject. The student has to qualify this course by attending the training which will be verified by concerned teacher.

Semester-II									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
BSC-EE-221	Mathematics-II	3	40	60	100	3	1	0	4
ESC-EE-221	Basic Electronics Engineering	3	40	60	100	3	1	0	4
BSC-EE-222	Engineering Physics	3	40	60	100	3	1	0	4
BSC-EE-223	Engineering Chemistry	3	40	60	100	3	1	0	4
ESC-EE-222	C-Programming	3	40	60	100	3	1	0	4
MC-EE-221	Environmental Science*	3	40	60	100	2	0	0	0
Total			**200**	**300**	**500**				**20**
Laboratory Courses									
ESC-EE-231	Basic Electronics Lab.	2	25	25	50	0	0	2	1
BSC-EE-231	Engineering Physics Lab.	2	25	25	50	0	0	2	1
BSC-EE-232	Engineering Chemistry Lab.	2	25	25	50	0	0	2	1
ESC-EE-232	C-Programming Lab	2	25	25	50	0	0	2	1
ESC-EE-233	Engineering Graphics Lab**	3	40	60	100	1	0	4	3
Total			**140**	**160**	**300**				**7**
Total (Theory + Lab)			**275**	**375**	**800**	**Total Credits**			**27**

**N.B: 1. ***Environmental science course is non-credits, and the student has to get at-least minimum pass marks to qualify the subject. Non-credits course marks are not included in total marks

2. ** The examination pattern of engineering graphics shall be same as of other theory courses.

Semester-III									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
BSC-EE-321	Mathematics-III	3	40	60	100	3	1	0	4
PCC-EE-321	Electromagnetic Fields and Waves	3	40	60	100	3	0	0	3
PCC-EE-322	Network Analysis & Synthesis	3	40	60	100	3	1	0	4
PCC-EE-323	Digital Electronics	3	40	60	100	3	1	0	4
PCC-EE-324	Electrical Engineering Materials	3	40	60	100	3	0	0	3
OEC-EE-(---)	Open Elective courses I	3	40	60	100	3	0	0	3
Total			**240**	**360**	**600**				**21**
Laboratory Courses									
PCC-EE-331	Digital Electronics Lab.	2	25	25	50	0	0	2	1
PCC-EE-332	Network Analysis & Synthesis Lab.	2	25	25	50	0	0	2	1
OEC-EE-333	Open Elective courses-I Lab	2	25	25	50	0	0	2	1
Total			**75**	**75**	**150**				**3**
Total (Theory + Lab)			**315**	**435**	**750**	**Total Credits**			**24**

Open Elective Courses-I

S. No.	Code	Title
1.	OEC-EE-321/PCC-CSE-321 & OEC-EE-331/PCC-CSE-331	Data Structures Using C & Data Structures Using C Lab
2.	OEC-EE-322/PCC-CSE-322 & OEC-EE-332/PCC-CSE-332	Object Oriented Programming Using C^{++} & Object Oriented Programming Using C^{++} Lab
3.	OEC-EE-323/PCC-CE-323 & OEC-EE-333/PCC-CE-332	Introduction to Fluid Mechanics & Fluid Mechanics Lab

Semester-IV									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
BSC-EE-421	Numerical Techniques	3	40	60	100	3	1	0	4
PCC-EE-421	Renewable Energy Sources	3	40	60	100	3	1	0	4
PCC-EE-422	Electrical Machines-I	3	40	60	100	3	1	0	4
PCC-EE-423	Electrical Measurements-I	3	40	60	100	3	0	0	3
OEC-EE-(--)	Open Elective courses-II	3	40	60	100	3	0	0	3
Total			**200**	**300**	**500**				**18**
Laboratory Courses									
PCC-EE-431	Computer-Aided Simulation Lab.	2	25	25	50	0	0	2	1
PCC-EE-432	Renewable Energy Sources Lab.	2	25	25	50	0	0	2	1
OEC-EE-(--)	Open Elective courses-II Lab	2	25	25	50	0	0	2	1
Total			**75**	**75**	**150**				**3**
Total (Theory + Lab)			**275**	**375**	**650**	**Total Credits**			**22**

At the end of semester IV, students are required to attend an Industrial Training for 6 weeks duration, during summer vacations. After the completion of training every student is required to prepare a detailed report of the training work which he/she has attended in an Organization/Industry/Company. Industrial Training shall be an essential component of curriculum to fulfill the eligibility criteria for appearing in semester V University Exam. Evaluation of Industrial Training shall be conducted during semester V.

Open Elective Courses II

S. No.	Course Code	Title
1.	OEC-EE-421/PCC-CSE-422 & OEC-EE-431/PCC-CSE-431	Python Programming & Python Programming Lab
2.	OEC-EE-422/PCC-CSE-425 & OEC-EE-432/PCC-CSE-433	Unix /Linux and Shell Programming & Unix /Linux and Shell Programming Lab
3.	OEC-EE-423/PCC-ECE-424 & OEC-EE-433/PCC-ECE-433	Linear Integrated Circuits & Pulse Switching & Linear Integrated Circuits Lab

Semester-V									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
PCC-EE-521	Power System-I	3	40	60	100	3	1	0	4
PCC-EE-522	Signals and Systems	3	40	60	100	3	0	0	3
PCC-EE-523	Electrical Machines-II	3	40	60	100	3	1	0	4
PCC-EE-524	Applied Electronics	3	40	60	100	3	1	0	4
OEC-EE-(---)	Open Elective courses-III	3	40	60	100	3	0	0	3
Total			**200**	**300**	**500**				**18**
Laboratory Courses									
PCC-EE-531	Electrical Machines Lab.	2	25	25	50	0	0	2	1
PCC-EE-532	Applied Electronics Lab.	2	25	25	50	0	0	2	1
PROJ-EE-531	Industrial Training-I	-	50	-	50	0	0	0	1
PROJ-EE-532	Seminar	-	100	-	100	0	0	0	2
Total			**200**	**50**	**200**				**5**
Total (Theory + Lab)			**400**	**350**	**750**	**Total Credits**			**24**

Open Elective Courses III

S. No.	Course Code	Title
1.	OEC-EE-521/PEC-CSE-522	Cyber-crime and Laws
2.	OEC-EE-522/PEC–CSE-722	Internet of Things
3.	OEC-EE-523/PEC-ECE-521	Industrial Electronics
4.	OEC-EE-524/PEC-ECE-725	Biomedical Instrumentation
5.	OEC-EE-525/PCC-CE-325	Disaster Preparedness and Planning
6.	OEC-EE-526/PCC-CE-326	Biology & Life Science

Semester-VI									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
PCC-EE-621	Power Electronics	3	40	60	100	3	0	0	3
PCC-EE-622	Power System-II	3	40	60	100	3	1	0	4
PCC-EE-623	Electrical Measurement-II	3	40	60	100	3	1	0	4
PCC-EE-624	Control System	3	40	60	100	3	1	0	4
PEC-EE-(---)	Professional Elective courses-I	3	40	60	100	3	0	0	3
Total			**200**	**300**	**500**				**18**
Laboratory Courses									
PCC-EE-631	Power System Lab.	2	25	25	50	0	0	2	1
PCC-EE-632	Electrical Measurement Lab.	2	25	25	50	0	0	2	1
PCC-EE-633	Control System Lab	2	25	25	50	0	0	2	1
Total			75	75	150				**3**
Total (Theory Lab)			275	375	650	**Total Credits**			**22**

At the end of semester VI students are required to attend an Industrial Training for 6 weeks duration, during summer vacations. After the completion of training every student is required to prepare a detailed report of the training work which he/she has attended in an Organization/Industry/Company. Industrial Training shall be an essential component of curriculum to fulfill the eligibility criteria for appearing in semester VII University Exam. Evaluation of Industrial Training shall be conducted during semester VII.

Professional Elective Course I

S. No.	Course Code	Title
1.	PEC-EE-621	Electrical Substation Design
2.	PEC-EE-622	Energy Audit and Management
3.	PEC-EE-623	Power Engineering
4.	PEC-EE-624	Industrial Electrical Systems
5.	PEC-EE-625	Computers in medicine

Semester-VII									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
PCC-EE-721	Power System Protection	3	40	60	100	3	0	0	3
PCC-EE-722	Electrical Drives	3	40	60	100	3	0	0	3
PCC-EE-723	Microprocessor and Interfacing	3	40	60	100	3	0	0	3
PCC-EE-724	Design of Electric Machines	3	40	60	100	3	0	0	3
PROJ-EE-721	Minor Project	-	150	-	150	0	0	0	3
PEC-EE-(---)	Professional Elective courses-II	3	40	60	100	3	0	0	3
Total			**350**	**300**	**650**				**18**
Laboratory Courses									
PCC-EE-731	Power System Protection Lab.	2	25	25	50	0	0	2	1
PCC-EE-732	Power Electronics & Drives Lab.	2	25	25	50	0	0	2	1
PCC-EE-733	Microprocessor and Interfacing Lab	2	25	25	50	0	0	2	1
PROJ-EE-731	Industrial Training-II	-	50	-	50	0	0	0	1
Total			**125**	**75**	**200**				**4**
Total (Theory + Lab)			**475**	**375**	**850**	**Total Credits**			**22**

At the start of VII semester every student shall be allotted a Minor Project under the supervision of an allotted mentor. Students are required to do preliminary exercise of survey of literature and preparation of a road map of the selected Major Project under the supervision of their allotted mentor. Students are required to complete the Minor Project during semester VII. Minor Project shall be evaluated internally as per university statutes by a committee consisting of:

1. Three-member committee constituted by Head of the Department
2. Coordinator(s)/Supervisor(s) of minor project/training

Professional Elective Course II

S. No.	Course Code	Title
1.	PEC-EE-721	Wind and Solar Energy systems
2.	PEC-EE-722	EHV AC and DC transmission
3.	PEC-EE-723	Control System Design
4.	PEC-EE-724	Energy Economics and Planning
5.	PEC-EE-725	Restructuring of Power systems

Semester-VIII									
Theory Courses									
Course Code	**Title**	**Scheme of Exam**				**Hrs./Week**			**Credits**
		Duration (Hrs.)	**IA**	**UE**	**Total Marks**	**L**	**T**	**P**	
PCC-EE-821	Entrepreneurship Development and Management	3	40	60	100	3	0	0	3
PROJ-EE-821	Major Project	-	300	200	500	0	0	0	9
PEC-EE-(---)	Professional Elective courses III	3	40	60	100	3	0	0	3
PEC-EE-(---)	Professional Elective courses IV	3	40	60	100	3	0	0	3
Total			**420**	**380**	**800**	**Total Credits**			**18**

After the university Exam of semester VII every student shall be allotted a Major Project pertaining to his/her stream under the supervision of an allotted mentor. Students are required to report in their respective departments to do preliminary exercise of survey of literature and preparation of a road map of the selected Major Project under the supervision of an allotted mentor. Students are required to complete the Major Project during semester VIII. Depending upon the infrastructure, Computing and other laboratories facilities the students shall be offered in house project on campus are they can complete their project work in any organization/industry outside the campus. Major Project shall be evaluated internally as well as externally as per university statues.

Professional Elective Course III & IV

S. No.	Course Code	Title
1.	PEC-EE-821	Electrical and Hybrid Vehicles
2.	PEC-EE-822	Power Quality and FACTS
3.	PEC-EE-823	Virtual Instrumentation
4.	PEC-EE-824	Neural Networks and Fuzzy systems
5.	PEC-EE-825	Optimization Techniques
6.	PEC-EE-826	Power System Transients
7.	PEC-EE-827	Line commutated active rectifiers
8.	PEC-EE-828	High voltage Engineering

Summary of Credits

Basic Science Course

S. No.	Course Code	Subject	Semester	Credits
1	BSC-EE-121	Mathematics-I	I	4
2	BSC-EE-221	Mathematics-II	II	4
3	BSC-EE-222	Engineering Physics	II	4
4	BSC-EE-231	Engineering Physics Lab	II	1
5	BSC-EE-223	Engineering Chemistry	II	4
6	BSC-EE-232	Engineering Chemistry Lab	II	1
7	BSC-EE-321	Mathematics-III	III	4
8	BSC-EE-421	Numerical Techniques	IV	4
Total Credits:				**26**

Engineering Science Course

S. No.	Course Code	Subject	Semester	Credits
1	ESC-EE-121	Basic Electrical Engineering	I	4
2	ESC-EE-131	Basic Electrical Engineering Lab	I	1
3	ESC-EE-122	Engineering Mechanics	I	3
4	ESC-EE-132	Engineering Mechanics Lab	I	1
5	ESC-EE-123	Computer Fundamentals	I	4
6	ESC-EE-133	Computer Fundamentals Lab	I	1
7	ESC-EE-134	Workshop Practices	I	1
8	ESC-EE-221	Basic Electronics Engineering	II	3
9	ESC-EE-222	C-Programming	II	4
10	ESC-EE-231	Basic Electronics Lab	II	1
11	ESC-EE-232	C-Programming Lab	II	1
12	ESC-EE-233	Engineering Graphics Lab	II	3
			Total Credits:	**27**

Humanities & Social Sciences Including Management Courses

S. No.	Course Code	Subject	Semester	Credits
1	HSMC-EE-121	Communication Skills	I	2
2	HSMC-EE-131	Communication Skills Lab.	I	1
3	HSMC-EE-821	Entrepreneurship Development & Management	VII	3
			Total Credits:	**6**

Mandatory Courses

S. No.	Course Code	Subject	Semester	Credits
1	MC-EE-121	Indian Constitution	I	0
2	MC-EE-131	Induction Program	I	0
3	MC-EE-221	Environmental Science	II	0
			Total Credits:	**0**

Program Core Courses

S. No.	Course Code	Subject	Semester	Credits
1.	PCC-EE-321	Electromagnetic Fields and Waves	III	3
2.	PCC-EE-322	Network Analysis & Synthesis	III	4
3.	PCC-EE-323	Digital Electronics	III	4
4.	PCC-EE-324	Electrical Engineering Materials	III	3
5.	PCC-EE-331	Digital Electronics Lab	III	1
6.	PCC-EE-332	Network Analysis & Synthesis Lab.	III	1
7.	PCC-EE-421	Renewable Energy Sources	IV	3
8.	PCC-EE-432	Renewable Energy Sources Lab	IV	1
9.	PCC-EE-431	Computer-Aided Simulation Lab	IV	1
10.	PCC-EE-422	Electrical Machines-I	IV	4
11.	PCC-EE-423	Electrical Measurements-I	IV	3
12.	PCC-EE-521	Power System-I	V	4
13.	PCC-EE-522	Signals and Systems	V	3
14.	PCC-EE-523	Electrical Machines-II	V	4
15.	PCC-EE-531	Electrical Machines Lab	V	1
16.	PCC-EE-524	Applied Electronics	V	3
17.	PCC-EE-532	Applied Electronics Lab	V	1
18.	PCC-EE-621	Power Electronics	VI	3
19.	PCC-EE-622	Power System-II	VI	4
20.	PCC-EE-623	Electrical Measurements-II	VI	4
21.	PCC-EE-631	Power System Lab	VI	1
22.	PCC-EE-632	Electrical Measurements Lab	VI	1
23.	PCC-EE-624	Control System	VI	4
24.	PCC-EE-633	Control System Lab	VI	1
25.	PCC-EE-721	Power System Protection	VII	3
26.	PCC-EE-731	Power System Protection Lab	VII	1
27.	PCC-EE-722	Electrical Drives	VII	3
28.	PCC-EE-732	Power Electronics & Drives Lab	VII	1

29.	PCC-EE-723	Microprocessor and Interfacing	VII	3
30.	PCC-EE-733	Microprocessors & Interfacing Lab.	VII	1
31.	PCC-EE-724	Design of Electrical Machines	VII	3
			Total Credits:	**77**

Professional Elective Courses

S. No.	Course Code	Subject	Semester	Credits
1	PEC-EE-(---)	Professional Elective courses-I	VI	3
2	PEC-EE-(---)	Professional Elective courses-II	VII	3
3	PEC-EE-(---)	Professional Elective courses-III	VIII	3
4	PEC-EE-(---)	Professional Elective courses-IV	VIII	3
			Total Credits:	**12**

Open Elective Courses

S. No.	Course Code	Subject	Semester	Credits
1	OEC-EE-(---)	Open Elective courses-I & Lab	III	4
2	OEC-EE-(---)	Open Elective courses-II & Lab	IV	4
3	OEC-EE-(---)	Open Elective courses-III	V	3
			Total Credits:	**11***

Project/Internship/ Seminar

S. No.	Course Code	Subject	Semester	Credits
1	PROJ-EE-531	Industrial Training-I	V	1
2	PROJ-EE-532	Seminar	V	2
3	PROJ-EE-721	Minor Project	VII	3
4	PROJ-EE-731	Industrial Training-II	VII	1
5	PROJ-EE-821	Major Project	VIII	9
			Total Credits:	**16**

Total Credits=175*

Note

***subjected to the condition if all the open electives chosen by the student are of 3 credits.**

Semester I

Course Title: Mathematics-I **Max. Marks: 100**
Course Code: BSC-EE-121 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course is designed to impart elementary knowledge of theory of calculus, linear algebra and sequence & series to engineering students that will serve them to solve various engineering problems.

Detailed Contents:

Unit-I

Differential Calculus: Rolle's Theorem, Mean value theorems, indeterminate forms and L'Hospital's rule; Successive differentiation and Leibnitz's theorem, Taylor's and Maclaurin's series of function of single variable, Expansion of functions of single variable.

Unit-II

Multivariable Calculus (Differentiation): Limit, continuity and partial derivatives, physical significance of partial derivative, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, directional derivatives, curl and divergence.

Unit-III

Integral Calculus: Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-IV

Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Unit-V

Matrices: Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Course Outcome:

Upon the successful completion of the course, the student will be able to:

CO1. Understand the significance of Rolle's Theorem, Mean Value theorem, Taylor's and Maclaurin's series for differentiable functions.

CO2. Identify the extrema of a function on an interval and classify them as minima, maxima or saddles using the first derivative test.

CO3. Use basic the integral rules to evaluate both definite and indefinite integrals and apply the same to find areas and volume of revolutions. Apart from these, they have a basic understanding of Beta and Gamma functions.

CO4. Apply the tools of power series and Fourier series to deal with functions of several variables that are essentials in most branches of engineering.

CO5. Learn the essential tools of matrices and linear algebra in a comprehensive manner.

Text Books/References:

1. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **D. Zill,** Advanced Engineering Mathematics, Jones & Bartlett.
3. **Jain &Iyengar**, Advanced Engineering Mathematics, Narosa Publishers.
4. **N. Piskunov**, Differential & Integral calculus, Vol-I & II
5. **G.B. Thomas and R.L. Finney**, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
7. **Veerarajan T.**, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. **Ramana B.V.**, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
9. **D. Poole**, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Basic Electrical Engineering **Max. Marks: 100**
Course Code: ESC-EE-121 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course has been designed to provide basic knowledge to the students about the principles of electric circuit analysis, electromagnetism and transformers.

Detailed Contents:

Unit-I

Review of Electric Circuits: Basic Electrical circuit terminology, concept of charge and energy, circuit parameters (resistance, inductance. Capacitance), ohm's law, Kirchhoff's current law (KCL), Kirchhoff's voltage law (KVL), series and parallel combinations of resistance, inductance & capacitance. Ideal and practical voltage & current sources and their transformations, dependent voltage and current sources.

Unit-II

D.C Circuit Analysis: Power & energy relations, analysis of series parallel DC circuits, Star-Delta transformations (ΔY), Loop & Nodal methods, Network Theorems: Thevenin's, Norton's, Maximum Power Transfer and Superposition Theorems (D.D Analysis only).

Unit-III

A.C. Circuit Analysis: Basic terminology and definitions, phasor and complex number representations, power energy relations in AC circuits, application of Network Theorems to AC circuits ,Resonance in series and parallel circuits, Concepts of active & reactive powers, Introduction to 3 phase circuits.

Unit-IV

Electromagnetism: Review of Fundamentals of Electromagnetism, Ampere's Law, analogies between electric circuits and magnetic circuits, Faraday's laws of electromagnetic induction, direction of induced emf, Lenz's law, magnetic saturation and leakage fluxes.

Unit-V

Basic Electrical Installations: Transformers: Concept of Inductance, Self & Mutual Inductance, Conventions for magnetically coupled circuits, Transformers: introduction, classification & construction of single phase transformer, emf equation and phasor diagrams.

Course Outcome:

At the end of this course, students will demonstrate the ability

CO1. To understand the concepts and applications of different laws used in the networks and circuits.
CO2. To study and analyze the D.C. Circuit and A.C. Circuit with different theorem.
CO3. To study the concepts related to electromagnetism.
CO4. To understand the principle and working of transformers.
CO5. To study and understand different types of electrical installations.

Text Books/ References:

1. **V. D. Toro**, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
2. **L. S. Bobrow**, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. **E. Hughes**, "Electrical and Electronics Technology", Pearson, 2010.

4. **D. P. Kothari and I. J. Nagrath**, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
5. **D. C. Kulshreshtha**, “Basic Electrical Engineering”, McGraw Hill, 2009.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Communication Skills **Max. Marks: 100**
Course Code: HSMC-EE-121 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 2 [2-0-0]

Course Objective: This subject is designed to attain the general proficiency in English for the engineering students.

Detailed Contents:

Unit-I
Vocabulary Building: The concept of Word Formation**,** Root words from foreign languages and their use in English**,** Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.**,** Synonyms, antonyms, and standard abbreviations.

Unit-II
Basic Writing Skills: Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

Unit-III
Identifying Common Errors in writing: Subject-verb agreement, Noun-pronoun agreement, Articles, Prepositions, Redundancies and Clichés

Unit-IV
Speaking skills: Interviews-Meaning, types of Interview, notices, Agenda, Minutes of meeting, writing introduction and conclusion.

Unit-V
Writing Practices: Comprehension**,** Précis Writing**,** Essay Writing

Course Outcome:
Upon the completion of the course, the students will be able:
CO1. To acquire basic proficiency in English including reading, listening comprehension, writing and speaking skills.
CO2. To make the students authoritative in self-expression in their day to day life in this fast-changing world.
CO3. To identify the common errors involved in writing.
CO4. To understand the nature and style of sensible writing.
CO5. To write effective and coherent paragraphs.

Text Books/References:

1. **Michael Swan,** Practical English Usage. OUP. 1995.
2. Remedial English Grammar. **F.T. Wood. Macmillan**.2007
3. On Writing **Well. William Zinsser**. Harper Resource Book. 2001
4. Study Writing**. Liz Hamp-Lyons and Ben Heasly**. Cambridge University Press, 2006.
5. **Communication Skills**. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. **Exercises in Spoken English**. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Engineering Mechanics **Max. Marks: 100**
Course Code: ESC-EE-122 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [2-1-0]

Course Objective: This course has been designed to make the students acquainted about forces and its effects, kinematics and statics.

Detailed Contents:

Unit-I

Two Dimensional force System: Basic Concepts, principal of transmissibility, resultant of a force System, Free body Diagrams, Equilibrium and equation of equilibrium Applications. Moment of a force about a point, Varrigon theorem, friction, law of friction, equilibrium of body lying on horizontal and inclined plane, Static and Dynamic Friction, wedge friction, Ladder friction applications.

Unit -II

Centroid and Centre of gravity: Centroid and moment of inertia; centroid of plane area and solid bodies. Moment of inertia of plane area. Theorem of parallel axis, Theorem of perpendicular axis, radius of gyration composite ideas. Mass moment inertia of circular plate, Cylinder, Sphere.

Unit -III

Member forces in Trusses: Planer truss structure, trust joint identification, strategy for planer truss analysis, Statistical determinacy and stability of planer trusses. Numerical truss analysis (Method of joints and method of sections).

Unit -IV

Kinematics of Particles: Velocity and acceleration in rectilinear motion along a plane and curved path. Tangential and normal components of velocity and acceleration motion curves. Kinematics of rigid bodies rotation, absolute motion, relative motion. Newton's 2nd law (rectangular, path, and polar coordinates).Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit -V

Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Course Outcome:

Upon successful completion of the course, student should be able to:

CO1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures

CO2. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);

CO3. Understand basic dynamics concepts – force, momentum, work and energy;

CO4. Understand and be able to apply Newton's laws of motion;

CO5. Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy;

Text Books/References:

1. **Bansal R.K.** (2010), A Text Book of Engineering Mechanics, Laxmi Publications
2. **Khurmi R.S.** (2010), Engineering Mechanics, S. Chand & Co.
3. **Irving H. Shames** (2006), Engineering Mechanics, 4th Edition, Prentice Hall
4. **F. P. Beer and E. R. Johnston** (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
5. **R. C. Hibbler** (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
6. **Andy Ruina and RudraPratap** (2011), Introduction to Statics and Dynamics, Oxford University Press
7. **Shanes and Rao** (2006), Engineering Mechanics, Pearson Education,
8. **Hibler and Gupta** (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
9. **Reddy Vijaykumar K. and K. Suresh Kumar** (2010), Singer's Engineering Mechanics

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Computer Fundamentals **Max. Marks: 100**
Course Code: ESC-EE-123 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This course is provided aiming to achieve a basic knowledge of computer and its programming among engineering students.

Unit-I

Introduction: History and Generations of Computers, Classification and Applications of Computers. Computer Hardware: Components of a computer system, Input and Output devices, Memory Hierarchy, Primary and Secondary memory. Computer Software, System and Application Software, Utility Programs.

Unit-II

Operating systems, Functions and types of O/S, DOS commands, BIOS, POST, Booting Process, Computer Virus, Types of Viruses, Use of Antivirus software.

Computer Languages (Machine, Assembly and High level languages), Translators (Assembler, Compiler and Interpreter). Introduction to algorithm and Flow chart:

Unit-III

Number System: Data Representation, Binary, Decimal, Octal and Hexadecimal number systems, Inter conversion of number system, 1's compliment, 2's compliment, 9's compliment, n's compliment. Logic Gates, Boolean algebra, alphanumeric representation, fixed point representation.

Unit-IV

Networking: Introduction to networking, Applications, types of computer networks, Network Topology, LAN, MAN, WAN. Networking devices: Hub, switch, router, repeater, and gateway. History of Internet, Internet, extranet and intranet, WWW, E-mail, ISPs, surfing, phishing.

Unit-V

Introduction to HTML: Introduction to HTML. Working of HTML, Creating and loading HTML page, tags, Structure of HTML, Document, Stand Alone Tags, Formatting text, Adding Images, Creating hyper Links, Tables, Sending E-mails through Web Page, Sample web pages.

Course Outcomes:

1. Know the basic components of the computer and working of each device.
2. Understand the functions of Operating System, softwares and DoS Commands.
3. Understand the representation of data in computer.
4. Know the fundamentals of Computer Networking.
5. Know the basics of HTML.

Text Books:

1. **Peter Norton**, Introduction to Computers, TMH.
2. **Sanjay Toledo Mata**, A First Course in Computers, TMH.

Reference Books:

1. **Rajaraman,** Introduction to Digital Computer Design, Prentice Hall India.
2. **Bartee, Thomas,** Digital Computer Fundamentals, TMH.

Note for Paper Setter: -The Question paper shall comprise of 10 questions. Two questions will be set from each Unit .The student has to attempt five questions at least one from each Unit.

Course Title: Indian Constitution **Max. Marks: 100**
Course Code: MC-EE-121 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 0[2-0-0]

Course Objective: The basic purpose of this subject is to make a general awareness about our constitution.

Detailed Contents:

Unit I

Constitutional Framework : Historical Background, Making of the constitution, Salient features of the Indian Constitution, Preamble to the Constitution, Union and its territory, Citizenship, Fundamental rights, Directive principles of state policy, Fundamental duties, Amendment of the constitution, Basic structure of the constitution.

Unit II

System of Government: Parliamentary system, Federal System, Centre-state relations, Inter-state relations, Emergency provisions

Unit III

Central government: President, Vice-President, Prime Minister, Central Council of Ministers, Cabinet committees, Parliament, Parliamentary committees, Parliamentary forums, Supreme Court
State Government: Governor, Chief Minister, State Council of Ministers, State legislature, High court, Subordinate Courts, Special status of Jammu and Kashmir, Special provision for some states
Local Government: Panchayati raj, Municipalities.

Unit IV

Constitutional Bodies: Election commission, Union Public service commission, State Public service Commission, Finance Commission, National Commission for SC's, National Commission for ST's, Special officer for Linguistic minorities, Comptroller and auditor general of India, Attorney General of India, Advocate General of India.

Unit V

Non-Constitutional Bodies: Planning Commission, National Development Council, National Human Rights Commission, State Human Rights Commission, Central Information Commission, State Information Commission, Central vigilance Commission, Central Bureau of Investigation, Lokpal and Lokayuktas
Other Constitutional Dimensions: Co-operative societies, Official Language, Public services, Tribunals, Rights and Liabilities of the Government, Authoritative text of the Constitution in Hindi Language, Special Provision relating to certain classes.

Course Outcome:

Upon the completion of this, the students will able to know:

CO1. About the constitutional framework.
CO2. About the government system
CO3. Various type of government
CO4. About Constitutional bodies: Election commission, UPSC, SPSC, Commission for ST/SC and many others.
CO5. Non-constitutional bodies: Planning Commission, NDC, NHRC, SHRC, CBI, Vigilance Commission and other dimensions of constitution.

Text Books/ References:

1. Indian Constitutional Law, M.P. Jain, 7th Edition.
2. Introduction to the Constitution of India, B. K. Sharma, PHI.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Basic Electrical Engineering Lab. **Max. Marks: 50**
Course Code: ESC-EE-131 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The lab has been designed to provide and implement basic knowledge about the principles of electric circuit analysis, electromagnetism and transformers to the students.

List of experiments:

1. Introduction to Circuit Elements.
2. Verification of Ohms Law.
3. Verification of Kirchhoff's Current and Voltage Law (KCL & KVL)
4. Verification of Thevenin's Theorem & Norton's Theorem.
5. Transformation of Star & Delta Networks.
6. Measurement of Power using 2-Wattmeter method.
7. Verification of Superposition Theorem.
8. Verification of reciprocity theorem.
9. To plot the Resonance curve for a Series & Parallel Resonance.
10. Determination of resonance frequency using LCR Meter.

Laboratory Outcome:

CO1. To study and analyze different circuit elements.
CO2. To study and implements different laws and theorems of electrical circuits.
CO3. To make the students aware about the principles and applications of basic electrical laws.
CO4. To measure the power using two wattmeter method.
CO5. To study and analyze the phenomenon of Resonance in Series and Parallel circuits.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Communication Skills Lab. **Max. Marks: 50**
Course Code: HSMC-EE-131 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

List of Laboratory Sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Laboratory Outcome:

Upon the completion of the lab, the students will be able to:

CO1. Developing intellectual, personal and professional abilities.

CO2. On completion of the course, the students will be accurate in communication.

CO3. The students will be able to communicate effectively on complex engineering activities with the engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Engineering Mechanics Lab. **Max. Marks: 50**
Course Code: ESC-EE-132 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of the Engineering mechanics Lab is to perform experiments which are related to Statics and Dynamics Loading in order to understand the behaviour of different mechanical equipment's which students study in theory.

List of Experiments:

1. To conduct tensile test and determine the ultimate tensile strength, percentage elongation and reduction.
2. To conduct the compression test and determine the ultimate compressive strength for a specimen.
3. To determine centroid of Lamina.
4. To determine the hardness of a given specimen using vicker/brinel/Rockwell hardness testing machine.
5. To very Lami's theorem.
6. To verify polygon law of forces.
7. Friction experiment on inclined plane.
8. Experiment on screw Jack.
9. To verify reactions at the supports of a simply supported beam.
10. To determine moment of inertia of various shapes.

Laboratory Outcome:

After the completion of lab course students will be-

CO1. Able to understand different engineering mechanics apparatus.
CO2. Able to understand the mechanical properties of materials.
CO3. Able to understand the moment of inertia of various shapes.
CO4. Get the practical idea of frictional forces.
CO5. Get working principle of screw jack.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Computer Fundamentals Lab. **Max. Marks: 50**
Course Code: ESC-EE-133 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Lab. Objective: The lab has been designed to provide and implement basic knowledge about the computer fundamentals to the students.

List of Experiments:

1. Experiments on dismantling of PC.
    a. Dismantling the system unit, recognize all major components inside a PC, describe function of each component and define the relationship of internal components.
2. Perform these DOS commands
    a. Internal commands.
    DIR, TYPE, DEL, ERASE, MD, CD, COPY, RMDIR, VER, DATE, TIME, PATH, CLS, RMDIR, VER, DATE, TIME, PATH, CLS, BREAK, SET, EXIT.
    b. External commands.
    APPEND, CHKDISK, ATTRIB, SYS, EDIT.
3. Experiments on system utilities
    a. Explore and describe some system utility like regedit, memory partioning, control panel, window tools.
4. MS-Word: Introduction, Starting MS-Word, MS-Word Screen and its Components, Elementary Working with MS-Word.
5. MS-Excel: Introduction, Starting MS-Excel, Basics of Spreadsheet, MS-Excel Screen and Its Components, Elementary Working with MS-Excel.
6. Create a spreadsheet of students, which contains marks obtained by students of a class in different subjects and then calculate maximum, minimum, average and sum of marks in each subject. Also calculate % of each student using functions and formulas in MS-Excel also draw pie chart and bar graph also.
7. MS-PowerPoint: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS-PowerPoint.
8. Make a simple presentation on your college, use 3D effects, animation on network topologies.
9. Create HTML pages for your business website.
10. Create HTML pages showing timetable of trains departing from Jammu-Tawi railway station.
11. Create web pages for your college.

Lab Outcomes: Upon the completion of course, the students will be able to:

1. Working on various Operating Systems and their usage
2. Understand and use MS-Office to create documents
3. Understand the basic DoS Commands
4. Recognize Hardware components and their assembly
5. Install Operating system on Hardware and working on HTML

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Workshop Practice **Max. Marks: 50**
Course Code: ESC-EE-134 **University Exam: 0**
Duration of Exam: 2 Hours **Internal Assessment: 50**
Credits: 1 [0-0-2]

Laboratory Objective: In this course the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials. It includes

1. Machine shop
2. Fitting shop
3. Carpentry
4. Welding shop
5. Smithy

Detailed Contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Electrical & Electronics
4. Carpentry
5. Plastic moulding, glass cutting
6. Metal casting
7. Welding (arc welding & gas welding), brazing

Laboratory Outcome:

CO1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3. By assembling different components, they will be able to produce small devices of their interest.

Text Books/References:

1. **Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., —**Elements of Workshop Technology‖, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. **Kalpakjian S. And Steven S. Schmid**, **—**Manufacturing Engineering and Technology‖,
3. 4th edition, Pearson Education India Edition, 2002.
4. **Gowri P. Hariharan and A. Suresh Babu**, Manufacturing Technology – I‖ Pearson Education, 2008.
5. **Roy A. Lindberg**, **—**Processes and Materials of Manufacture‖, 4th edition, Prentice Hall India, 1998.
6. **Rao P.N**., **—**Manufacturing Technology‖, Vol. I and Vol. II, Tata McGraw Hill House.

Note: Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Course Title: Induction Program **Max. Marks: 0**
Course Code: MC-EE-131 **University Exam: 0**
Duration of Exam: 0 Hours **Internal Assessment: 0**
Credits: 0 [0-0-0]

Induction program

Induction program for students to be offered right at the start of the first year. It should include but not limited to following Activities

1. Physical activity
2. Creative Arts
3. Universal Human Values
4. Literary
5. Proficiency Modules
6. Lectures by Eminent People
7. Visits to local Areas
8. Familiarization to Dept./Branch & Innovations

Semester II

Course Title: Mathematics-II **Max. Marks: 100**
Course Code: BSC-EE-221 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This course is designed to impart advanced knowledge of multivariable integration, theory of differential equations and complex variable to engineering students that will serve them to solve real life engineering problems.

Detailed Contents:

Unit-I

Multivariable Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes' (without proofs).

Unit- II

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Second order linear differential equations with variable coefficients, method of variation of parameters.

Unit- III

Partial Differential Equations: Partial differential equations and its formation, Linear and non-linear partial differential equations of first order and their solutions, Charpit's method, Lagrange's method, Homogenous and non-homogenous linear partial differential equations with constant coefficients and their solutions, Applications of Partial Differential Equations with initial and boundary conditions, Solution by the method of separation of variables.

Unit- IV

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Unit- V

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem (without proof) and Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Course Outcome:
Upon the completion of this course, the students will be able to:

CO1. Compute double and triple integrals over rectangular and spherical domains and memorize important theorems: Green, Gauss divergence and Stokes with their applications in various engineering problems.

CO2. Distinguish between linear and non-linear equations. Recognize and solve equations of Bernoulli, Euler and Clairaut.

CO3. Solve partial differential equations of various kinds and apply the same to solve problems of real world.

CO4. Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations and conformal mapping.

CO5. Apply the Cauchy Residue theorem to evaluate definite integrals, compute the Taylor and Laurent expansions of simple functions and determine the nature of the singularities and calculating residues.

Text Books/References:

1. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **D. Zill,** Advanced Engineering Mathematics, Jones & Bartlett.
3. **Jain &Iyengar**, Advanced Engineering Mathematics, Narosa Publishers
4. **N. Piskunov**, Differential & Integral calculus, Vol-I & II
5. **G. B. Thomas and R.L. Finney**, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
6. **S. L. Ross**, Differential Equations, 3rd Ed., Wiley India, 1984.
7. **E. A. Coddington**, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
8. **E. L. Ince**, Ordinary Differential Equations, Dover Publications, 1958.
9. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Basic Electronics Engineering **Max. Marks: 100**
Course Code: ESC-EE-221 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4[3-1-0]

Course Objective: This course aims to provide students with solid background of semiconductors and some basic solid state electronic devices used in circuits.

Unit-I

Semiconductors: Classification, semiconductor bonds, Energy band description, Semiconductor types, Energy band diagram for Semiconductors, Drift and Diffusion Current, Mobility of Charged particles, Current density and Conductivity, Conductivity of Semiconductors, Hall Effect.

Unit-II

Introduction to p-n Junction: Current components in p-n junction, Diodes and Characteristics, temperature dependence, equivalent circuits. Rectifiers, half wave, full wave rectifiers, bridged rectifiers (efficiency, ripple factor). Clipping and clamping circuits. Basic operations of Zener, Avalanche and Photo Diodes.

Unit-III

Transistors: Types of transistors, operation & characteristics, CE, CB and CC configurations, Input output characteristics and graphical analysis of basic amplifier circuits, use of transistor as a switch.

Unit-IV

Biasing Techniques and biasing stability (BJT):- Need for biasing, operating point, load line analysis, bias stability. fixed bias configuration, emitter bias configuration, voltage divide bias configuration, analysis of these biasing techniques.

Unit-V

Field Effect Transistors: Operation and characteristics of JFET and MOSFET, types of MOSFET, Introduction to feedback, Types of feedbacks, Sinusoidal Oscillators, Hartley, Colpitts and Phase Shift oscillators (transistor version only and no derivation).

Course outcomes:

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

- **CO1.** Describe the energy bands and the scientific principles behind conductivity in semiconductors.
- **CO2.** Analyze the working of PN junction diode and apply diode in various applications such as rectifiers and other wave shaping circuits.
- **CO3.** Analyze the working of various traditional transistors such as BJT and FET along with the recently used MOSFET based transistors as well as the concept of biasing in these transistors.
- **CO4.** Understand various feedback systems and oscillators.
- **CO5.** Design basic analog circuits

Text Books:

1. **Millman & Halkias**, Electronic Devices & Circuits, TMH
2. **Boylestad** and **Nashelky,** Electronic Devices & Circuits, PHI.

Reference Books:

1. **Floyd T. L.,** Electronic Devices, Pearson Education.

2. **Sedra & Smith,** Microelectronic Circuits, Oxford Printing Press.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Engineering Physics **Max. Marks: 100**
Course Code: BSC-EE-222 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective:

1. To understand the importance of applications of Applied Physics in daily life
2. To provide the students with a basic understanding of Physics that may be required by engineers in the course of their careers
3. To acquaint students with the fundamentals of vibrations, acoustics and ultrasonic and how they help in mankind by using engineering skills.
4. To enhance knowledge related to principle working of Lasers and its different components to make it suitable for various purposes
5. To introduce the learners to the basics of Quantum Mechanics

Detailed Contents:

Unit-I

Waves, Oscillations and Introduction to Acoustics: Wave motion, its types, Equations of wave motion, Energy and Intensity of a progressive wave, Introduction to ultrasonic waves, magnetostriction and piezoelectric effect, productions of ultrasonic waves, their detections and applications. A brief introduction to the acoustics of a hall, factors affecting the acoustics of the buildings, Reverberation Period, Sabine's Formula for calculating Reverberation Time.

Unit-II

Electrostatics in a linear dielectric medium & Magnetostatics: Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; solving simple electrostatics problems in presence of dielectrics – Point charge at the Centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field. Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Unit -III

Quantum Mechanics for Engineers: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets.

Unit-IV

Applying the Schrodinger equation: Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator.

Unit-V

Optics: Interference: Introduction, Interference due to division of wave front: Fresnel's Biprism, Interference due to division of amplitude: wedge shaped film, Newton's rings. Diffraction: Introduction, Difference between Fresnel and Fraunhofer diffraction, Single slit diffraction, Transmission diffraction grating, absent spectra. Spontaneous and stimulated emissions, Einstein's coefficients, Laser and its

principle, He-Ne laser.

Course Outcomes:

After completing of the course, the students will:

CO1. Understand the importance of Applied Physics in describing the technology we are using today in different engineering fields

CO2. Acquired knowledge of Waves, Vibration and acoustics, helps the students to develop the acoustically good hall.

CO3. Knowledge of basic Quantum Mechanics can help the students for further research applications as they can be applied to any quantum, mechanical situation to find energy, momentum etc.

CO4. Acquired knowledge of Optics help the students to

a) Know more about propagation of light and wave optics.
b) Describe the requirements for a system to act as a laser.
c) Differentiate the various types of lasers and their means of excitation.
d) Able to explain, which laser would best meet the need for a industrial or research task.
e) Demonstrate an awareness of the safety responsibilities involved in working with lasers.

Text Books/ References:

1. **Pathania K. S. &Khera S. K.,** Waves and Vibration,
2. **Beiser**, **Arthur**, Concepts of Modern physics, TMH.
3. **Rangwala** and **Mahajan**, "Electricity and Magnetism", Tata McGraw Hill, 1998
4. **Ghatak A. K., Dass P.,** Laser theory & application of ultrasonic waves,
5. **David J. & Cheek**, Fundamentals and application of ultrasonic waves,
6. **Avadhanulu M. N. &Khsirsagar P. G.,** Engineering Physics (S. Chand & Co.)
7. **Vijaya K. K., Chandralingam S.,** Modern Physics, S. Chand & Co. Ltd, New Delhi
8. **Mani and Mehta**, G.K. "Modern Physics", Affiliated East-West Press Pvt. Ltd., 1998.
9. **Arora C.L**, Refresher Course in Physics, S. Chand & Company Ltd.
10. **Grifiths David J.,** Introduction to Quantum Mechanics, 2nd Edition 2016, Cambridge University Press
11. **Sharma K. K.**, Optics: Principles and Applications 2017, Elsevier
12. **Shankar R.**, Principles of Quantum Mechanics 2011, Springer
13. **Jenkins & White H E**, Fundamentals of Optics 4 edition 2017, McGraw Hill Education

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Engineering Chemistry **Max. Marks: 100**
Course Code: BSC-EE-223 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course is designed to familiarizing the students of engineering with Water treatment, polymerization, photochemistry, corrosion and transition metal chemistry.

Detailed Contents:

Unit-I

Water Treatment: Water quality measurement, Hardness of water, Estimation of hardness of water ,Disadvantages of hard water ,Scale and sludge formation; disadvantages, prevention and treatment, Desalination method, reverse osmosis ,Electro dialysis, Domestic water treatment.

Unit-II

Polymerization

Basic concept of polymerization, Broad classification and industrial applications (Buna-N, Buna-S, Polyester, Polyethene, Polypropene, Polystyrene,), Thermosetting plastic and its softening, Biodegradable and non-biodegradable wastes.

Unit- III

Photochemistry: Photo excitation, Luminescence and types, Norrish-I and Norrish-II reactions, Application examples of photolysis, Photosynthesis Z –Diagram, Chemistry of vision, MRI equipment and procedure of working.

Unit-IV

Transition Metal Chemistry: Structure of organic compounds up to coordination no 6, Isomerism (geometrical, optical, ionization, linkage and coordination isomerism, bonding in coordination compounds by CFT, VBT. Application of coordination compounds in organic synthesis and Medical fields.

Unit-V

Cement and Lime: Introduction and types of cement, Manufacture of Portland cement, Setting and hardening of cement, Introduction and properties of Lime, Setting and hardening of lime.

Course Outcome:

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

CO1. Apply the methods to produce soft water for industrial use and potable water at cheaper cost.
CO2. Substitute metals with conducting polymers and also produce cheaper bio-degradable polymers to reduce environmental pollution,
CO3. Apply knowledge about photochemical and photo physical processes and the reactivity of excited states to explain applications in photochemical energy conversion.
CO4. Understand structure of organic compounds and transition metal compound synthesis,
CO5. Understand the manufacturing process of cement and lime.

Text Books/References:

1. **Odion G.G**-Principles of Polymerisation, John Wiley and sons.
2. **S.S Dara**-A Text Book of Engg. Chemistry.

3. **B.Sivasankar**-Engineering Chemistry, Tata McGraw Hill Publication.
4. **S.Chand**-Practical Manual for Engineering Chemistry.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: C-Programming **Max. Marks: 100**
Course Code: ESC-EE-222 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This course is provided aiming to enhance the logical skills of engineering students with the basic programming concepts and implementation in C Programming.

Unit-I

Introduction to C Programming: Overview of programming languages, algorithms and flowcharts, History of C, Structure of a C Program, Compiling & Executing a C program. Constants, Variables and Data Types, Storage classes, Operators and Expressions, Data Input and Output.

Unit-II

Control Statements: Decision making and branching, IF statement, IF-ELSE statement, nested IF-ELSE statement, Switch statement, break statement, continue statement. Looping: while statement, do-while statement, for statement.

Unit-III

Introduction to arrays: One dimensional arrays, Two dimensional arrays and Multidimensional arrays, basic operations on arrays, strings, basic string operations**.**

User defined data types: Structure, Defining structures, Array of Structures, Introduction to Union and enumerated data types.

Unit-IV

Functions: Introduction to Function, Types of functions, function declaration, calling a function, passing arguments to functions, passing arrays to functions, Recursion.

Unit-V

Introduction to Pointers & Files: Operations on pointer, pointers & multidimensional arrays, pointers & character strings. Dynamic Memory Allocation in C: malloc, calloc, realloc and free functions. Introduction to File, Operations on files: open, close, read and write.

Course Outcomes: The student will be able:

1 To translate the algorithms and flowcharts to programs (in C language) for execution.
2 To make the usage of various control statements for developing an efficient program to solve the problems.
3 To decompose a complex problem into functions for solving it efficiently.
4 To use the arrays and user defined data types for synthesizing a complete program.
5 To use pointers, files and dynamic memory allocations to perform several operations in programs.

Text Books

1. **Yashavant P. Kanetkar ,** Let Us C, BPB Publication, 15th Edition.
2. **Gottfried**, Programming with C, TMH.

Reference Books

1. **E. Balaguruswamy**, Programming in ANSI C, Tata McGraw-Hill.
2. **Venugopal**, C Programming, TMH.
3. **Yashwant Kanitkar**, Pointers in C, TMH.

Note for Paper Setter: -The Question paper shall comprise of 10 questions. Two questions will be set from each Unit .The student has to attempt five questions at least one from each Unit.

Course Title: Environmental Science **Max. Marks: 100**
Course Code: MC-EE-221 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 0 [2-0-0]

Course Objective: This course is designed to make the engineering students to understand the significance of environment and ecology in human survival and growth. It also aims to connect the budding engineers to nature.

Detailed Contents:

Unit-I

Elements of Ecology: Definition, Scope and basic principles of ecology and environment. Biological levels of organization, population, community, ecosystem and biosphere. Climatic factors - Solar radiations, temperature, water and precipitation.

Unit-II

Environmental pollution: Types of pollution, Air pollution, Noise pollution, Water pollution, Soil pollution, Thermal pollution, Radiation pollution

Unit-III

Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles. Global Oxygen Cycles. Hydrological cycles.

Unit-IV

Succession: Concepts of succession, Types of Succession, Trends in succession, Climax and stability, Co-evolution and group selection.

Unit-V

Major biomes of the world, Characteristics of terrestrial fresh water and marine ecosystems; Forests, grasslands, lake, river and marine ecosystems of India.

Course Outcome:

Upon the completion of the course, students will able to:

CO1. Learn about the environment and ecology.
CO2. Understand different types of pollution. Air, Noise, Water, Soil, Thermal and Radiation pollution.
CO3. Understand biogeochemical cycles and human contribution in it.
CO4. Learn succession and various types of succession.
CO5. Demonstrate the ability to understand the biomes of world and its importance in human survival.

Text Books/References:

1. **J.S.Singh, S.P. Singh and S.R. Gupta.** 2008. Ecology, Environment and Resource Conservation. Anamaya Publications (New Delhi).
2. **S.C. Santra.** 2011. Environmental Science. New Central Book Agency.
3. **M.H. Rao and H.V.H. Rao.** 1998. Air Pollution. Tata McGraw Hill Publication.
4. **V.P. Kudesia.** 1997. Air Pollution. Pragati Prakashan.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Basic Electronics Lab. **Max. Marks: 50**
Course Code: ESC-EE-231 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Objective: The course is designed to provide experimental foundation for the theoretical concepts and to familiarize students with basic electronic devices, their applications and characteristics.

List of Experiments:

1. To plot the Resonance curve for a series & parallel resonance.
2. To determine and plot operating characteristics of a PN junction diode
3. To study the input / output waveforms of Half wave and bridge wave rectifiers
4. To suppress the ripple in rectifiers using RC filters.
5. To study the clipper and clamper circuits.
6. To study the Zener characteristics and its application as voltage regulator
7. To plot characteristics of transistor in CE/CB configuration
8. To plot characteristics of a BJT.
9. To plot MOSFET characteristics.
10. To study frequency response of RC Coupled Oscillators.

Laboratory Outcomes:

- **CO1.** Determine the characteristics of PN Junction and Zener diode.
- **CO2.** Design various rectifiers configuration and evaluate its various performance parameters.
- **CO3.** Design and analyze various wave shaping circuits.
- **CO4.** Determine the characteristics of a BJT and MOSFET
- **CO5.** Design and analyze the frequency response of RC Coupled Oscillators

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents. Experimentation to be supported by computer simulations.

Course Title: Engineering Physics Lab. **Max. Marks: 50**
Course Code: BSC-EE-231 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The Laboratory is designed to provide experimental foundation for the theoretical concepts and to familiarize students with experimental apparatus, the scientific method and method of data analysis.

List of Experiments:

1. Measurement of Resistance.
2. Measurement of e/m by helical method/Thomson's method.
3. Determination of Resistivity of a given wire.
4. Determination of Band Gap of a semiconductor.
7. To determine the refractive index of the prism material using spectrometer.
8. To determine Young's modulus of a bar.
9. To determine the wavelength using Fresnel's bi-prism/diffraction grating.
10. To Determine Plank's Constant.
11. Verify the Stefan's law by incandescent lamp
12. To determine the susceptibility of a ferromagnetic material
13. Study of Nano TiO2 solar cell
14. Ultrasound measurement a given liquid

15 Joule's constant experiment

16. Determination of unknown capacitance of a capacitor by de-Sauty bridge method.
17. Refractive index of a glass slab/ water by travelling microscope
18. To determine the frequency of an ac supply by using electrical vibrator
19. To find the inner and outer diameter of a hollow cylinder by using Vernier caliper.
20. To determine the diameter of a thin wire by using screw gauge and its area of cross-section.
21. Measurement of 'g' and Time period by using compound pendulum.
22. To find the viscosity of a liquid using stoke's method.

Laboratory Outcome:

On Completion of this course, students are able to –

CO1. Develop skills to impart practical knowledge in real time solution.

CO2. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.

CO3. Design new instruments with practical knowledge.

CO4. Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.

CO5. Understand measurement technology, usage of new instruments and real time applications in engineering studies.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Engineering Chemistry Lab. **Max. Marks: 50**
Course Code: BSC-EE-232 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The course is designed to provide experimental foundation for the scientific method for analysis, synthesis and determination of various chemicals

List of Experiments:

1. Acid Base Titrations.
2. Viscosity of Solutions, Determination of composition of sugar solutions from Viscosity.
3. Synthesis of Aspirin.
4. Determination of Functional Groups in Organic Compounds.
5. Synthesis pf p-Nitro Aniline from Acetanilide.
6. Conduct metric Titrations.
7. Determination of Proteins in given sample of Food.
8. Determination of Flash and Fire Point of a Lubricant.

Laboratory Outcome:
At the end of practical course the students will be familiarized about
CO1. Titrations,
CO2. Synthesis of organic compounds,
CO3. protein determination and viscosity of solutions and
CO4. temperature dependent properties of lubricant.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: C-Programming Lab. **Max. Marks: 50**
Course Code: ESC-EE-232 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Lab. Objectives: The course is designed to provide practical foundation for computer programming and to familiarize students with error handlings in programming.

List of Experiments:

1. Familiarization with programming environment.
2. Basic programs in Sequential Statement in C
3. Simple computational problems using arithmetic expressions.
4. Problems involving if-then-else structures.
5. Iterative/looping problems e.g., sum of series.
6. Performing operations on 1D Array.
7. Performing operations on 2D Array.
8. Performing operations on String.
9. Programs on Function declaration, definition and calling.
10. Implementation of Mathematical function
11. Programming for solving Numerical methods problems.
12. Programs on Recursive functions.
13. Programs on Pointers and structures.
14. Programs on File operations.

Lab. Outcomes

1. To be able to correct syntax and logical errors as reported by the compilers and run time for basic programs.
2. To be able to write iterative as well as recursive programs using functions as well
3. To be able to represent data in arrays, strings and structures and manipulate through a program
4. To be able to declare pointers of different types and use them in defining self-referential structures.
5. To be able to create, read and write to and from simple text files.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Engineering Graphics Lab **Max. Marks: 100**
Course Code: ESC-EE-233 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [1-0-4]

Laboratory Objective: The course is designed to develop the ability to visualize and communicate three-dimensional shapes and train the students to create drawings following the engineering graphics conventions.

Detailed Contents:

Unit-I

Introduction to Engineering Graphics: Engineering drawing as language of Engineers. Drawing instruments and their uses. Projections: The planes of projections, first and third angle projections, projection of points lying in any quadrant. Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scale: needs and importance, to find representative factor of a scale, drawing of simple and diagonal scales.

Unit-II

Projection of Straight line and their Traces: Projection of planes. Planes parallel to reference plane; plane perpendicular to both reference planes; planes perpendicular to one and inclined to other reference plane. Projection of solids with their axes perpendicular or inclined to one reference plane but parallel to other.

Unit-III

Section of Solids & Development of Surfaces: Definition of sectioning and its purpose, Procedure of sectioning, Illustration through examples, types of sectional planes. Sectional orthographic views of geometrical solids, Purpose of development, Development of prism, cylinder, cone and pyramid surface

Unit-IV

Orthographic Projections: Theory of orthographic projections (Elaborate theoretical instructions) Drawing 3 views of given objects (Non-symmetrical objects and blocks may be selected for this exercise) Exercises on both first angle are third angle.

Unit-V

Isometric Projection: Classification of pictorial views, Basic Principle of Isometric projection, Isometric Views of lines, Planes, Simple and compound Solids; Difference between isometric projection and Isometric view, Isometric projection of solids such as cube, prism, pyramid and cylinder. Introduction to computer aided drafting (CAD)

Laboratory Outcome:

On completion of course students must be able

CO1. To read Engineering Drawing and execute the construction work with the help of available drawing
CO2. To represent three dimensional objects by two dimensional views.
CO3. Students must be in a position to show hidden details of objects or underground constructions work by drawing sectional views.
CO4. Exposure to creating working drawings
CO5. Exposure to the visual aspects of engineering design.

Text Books/ References:

1. **Bhat, N. D. and Panchal, V. M**., Engineering Drawing, Charotar Publishers, Anand.
2. **Narayana, K. L. and Kannaiah, P**.,Engineering Graphics, Tata McGraw Hill, New Delhi.

3. **Gill P. S.**, Engineering Graphics and Drafting, Katria and Sons, Delhi.
4. **Luzzadde Warren J.,** Fundamentals of Engineering Drawing, PHI.
5. **Shah, M.B. &Rana B.C.** (2008), Engineering Drawing and Computer Graphics,Pearson Education

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Semester III

Course Title: Mathematics-III **Max. Marks: 100**
Course Code: BSC-EE–321 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The objective of this course is to familiarize the students with various transform. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Detailed contents

Unit-I

Integral Transform-I: Introduction, Laplace transform, Existence theorem, Properties and theorem of Laplace transform, Laplace transform of Unit-step function, impulse function, periodic function and error functions, Inverse Laplace transform, Convolution theorem. Applications of Laplace transform in solving differential and integro-differential equations.

Unit-II

Integral Transform-II: Fourier integral, Fourier Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Inverse Fourier transform, Fourier Sine and Cosine transforms, Properties of Fourier transform, Inverse Fourier transform, Convolution theorem, Parseval's identities for Fourier transforms, Fourier transform of the derivatives of a function, Applications of F-transform to Boundary Value Problems.

Unit-III

Z-Transform: Introduction and definition of z-transform, some standard forms, Linearity property, Damping rule Some standard results, shifting un to the right and to the left, Multiplication by n. Two basic theorems, Inverse Z-Transform, Convolution theorem, Application to difference equations.

Unit-IV

Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables,

Unit-V

Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas.

Course Outcomes:

After the completion of this course, the students will be able to:

CO1. Understand the basic concepts and techniques to solve Laplace transform and also learn to apply the same to solve various problems of engineering which are modelled through differential equations

CO2. Demonstrate the ability to understand the basic concepts and techniques to solve Fourier's transform and also learn to apply the same to find solutions of boundary value problems (BVP).

CO3. Apply the concepts of the z-transform in solving difference equations and other discreet signal system.

CO4. Learn the ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

CO5. Understand the basic ideas of statistics including measures of central tendency, correlation and regression and apply various statistical methods in engineering problems.

Text Books/References:

1. **Erwin kreyszig**, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. **Ross, A:** First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. **Ramana B.V.,** Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
4. **Veerarajan T.,** Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2010.
5. **W. Feller,**An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
6. **David A. Santos,** Probability: An Introduction, Jones &Bratlett

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit. Use of calculator is allowed in the examination.

Course Title: Electro Fields and Waves **Max. Marks: 100**
Course Code: PCC-EE–321 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to understand the student with different aspect of electrical and magnetic Field.

Detailed contents

Objective: The course has been designed to acquaint the students with basic concepts of Electromagnetic theory.

Unit-I

Vector Calculus: Review of vector analysis, Scalar & vector products, gradient, divergence and curl of a vector, Rectangular, Cylindrical and Spherical co-ordinate system, Transformation amongst rectangular, cylindrical and spherical co-ordinate system.

Unit-II

Electrostatics: Coulomb's law, application of coulombs law, electric field intensity from point charges, field due to continuous distribution of charges, gauss's law, application of gauss's law, Electric displacement and displacement density potential function, potential field of a point charge, Laplace's and Poison's equations, Divergence Theorem.

Unit-III

Magnetostatics: Magnetic field intensity and magneto motive force, Ampere's Circuital law, applications of ampere's circuital law, Biot-savart law and its application, vector potential, magnetic dipole. Ampere's work law in differential vector form, continuity of currents, conduction and displacement current, Strokes Theorem.

Unit-IV

Time Varying Fields: Faradays law, Maxwell's equations (Differential, Integral and Phasor forms). Uniform plane waves. Representation of wave motion in free space, perfect dielectrics and Lossy dielectrics (Wave equations). Pointing Theorem and Power density. Propagation in good conductor and Skin effect. Reflection of Uniform plane waves.

Unit-V

Introduction To Transmission Line and Wave Guides: Introduction, Circuit representation of parallel plane transmission lines, Transmission lines with losses, Characteristic impedance, Characteristic impedance at radio frequencies, Propagation constant, Attenuation constant and phase constant, Waves between parallel plane, Transverse Electric wave, Transverse magnetic waves; characteristics of TE & TM waves; velocity of propagation; Attenuation in parallel plane guides; wave impedance.

Course Outcomes:

At the end of the course, students will demonstrate the ability.

CO1. Apply vector calculus to static electric-magnetic fields in different engineering situations.

CO2. Analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.

CO3. Examine the phenomena of wave propagation in different media and its interfaces.

CO4. Analyze the nature of electromagnetic wave propagation in guided medium.

Text / References:

1. **M. N. O. Sadiku**, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. **A. Pramanik**, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. **A. Pramanik**, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. **G. W. Carter**, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. **W. J. Duffin**, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. **W. J. Duffin**, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. **E. G. Cullwick**, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. **B. D. Popovic**, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. **W. Hayt**, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Note for paper setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit.

Course Title: Network Analysis & Synthesis **Max. Marks: 100**
Course Code: PCC-EE-322 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of electrical networks and their synthesis.

Detailed contents

Unit-I

Network Theorems & Network Topology: Network Theorems Superposition, Reciprocity and Millman's, theorems, Thevenin's and Norton's theorems; Maximum Power transfer theorem (A.C Analysis only). Network Topology: Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality.

Unit-II

Capacitive, Inductive Transients & First Order Circuits: Capacitive Transients, Inductive Transients, Combination of Capacitance & Inductance, Initial and Final Conditions, Exponential Functions, Timing Intervals of First and 2^{nd} Order Circuits. Laplace Transform application to solve differential equations and analysis of electric circuits.

Unit-III

Two Port Networks Parameters: Z Parameter, Y parameter, h – parameter, ABCD parameter, Equivalent circuit using these parameters. Condition for reciprocity and symmetry of two port network in different parameters. Interconnection of two port networks. Cascade connection of two port networks parallel connection of two port networks. Series and series parallel connections. Inter conversion of parameters.

Unit-IV

Network Synthesis: Transfer Functions, Natural and Forced Responses, Poles and Zeros of Transfer Functions, Foster and Caure's Forms, Stability, Hurwitz's Polynomials.

Unit-V

Filter Synthesis: Introduction, Classifications of filters, Characteristic Impedance and propagation constant of pure reactive Networks, Ladder Network, T–Section, Pie Section, Terminating Half Section, Pass Bands and Stop Bands, Design of constant K, n – Derived Filters, Composite Filters.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. Apply network theorems for the analysis of electrical circuits.
CO2. Provide solution for First and second order networks and obtain the transient and steady-state response of electrical circuits.
CO3. Analyze two-port circuit behavior.
CO4. To synthesize various networks using different synthesis techniques.
CO5. To understand and synthesize different types of filters.

Text / References:

1. **M. E. Van Valkenburg**, "Network Analysis", Prentice Hall, 2006.
2. **D. Roy Choudhury**, "Networks and Systems", New Age International Publications, 1998.

3. **W. H. Hayt and J. E. Kemmerly**, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. **C. K. Alexander and M. N. O. Sadiku**, "Electric Circuits", McGraw Hill Education, 2004.
5. **K. V. V. Murthy and M. S. Kamath**, "Basic Circuit Analysis", Jaico Publishers, 1999.

Note for paper setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Digital Electronics **Max Marks: 100**

Course Code: PCC-EE-323 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Objective: The objective of this subject is to enable the students to know basic concepts of digital electronics design and build digital hardware.

Detailed Contents:

Unit-I

Review of number systems, BCD, Excess-3, Gray and Alphanumeric codes. Boolean algebra, Boolean Theorems, De-Morgan's Theorems, Standard Forms of Boolean Expressions, Simplification techniques and Minimization methods: K-MAPS, Q-M (Tabulation) method.

Unit-II

Combinational Logic Circuits: Design and Analysis of Basic Combinational Logic Circuits, Combinational Logic Using Universal Gates. Basic Adders, Subtractors, Parity-Checkers and Generators, Comparators, Decoders, Encoders, Code Converters, Multiplexer (Data Selector), De-multiplexers, seven segment display.

Unit-III

Sequential Circuits: Latches, Flip-flops (SR, JK, T, D, Master/Slave FF), Edge-Triggered Flip- Flops, characteristic tables and excitation tables, conversion of flip-flops, Design of Flip-Flops using state diagrams and state tables, state reduction and assignment.

Unit-IV

Basic Flip-Flop Applications: Shift registers and Functions, Serial In - Serial Out Shift Registers,Serial In - Parallel Out Shift Registers, Parallel In - Serial Out Shift Registers, Parallel In -ParallelOut Shift Registers, Bidirectional Shift Registers, Synchronous and Asynchronous Counter Operation, Mod-n Counters, Design of counters.

Unit-V

Basics of Semiconductor Memories: Random-Access Memories (RAM), Read Only Memories (ROMs), Programmable ROM's (PROMs and EPROM's), PAL, PLA, IEEE notations

Introduction to digital logic families: brief background and comparison of various logic families-TTL, ECL, MOS, CMOS.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Examine the structure of various number systems and its application in digital design.
- **CO2.** Understand, analyze and design various combinational and sequential circuits.
- **CO3.** Analyze different types of registers and design counter circuits.
- **CO4.** Analyze different logic families, their characteristics and performances
- **CO5.** Design solutions to real world problems.

Text Books:

1. **Morris Mano**, Digital Logic Design, TMH.
2. **Anil K Miani**, Digital Electronics, Wiley publications.

Reference Books:

1. **Tocci R. J.** &**Widner**, Digital Systems: Principles and Applications, PHI.
2. **P. Malvino**, Digital principles and applications, Tata McGraw.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will beset from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Electrical Engineering Materials **Max. Marks: 100**
Course Code: PCC-EE-324 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The course has been designed to get student acquainted with the properties of various engineering materials and their applications in Engineering Sciences.

Detailed contents

Unit-I

Crystal Structure of Solids: Atomic packing, crystal lattice, Different type of crystal Bands, structure of silicon & Germanium, Energy Bands in solids, one dimensional lattice, Electron in periodic potential, concept of hole, Three dimensional Lattice and Brullioun Zones Elastic Wave and Photons (Elementary Ideas).

Unit-II

Insulating Materials: Introduction to Insulators, dielectric behavior, Properties of Insulating Materials, Insulators in Static & Alternating fields, classification as per temperature rise, Practical Dielectrics, Liquid: Solid and Gaseous and their applications.

Unit-III

Dielectric Materials: Polarization, Quantitative and qualitative discussion of dielectric constants of polyatomic molecules, Internal fields in solids and Liquids. Ferroelectrics & Piezoelectric Materials, spontaneous polarization, Frequency dependence of polarizabilities, complex dielectric constant of non-dipolar solids, Dipolar relaxation, dielectric losses, Dielectric Break downs.

Unit-IV

Magnetic Materials: Review of magnetic field concepts, Orbital dipole, and angular momentum of simple atomic models, classification of magnetic materials, spontaneous magnetism, Curie- Weiss Law, coercive forces; antiferro magnetic materials, ferromagnetic materials, Properties & applications of ferrites.

Unit-V

Conductivity of Metals: Ohm's Law, Relaxation time, collision time and mean free path, resistivity of conductors, temperature dependence of resistivity, super conductivity.

Semiconductor Materials: classifying materials as semiconductors, chemical bond in Si and Ge & its consequences, density of carriers in intrinsic semiconductors, the energy gap, the conductivity of intrinsic semiconductors, Carrier densities in n-type semiconductors & p-type semi-conductors, Hall Effect and Carrier Density.

Course Outcomes

CO1. Given a type of material, the students will be able to qualitatively describe the bonding scheme and its general physical properties, as well as possible applications in electrical engineering.
CO2. This will be helpful for the students to understand about the insulating properties of the materials.
CO3. This will be helpful for the students to understand about the Dielectric properties of the materials.
CO4. Students will be able to do comparative analysis of magnetic materials based upon their properties.
CO5. Students will be able to differentiate among various materials such as conductor and semiconductor based upon the internal composition and conductivities.

Text Books/References

1. **Dekker**, Electrical Engineering Materials.
2. **Allison**, Materials & Electronics Engineering & Devices.
3. **Raghvan**, Electrical Engineering Materials.
4. **S.P. Seth and P. V. Gupta**, Electrical Engineering Materials.

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Open Elective course-I **Max. Marks: 100**
Course Code: OEC-EE-(--) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Open Elective Courses I

Course Title: Data Structures Using C **Max Marks: 100**
Course Code: OEC-EE-321/PCC-CSE-321 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 4[3-1-0]

Course Objectives:
1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit-I

Review of Data Types and Concepts: Review of data types, Scalar types, Primitive types, Structures, Unions, Enumerated types, Records, Sparse Matrices, Recursion and its importance.

Unit-II

Searching and Sorting: Searching: Sequential search, Binary search, Hashing, General Idea for Hash Function, Separate Chaining, Open Addressing, Linear Probing.
Sorting: Bubble sort, Insertion Sort, Selection sort, Heap sort, Merge sort, Quick sort, External Sorting.

Unit-III

Expression and Linear Data Structure: Definition of a Data structure, ADT, Linear Data structures.
Stack**:** Operations, Applications, implementation using linked list as well as arrays, Expressions and their conversions, Infix, Postfix & Prefix.
Queue**:** Types, Operations, Applications, implementation using linked list as well as arrays. Linked List**:** Types, Operations, Applications, Implementation.

Unit-IV

Trees: Preliminaries, Trees, Forest, Binary Trees, Binary Search Tree ADT, Binary Search Trees, Conversion of Forest to Binary Tree, Binary Search Tree, AVL Trees, Tree Traversals, Priority Queues (Heaps), Model, Simple implementations, Binary Heap.

Unit-V

Graphs: Definitions, Representation of Graphs, Adjacency Matrix, Path Matrix, Operations on Graphs, Traversing a graph: BFS and DFS, Shortest Path Algorithms: Dijkstra`s Algorithm and Warshall`s Algorithm, Minimum Spanning Tree, Kruskal`s Algorithm and Prim`s Algorithm.

Course outcomes: At the end of this course, the student will able to do the following:
1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Text Books:

1. **Tanenbaum A. S.**, Data Structure Using C, Dorling Kindersley Publisher.
2. **Ellis Horowitz and Satraj Sahni**, An Introduction to Data Structures, Computer Science Press, Rockville MA 1984.

Reference Books:

1. **Richard F. Gilberg, Behrouz A. Forouzan**, Data Structures: A Pseudocode Approach with C, Thomson Cole, 1998.
2. **Hopcroft A. J. E. & Ullman J. D.,** Data Structures and Algorithms, Pearson Education Asia, 1983.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Object Oriented Programming Using C++ **Max Marks: 100**
Course Code: OEC-EE-322 / PCC-CSE-322 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 4[3-1-0]

Course Objective: The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.

Detailed Contents:

Unit-I
Concepts of Object-Oriented Programming: Object Oriented Programming Paradigm, Basic concepts of OOP's, Benefits of OOPS, Introduction to object oriented analysis and design, Design steps, Design example, Object oriented languages, Comparison of procedural and object-oriented programming languages.
Unit-II
Expressions, Control Structures, Arrays, Pointers and Functions: Data Types, Operators, expressions and control structures. Arrays, Storage of arrays in memory, Initializing Arrays, Multi-Dimensional Arrays, Strings, Pointers, accessing array elements through pointers, Arrays of pointers, Pointers to pointers, Void Pointers, Functions, Arguments, Passing Pointers as Function Arguments.
Unit-III
Classes and Objects: Structure and Class, Classes and objects, access specifies in C++, Inline Functions, Friend Functions, Constructors, and Destructors.
Polymorphism: Function Overloading, Operator Overloading, Virtual functions, Type Conversions in C++. Dynamic memory allocation in C++.
Unit-IV
Inheritance: Inheritance, single Inheritance, Multiple Inheritance, Multi-level inheritance, hierarchical inheritance, hybrid inheritance, Virtual base classes, Virtual functions, function overriding.
Generic programming with templates: Class templates, Function Templates, overloading template function, templates as member function of a class.
Unit-V
Exception Handling and Files: Exception handling overview, exception handling mechanism, throwing, and catching mechanism, multiple catch, catch all exceptions, rethrowing an exception.
Streams and Files: C++ Streams, Unformatted I/O operations, Formatted Console I/O operations, Opening and closing a file, File Pointers and their Manipulations, Sequential Input and Output Operations, Command Line Arguments.
Course Outcomes: At the end of this course, students will be able to:

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.
5. Must be able to understand and use Exception handling.

Text Books:

1. **Robert Lafore,** Object Oriented Programming in Turbo C++, Galgotia Publications.

2. **Balagurusamy E**, Object Oriented Programming with C++, Tata McGraw Hill.

Reference Books:

1. **Bjarne Strustrup**, The C++ programming Language, Addison Wesley.
2. **Booch**, Object Oriented Analysis and Design with Applications, Addison Wesley.
3. **Chair H. Pappas & William H. Murray**, Complete Reference Visual C++, TMH

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt 5 questions selecting at least one question from each unit.

Course Title: Introduction to Fluid Mechanics **Maximum Marks: 100**
Course Code: OEC-EE-323/PCC-CE-323 **University Examination: 60**
Duration of Exams: 3 hours **Internal Assessment: 40**
Credit 3(2-1-0)

Objective: The objective of this course is to acquaint the students about the characteristics and behavior of static and flowing fluids and to introduce the students to various concept and applications of hydraulics. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulics.

Detailed Contents:

Unit-I

Physical Properties of Fluids: Mass density, Weight density, Specific gravity; Viscosity-kinematic viscosity, Units, Newtons law of viscosity; Surface tension- expressions for liquid droplet, hollow bubble & liquid jet Capillarity-expressions for rise/fall; Types of Fluid-Ideal, Real, Newtonian & Non-Newtonian fluids; Types of flows-Laminar & turbulent flows, Steady & unsteady, Uniform & non-uniform, Compressible & incompressible flows, Streamlines, Streak lines & Path lines; Continuity equation & its differential form; Velocity potential and Stream functions.

Unit-II

Fluid Statics: Pressure-absolute, gauge, atmospheric & vacuum pressures; Pascal's law and Pressure variation in a static fluid; Manometers-piezometer, U-tube, Single column and differential U-tube manometers; Total pressure & Centre of pressure on plane and curved submerged surfaces; Buoyancy & Archimedes Principle, Meta-Centre-determination of metacentric height by analytical & experimental methods; Stability of submerged and floating bodies.

Unit-III

Dynamics of Fluid Flow: Euler's equation of motion along streamline and Bernoulli's equation; Flow measurement by Venturimeter & Orificemeter; Momentum of fluid- Impulse-momentum equation, Kinetic & Momentum Correction factors and Moment of momentum equation; Vortex Motion-Free and Forced vortex flows.

Unit-IV

Dimensional Analysis and Similitude: Dimensional homogeneity, Dimensional analysis-Rayleigh method and Buckingham's Pi- theorem; Similitude; Dimensionless numbers; Model Laws-Reynolds and Froude Model laws; Model testing of partially submerged bodies; Distorted models and their scale ratios.

Unit-V

Miscellaneous

Flow around submerged bodies: Drag on a flat plate, cylinder and sphere. Circulation & lift on cylinder.
Orifices & Mouthpieces: Flow through large rectangular orifice & external cylindrical mouthpiece.
Notches & Weirs: Discharge over rectangular, triangular and trapezoidal notches/weirs.

Course Outcomes: After the completion of the course the students will be able to

1. Understand type of fluid, behavior of fluid, basic concept and theorem used in fluid Mechanics and apply their knowledge of fluid mechanics in addressing problems in Hydraulics.

2. They will possess the skills to solve problems in laminar flow, Turbulent flow, boundary layer thickness calculation and for better understanding of this all application.
3. They will gain knowledge in Types of models, Application of dimensional analysis and model studies to fluid flow problem.
4. The basic of The Laminar Flow and turbulent flow and concept of boundary layer theory
5. The Dimensional analysis and model studies to the flow problems.

Text Books:

1. **Kumar, D. S.,** Fluid Mechanics. Kataria & Sons Publishers, New Delhi, 1998 Ed.
2. **Streter V. L., Wylie, E.B. & Bedford K. W.,** Fluid Mechanics, MGH, 2001 **Reference**

Books:

3. **P.M. Modi and S.M. Seth**, Hydraulics and Fluid Mechanics, Standard Book House
4. **K. Subramanya** ,Theory and Applications of Fluid Mechanics, , Tata McGraw Hill

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each Unit. The student has to attempt five questions at least one from each Unit.

Course Title: Digital Electronics Lab **Max Marks: 50**
Course Code: PCC-EE-331 **University Exam: 25**
Duration of Exam: 3 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments:

1. Study of pin diagram of various ICs and to test the logic gates and verify their truth tables.
2. Implementation of following combinational circuits using Logic Gates.
    a. Half and Full Adder.
    b. Half and Full Subtractor.
3. Implementation of Multiplex, De-multiplexer, Decoder and Encoder.
4. Implementation of Boolean functions using MUX.
5. To add two 4-bit binary numbers using IC 7483.
6. To verify the operation of different modes of shift register using IC 7495.
7. Design of BCD to 7 segment display using logical gates.
8. Implementation of different Flip-Flops.
9. Implementation of Shift registers and Counters using Flip-Flops.
10. Simulations
    a. Introduction to circuit maker and electronic work bench.
    b. Implementation of experiments from Serial No. 1 to 9 through simulations.

Course Outcomes:

After completion of the course student will be able to:

CO1. Test and verify logic gates with its truth.
CO2. Implement basic arithmetic circuits.
CO3. Implement Multiplexer, De-Multiplexer, Encoder & Decoder circuits.
CO4. Use modern engineering and IT tools for circuit simulations.
CO5. Function effectively as a team.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Network Analysis & Synthesis Lab **Max. Marks: 50**
Course Code: PCC-EE-332 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The student will be able to verify different fundamental theorem. Also student will be able to analyze & synthesize network.

List of Experiments:

1. Verification of Thevenin's theorem, Norton's theorem.
2. Verification of Maximum power transfer theorem, Superposition theorem.
3. Verification of Reciprocity theorem.
4. Design and implementation of T and Π passive filters.
5. Determination of h-parameters of a network.
6. Study of sinusoidal steady state response of a network.
7. Study of transient response of a network.
8. Study of passive integrator and differentiator.
9. Syntheses of RC-network for a given network function.
10. Verification of equivalence of star and delta transformation.

Laboratory Outcomes:
The student's will be

CO1. Knowing about various networks.
CO2. Able to analysis various theorems.
CO3. Able to design and implement passive filters.
CO4. Able to evaluate steady and transient state of a network.
CO5. Able to finds many performance indices in the circuit.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Open Elective Course-I Lab **Max. Marks: 50**
Course Code: OEC-EE-333 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Open Elective Courses-I Lab

Course Title: Data Structures Using C Lab **Max Marks: 50**

Course Code: OEC-EE-331/PCC-CSE-331 **University Exam: 25**

Duration of Exam: 2 hours **Internal Assessment: 25**

Credits: 1[0-0-2]

List of Programs:

1. Program to demonstrate concept of structures.
2. Program to implement single Linked List.
3. Program to implement Doubly Linked List.
4. Program to implement Stack using Linked List.
5. Program to implement Queue using Linked List.
6. Program to implement Stack using arrays.
7. Program to implement Queue using arrays.
8. Program to Create and Copy a Tree.
9. Program to implement Tree Traversal.
10. Program to implement Insert and Delete Operation on Trees.
11. Program to implement AVL Trees.
12. Program to implement Warshal`s algorithm to find path matrix.
13. Program to implement Djikstra`s algorithm.
14. Program to implement Binary Search.
15. Program to implement Bubble, Selection, Insertion, Heap, Merge and Quick Sort.

Course Outcomes:

1. Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
2. Understand basic data structures such as arrays, linked lists, stacks and queues. Describe the hash function and concepts of collision and its resolution methods
3. Solve problem involving graphs, trees and heaps
4. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

Note: This is only the suggested list of practical exercises. Instructor may add or change some practical's relevant to the course contents.

Course Title: Object Oriented Programming Using C++ Lab **Max Marks: 50**

Course Code: OEC-EE-332 / PCC-CSE-332 **University Exam: 25**

Duration of Exam: 2 hours **Internal Assessment: 25**

Credits: 1[0-0-2]

List of Experiments:

1. Program to break a number into its factors
2. Program to generate prime series from 1 to 100.
3. [Classes and Objects] Program to demonstrate the use of static data members.
4. [Classes and Objects] Program to demonstrate the use of friendly functions.
5. [Constructors and Destructors] Program to demonstrate the use of zero argument and parameterized constructors.
6. [Constructors and Destructors] Program to demonstrate the use of multiple constructors in a class (Overloaded constructors).
7. [Operator Overloading] Program to demonstrate the overloading of unary operators.
8. [Operator Overloading] Program to demonstrate the overloading of binary arithmetic operators.
9. [Operator Overloading] Program to demonstrate the overloading of binary arithmetic operators using friend function.
10. [Typecasting] Program to demonstrate the typecasting of basic type to class type.
11. [Typecasting] Program to demonstrate the typecasting of class type to class type.
12. [Inheritance] Program to demonstrate the multilevel inheritance.
13. [Inheritance] Program to demonstrate the multiple inheritance.
14. [Inheritance] Program to demonstrate the virtual derivation of a class.
15. [Polymorphism] Program to demonstrate the runtime polymorphism.
16. [Exception Handling] Program to demonstrate the exception handling.
17. [Templates and Generic Programming] Program to demonstrate the use of function template.
18. [Templates and Generic Programming] Program to demonstrate the use of class template.
19. [File Handling] Program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,
20. [File Handling] Program to demonstrate the reading and writing of objects.

Course Outcomes:

At the end of this course, the student will able to do the following:

1. Understanding and implementation of various object oriented programming concepts like inheritance, polymorphism, object and classes etc.
2. Designing the application using the object oriented concepts

Note: This is only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Fluid Mechanics Lab **Maximum. Marks: 50**
Course Code: OEC-EE-333/PCC-CE-332 **University Examination: 25**
Duration of Exams: 2 hours **Internal Assessment: 25**
Credits 1(0-0-2)

List of Practical's:

1. To determine the density of a liquid (Water, oil, petrol)
2. To determine experimentally the Meta-centric height of a ship model.
3. To verify the Archimedes principle experimentally.
4. To verify the Bernoulli's equation experimentally.
5. To determine coefficient of discharge in an Orificemeter.
6. To determine coefficient of discharge in Venturimeter.
7. To determine the coefficients of discharge, velocity and contraction of a rectangular orifice.
8. To determine the coefficients of discharge, velocity & contraction of external cylindrical mouthpiece.
9. To determine the coefficients of discharge, velocity and contraction of a rectangular Notch.
10. To calibrate a sharp crested triangular Weir.

Course Outcomes: After the completion of the course the students will be able to

1. Understand about metacenter and measure meta centric height.
2. Measure the coefficients of contraction, discharge, velocity.
3. Carry out the flow measurements by orificemeter & venturimeter.
4. Understand about the boundary layers.
5. Measure the friction factor for commercial pipes.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Semester IV

Course Title: Numerical Techniques **Max. Marks: 100**
Course Code: BSC-EE-421 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This Course aims at providing the necessary basic concepts of a numerical techniques and give procedures for solving numerically different Kinds of problems occurring in engineering and technology.

Detailed Contents:

Unit-I

Solutions to Algebraic and Transcendental Equations: Solutions to algebraic and transcendental equations by iterative, Bisection, Regula-Falsi, Newton-Raphson methods and Secant Methods.

Unit-II

Interpolation: Finite-differences and operators, Relation between operators, Interpolation With Equal Intervals – Newton's Forward And Backward Difference Formulae, Interpolation With Unequal Intervals – Lagrange's Interpolation – Newton's Divided Difference Interpolation .

Unit-III

Numerical Differentiation & Integration: Introduction to Numerical differentiation and integration, Errors in Numerical differentiation, Trapezoidal rule, Simpson's one-third rule, Simpson's third-eight rule, Boole's rule and Weddle's rule, Newton-Cote integration formula.

Unit-IV

Matrix and Linear System of Equations: Direct Methods: Gauss and Gauss-Jorden method, Crout's Triangularization method, Iterative methods: Gauss –Jacobi and Gauss Seidel method, Newton method for nonlinear simultaneous equations

Unit-V

Numerical Solutions to Ordinary Differential Equations: Numerical solution of ordinary differential equations by Taylor's Series, Picard's method, Euler's method, Modified Euler's method and Runge-Kutta method of 4^{th} order, Finite-difference method for Boundary value problems

Course Outcome:

Upon the completion of this course, the students will:

CO1. Comprehend of the Power of Numerical Techniques, and Ideas.
CO2. Apply these techniques to problems drawn from Industry, Management and other engineering fields.
CO3. Demonstrate the ability to solve linear system of equations.
CO4. Solve various problems of linear and nonlinear differential equations by using numerical methods.

Text Books/References:

1. **Introductory Methods of Numerical Analysis,** S S Sastry, PHI

2. **Numerical Methods in Engineering and Science: (C, and C++, and MATLAB)**, B. S. Grewal, Khanna Publication
3. **Jain, M. K &Iyengar. S.R.K**, numerical method for scientific and engineering computation, 3rd edition, New Age Publishers
4. **Grasselli, M. &Pelinovsky, D**: Numerical Mathematics, Jones &Bratlett

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Renewable Energy Sources **Max. Marks: 100**
Course Code: PCC-EE-421 **University Exam: 60**
Duration of Exam: 3Hours **Internal Assessment: 40**
Credits: 4[3-1-0]

Course Objective: The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

Detailed Contents:

Unit-I

Energy Scenario in India, Renewable and Non-renewable Energy sources, Causes of Energy Scarcity, Solution to energy Scarcity, Need for Renewable Energy, Advantages and Disadvantages of Renewable energy, Renewable Energy statistics worldwide and India.

Unit-II

Solar energy, solar photovoltaic, PV Technologies-Amorphous, Monocrystalline, polycrystalline-I characteristics of a PV cell, PV module, array, Maximum Power Point Tracking (MPPT) algorithms, Concentrated Solar Power, types of collectors, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, Application of Solar Power, Economic Policies to Promote Solar Energy.

Unit-III

Introduction, Electricity Generation using Wind Energy Generators (WEG), Evaluating Wind Turbine Performance, Wind Potential, Wind Energy in India, Wind Turbine Size and Power Ratings, Advantages of Wind-Generated Electricity, Cost Issues, Environmental Concerns, Supply and Transport Issues.

Unit-IV

Bio energy, Types of Bio Gas Plants, tidal energy, classification of Tidal Plants, Geothermal Power plants, ocean thermal energy systems, Open OTEC Cycle, Closed OTEC Cycle. Introduction to Magneto Hydro Dynamics (MHD) Power & fuel cells, types of fuel cells.

Unit-V

Energy storages: Introduction, characteristics of energy storage system, storage capacity, charging and discharging rate, storage efficiency, storage of mechanical energy, fly wall energy storage, compressed air storage, electro chemical energy storage system (Battery).

Course Outcome:

After learning the subject, student will be able to:

CO1. Appreciate the importance of energy crises and consequent growth of the power generation from the renewable energy sources

CO2. Demonstrate the knowledge of physics of solar power generation and the associated issues.
CO3. Demonstrate the knowledge of the physics of wind power generation and all associated issues.
CO4. Understand the utilization of Bio Gas Plants, Tidal, MHD, Fuel Cells by identifying the sites where their production is feasible.
CO5. Demonstrate the ways by which energy can be stored indifferent forms.

Text Books/References:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, Shobh Nath Singh, Pearson India
4. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
5. Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Electrical Machine I **Max. Marks: 100**
Course Code: PCC-EE-422 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The student will be able to understand the basic concept and analyze the characteristics of electrical machines and transformer.

Detailed Contents:

Unit-I

Magnetic fields and magnetic circuits: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law. Influence of highly permeable materials on the magnetic flux lines. B-H curve of magnetic materials, linear and nonlinear magnetic circuits. Analogy between electrical and magnetic circuits.

Unit-II

Transformers I: Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses, and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back (Hopkinson's) test, separation of hysteresis and eddy current losses Autotransformers - construction, principle, applications, and comparison with two winding transformers. Tap-changing transformers - No-load and on-load tap-changing of transformers. Transformer magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current.

Unit-III

Transformers II:

Principle of operation, construction, three phase transformer connections, open delta (V-V) connection, Phase conversions of three phase transformer (Scott Connections), Transformer ratings, Parallel operation of single and three phase transformers.

Special purpose transformers – Impedance matching transformers, Isolation transformers, constant current & constant voltage transformers. Instrument transformers (Introduction)

Unit-IV

DC machines: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Unit-V

DC machine - motoring and generation: Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator,

back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, Shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back (Swinburne) testing of DC machines

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the basic concepts of magnetic circuits.
CO2. Able to explain the concept behind Electromagnetic force and torque.
CO3. Analyze single phase and three phase transformers circuits.
CO4. Understand the operation of dc machines.
CO5. Analyze the differences in operation of different dc machine configurations.

Text Books/References:

1. **A. E. Fitzgerald and C. Kingsley**, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. **A. E. Clayton and N. N. Hancock**, "Performance and design of DC machines", CBS Publishers, 2004.
3. **M. G. Say**, "Performance and design of AC machines", CBS Publishers, 2002.
4. **P. S. Bimbhra**, "Electrical Machinery", Khanna Publishers, 2011.
5. **I. J. Nagrath and D. P. Kothari**, "Electric Machines", McGraw Hill Education, 2010.

Note for paper setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Electrical Measurement-I **Max. Marks: 100**
Course Code: PCC-EE–423 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques.

Detailed Contents:

Unit-I

Measurement System & Characteristics of Instruments: Introduction, significance of measurements, methods of measurements, Instruments & measurement system, Classification of instruments – mechanical, electrical & electronic instruments, deflection & null type instruments, Comparison of Analog & digital modes of operation. Application of measurement systems, errors in measurements, types of errors. Accuracy, Precision, Resolution, loading effects. Units-Absolute, Fundamental & derived.

Unit-II

Bridge Circuits: Wheatstone Bridge- galvanometer sensitivity, current through galvanometer & limitations, Kelvin Double Bridge, Maxwell Inductance Bridge, Maxwell inductance–capacitance Bridge, Anderson's bridge, Schering Bridge, Hay Bridge & Wien's Bridge. Measurement of effective resistance, inductance & capacitance at high frequency Meter.

Unit-III

Electro-mechanical Indicating Instruments: D Arsonval Galvanometer- construction & theory, Torque equation, Dynamic behavior & Galvanometer constants. Ballistic galvanometer- construction & theory. Introduction to PMMC Instruments and Moving Iron Instruments.

Unit-IV

Ammeters, Voltmeters: DC Ammeter, Multi-range Ammeter, RF Ammeter. DC Voltmeter, Multi-range Voltmeter, Extending ammeter & Voltmeter Ranges- Multipliers & shunts, The Aryton Shunt or Universal Shunt, Requirements of a Shunt, Introduction to Instrument Transformers & their application to extension of Instrument range.

Unit-V

Measurement of Energy & Power: Measurement of power in three phase AC circuits using single phase & three phase wattmeter, Measurement of reactive power (single phase & three phase), Measurement of energy using Induction type meter, Energy meter testing, Power factor meter.

Course Outcome:

The student will learn:

CO1. Introduction to Measurement System & Characteristics of Instruments.

CO2. Exposure to the Bridge Circuits and to learn various measurements techniques used for the measurement of capacitance and inductance.

CO3. Exposure to Electromechanical Indicating Instruments.

CO4. Exposure to various types of Ammeters and Voltmeters.

CO5. Exposure to different methods used in the measurements of Energy & Power.

Text Books/References:

1. **Albert D.Helfrick and William D. Cooper**, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. **Ernest o Doebelin and dhanesh N manik**, "Measurement systems" ,5th edition ,McGraw-Hill, 2007.
3. **John P. Bentley**, "Principles of Measurement Systems", Fourth edition, Pearson Education Limited, 2005.
4. **A. K. Sawhney**, "Course In Electrical And Electronic Measurement And Instrumentation", DhanpatRai Publisher, 2000.
5. **Bouwens,A.J**, "Digital Instrumentation", Tata Mc-Graw Hill, 1986.
6. **David A.Bell**, "Electronic Instrumentation and Measurements", Second edition, Prentice Hall of India, 2007.

Note for Paper Setter: -The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting one from each unit.

Course Title: Open Elective courses-II **Max. Marks: 100**
Course Code: OEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: _____

Open Elective Courses-II

Course Title: Python Programming **Max Marks: 100,**

Course Code: OEC-EE-421/PCC-CSE-422 **University Exam: 60**

Duration of Exam: 3 hours **Internal Assessment: 40**

Credits: 3[3-0-0]

Course Objective: Python is a modern language useful for writing compact code specifically for Programming in Server-Side web Development, AI, data analytics and Game Programming. This course covers the basics and advanced python programming to harness its potential for modern computing requirements

Unit-I

Introduction to Python: Introduction to Python, History, Installation and Working, Understanding variables, basic operators, and blocks. Declaring and using Numeric and string data type, defining list and list slicing, Use of Tuple data type, working with sequence. Flow Control: Conditional blocks using if, else and else if, loops in python for loop, while loops in python, Loop manipulation using pass, continue, break and else Programming.

Unit-II

Python Functions, Modules and Packages: Organizing python codes using functions, modules. Importing own module as well as external modules, Understanding Packages, Powerful Lamda function. Python String, List, tuple, set and Dictionary Manipulations:

Unit-III

Python Object Oriented Programming –Concept of class, object and instances, Constructor, class attributes and destructors, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support. Multithreading: Understanding threads, forking threads, synchronizing the threads, Programming using multithreading. Working with System (sys Module), Working with Operating System (os module).

Unit-IV

Python File Operation: Reading and Writing files in python, read functions and write functions, manipulating file pointer using seek, Programming using file operations. Python Regular Expression: pattern matching and searching using regex in python, Real time parsing of networking or system data using regex, Password, email, URL validation using regular expression

Unit-V

Python Exception Handling: Avoiding code break using exception handling, Handling and helping developer with error code, Built-in exception. Database Interaction**:** SQL Database connection using python, Creating and searching tables, Reading and storing config information on database, Programming using database connections

Course Outcomes: At the end of this course, the students will able to do the following:

1. To understand data and the operations that can be applied to each data type
2. To write programs that get input, perform calculations, and provide output
3. To understand the OOPs concepts with respect to fourth generation language
4. To write well designed and well documented programs that is easily maintainable.
5. To test and debug programs (find out what is wrong and fix it)**.**

Text Books:

1. **R. Nageswara Rao**, "Core Python Programming", Dreamtech.
2. **Wesley J. Chun.,** "Core Python Programming", -2nd Edition Prentice Hall.
3. **Kenneth A. Lambert**, "The Fundamentals of Python: First Programs", 2011, Cengage Learning,

Refercence Books:

1. **Luke Sneeringer,** "Professional Python", Wrox.
2. **John V Gutttag.,** "Introduction to Computation and Programming using Python", PHI.
3. **Allen B. Downey,** "Think Python", Green Tea Press, 2012.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Unix/Linux & Shell Programming **Max Marks: 100**

Course Code: OEC-EE-422/PCC-CSE-425 **University Exam: 60**

Duration of Exam: 3 hours **Internal Assessment: 40**

Credits: 3 [3-0-0]

Course Objective: This subject aims to provide students with fundamental principles and comprehensive knowledge of Unix/Linux & Shell Programming.

Unit-I

Introduction to the kernel: Architecture of the UNIX, overview of the concept of buffer cache. Internal representation of files**,** node, accessing blocks, releasing blocks, structure of regular files, conversion of a path name to an inode, inode assignment to a new file

Unit-II

System Calls: System calls for the file systems**;** open, read, write, close. The pipesystem call, opening a named pipe, reading and writing pipes, closing pipes, dup, mounting and un-mounting file system, link, unlink. System calls for time and clock.

Unit-III

Processes: The structure of processes: process states and transitions, layout of system memory, the context of a process, saving the context of the process, manipulation of the process address space. Process Control: process creation, signals, process termination, the user id of a process, changing the size of the process, the system boot and init process.

Unit-IV

Shell Programming: Study of different types of shells like Bourne shell, C & K shell. Shell variable, shell script, shell command. Looping and making choices, for loop, while and until, passing arguments to scripts. Programming with different shells.

Unit-V

Inter Process Communication: Inter Process communication, process tracing, network communication, sockets, Multiprocessor system, problem of multiprocessor systems, solution with master and slave processor, solution with semaphores.

Course Outcomes: At the end of this course, the students will able to do the following:

1. Understanding the concept of shell programming
2. Understanding the working of kernel and implementing them.
3. Implementing the system calls, process management, and inter process communication
4. Understand Shell Programming and its implementation.
5. Understanding Semaphores along with interprocess communication.

Text Books:

1. **Maurice J Bach.,** The design of the UNIX operating system, Prentice-Hall, 1986.
2. **Raymond S. Eric**, The Art of UNIX Programming.

Reference Books:

1. **Stephen Prata,** Advanced UNIX: A Programmer Guide, Howard W. Sams, 1987
2. **Rochkind,** Advanced Unix Programming.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Linear Integrated circuits & Pulse Switching **Max Marks: 100**
Course Code: OEC-EE-423/PCC-ECE-424 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3[3-0-0]

Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of OPAMP based linear and Non-linear circuits and different wave shaping circuits.

Unit-I

Op-Amplifier Fundamentals:

Op-amp Block Diagram, ideal and practical Op-amp specifications, DC and AC characteristics, 741 op-amp & its features,Basic Op -Amp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations; Biasing of Op-Amps.

Unit-II

Linear and Non-Linear applications of OP-Amps:

Linear applications:-Voltage Followers, Non-inverting & Inverting amplifiers, Summing amplifiers, Difference amplifier, Instrumentation amplifier, AC amplifier, V to I, I to V converters.

Non-Linear applications:-Basic comparator & its characteristics, zero crossing detector, Inverting and non-inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Triangular and Square wave generators, Log and Anti log amplifiers, Precision rectifiers.

Unit-III

Active Filters and Oscillators

Filters:-Butterworth Filters Low pass filter, High pass filter, Band-Pass Filters, Band Reject Filters, All-Pass Filters.

Oscillators:- Phase Shift Oscillator, Wien Bridge Oscillator, Voltage-Controlled Oscillator(VCO)

Unit-IV

Switching and waveshaping circuits: Linear wave shaping circuits: High Pass circuits, Low pass circuits, Differentiator, Integrator, RLC circuits, Ringing circuits. Clamping Theorem.

Time- base Generators: Time- base Generators, Methods of generating a time –base waveform, exponential sweep circuit, sweep circuit using UJT, sweep circuit using a transistor switch, Miller and Bootstrap time base generators-basic principles.

Unit-V

Timers, Blocking Oscillators & Phase Locked Loops: Introduction to 555 timer- its applications as Monostable and Astable multivibrators, Linear voltage regulators- protection mechanism- LM 723 functional diagram, functional operation of 78xx series IC and design of fixed and adjustable regulators. Blocking- Oscillator, Astable transistor blocking oscillator (Diode-controlled and RC-controlled), Application of blocking oscillator. Phase Locked Loop, frequency multiplication, frequency translation.

Course Outcomes:

After completion of the course student will be able to:

CO1. Solve Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate of op-amps.

CO2. analyze and design Voltage Followers, Non-inverting & Inverting amplifiers, Summing amplifiers, Instrumentation amplifier, AC amplifier, V to I, I to V converters using Op-Amps

CO3. Analyze and design zero crossing detector, Inverting and non-inverting Schmitt trigger circuits, Monostable & Astable multivibrator, Triangular and Square wave generators, Log and Anti log amplifiers, Precision rectifiers using Op-amps

CO4. Analyze Time- base Generators, Timers, Blocking Oscillator and Phase Locked Loops

Text Books:

1. C**howdhury D. Roy**, Linear Integrated Circuits, New Age International (p) Ltd, 2nd Ed., 2003.
2. **Ramakant A. Gayakwad**, 'OP-AMP and Linear IC's', Prentice Hal, 1999.

Reference Books:

1. Sergio Franco, 'Design with operational amplifiers and analog integrated circuits', McGraw-Hill, 2002
2. **Coughlin R.F. & Driscoll Fredrick**- Operational Amplifiers & Linear Integrated Circuits, PHI.
3. **J. Michael Jacob**, 'Applications and Design with Analog Integrated Circuits', Prentice Hall of India, 2002.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will beset from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Computer-Aided Simulation Lab **Max. Marks: 50**
Course Code: PCC-EE-431 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The laboratory is all about the modeling and design of various aspect of Electrical engineering.

List of Experiments

1. Introduction to MATLAB, Coding and Simulation.
2. Computation of parameters and modeling of transmission lines
3. Formation of bus admittance and impedance matrices.
4. Solution of power flow using gauss-seidel method.
5. Short circuit analysis.
6. Solution of power flow using Newton-Raphson method.
7. Load – frequency dynamics of single area power systems.
8. Load – frequency dynamics of two area power systems.
9. Transient and small signal stability analysis–single machine infinite bus system.
10. Transient stability analysis – multi machine infinite bus system.
11. Economic dispatch in power systems.
12. To learn the design algorithms of electrical machines
13. Design of transformer, its windings and core.
14. Design of DC Series machine.
15. Design of DC Shunt machine.
16. Design of wound rotor induction machine.
17. Design of squirrel cage induction machine.
18. Design of single-phase induction machine.
19. Design of synchronous machine.

Laboratory Outcomes

The students will be

CO1. Able to model and compute transmission line parameter.
CO2. Perform load flow for line flows.
CO3. Stability analysis.
CO4. Economical Load dispatch.
CO5. Able to design various types machine on MATLAB.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Renewable Energy Sources Lab. **Max. Marks: 50**
Course Code: PCC-EE-432 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: To understand the working of various renewable energy resources.

List of Experiments:

1. Study of the voltage and current of solar cells.
2. Study of voltage and current of the solar cells in series and parallel calculation.
3. Study of both I-V characteristics and the power curve to find the MMP and efficiency.
4. To calculate the efficiency of solar cell.
5. Study of the application of solar cells of charging Ni-Cd battery so that the loads can be used while the module is unexposed to light.
6. Study of the application of solar cells of providing electrical energy to the domestic appliances such as lamp, fan and radio.
7. Installation of wind turbine set up and measurements of wind energy based DC voltage and current.
8. Measurement of voltage and current of wind energy based DC supply with the change in angle of blades.
9. Measurement of V-I (voltage and current) of wind energy based DC supply with change in direction of wind.
10. Measurement of V-I (voltage and current) of wind energy based DC supply with change in speed of wind imposed on the blade.
11. Study of the application of wind energy based DC supply of changing the Ni-Cd battery so that the load can be used even while the module is unexposed to wind.
12. Study of the application of wind energy based DC supply of providing electrical energy to the domestic application such as lamp, fan FM receiver etc.

Laboratory Outcomes:

Student will

CO1. Understand the V-I characteristics of Solar cell.
CO2. Able to evaluate MPP and efficiency.
CO3. Able to understand the installation of wind turbine.
CO4. Able to measure V-I of wind energy based DC supply but changing various means.
CO5. Able to understand the application of wind energy based DC supply system.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Open Elective Lab courses-II **Max. Marks: 50**
Course Code: OEC-EE-(---) **University Exam: 25**
Duration of Exam: 3 Hours **Internal Assessment: 25**
Credits: _____

Open Elective Lab Courses-II

Course Title: Python Programming Lab **Max Marks: 50**
Course Code: OEC-EE-431/PCC-CSE-431 **University Exam: 25**
Duration of Exam: 2 hours **Internal Assessment: 25**
Credits: 1[0-0-2]

Lab Objectives:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

List of Programs:

1. Write a program to demonstrate different number datatypes in python.
2. Write a program to perform different arithmetic operations on numbers in python.
3. Write a program to create, concatenate and accessing substring from a string.
4. Write a python script to print the current date in following format
5. Write a python script to use string methods
6. Write a python program to create, append and remove lists in python.
7. Write a program to demonstrate working with tuples in python
8. Write a program to demonstrate working with dictionaries in python
9. Write a program to check whether a number is oven or odd using if condition
10. Write a program to demonstrate for loop
11. Write a program to demonstrate while loop
12. Write a program to display prime numbers between 50 to 60
13. Write a program to display Fibonacci series
14. Write a program to display Armstrong number
15. Write a program to display address of variables
16. Write a program to implement Function in python
17. Function call with tuple and dictionary
18. Write a program to implement modules
19. Write a program to implement ladders and snake game
20. Write a program to implement dir function in modules
21. Write a program to explore math module
22. Write a program to explore datetime module
23. Write a program to explore lambda functions
24. Write a program to implement linear search

COURSE OUTCOME: Upon completion of the course, students will be able to:

1. Write, test, and debug simple Python programs.
2. Implement Python programs with conditionals and loops.
3. Develop Python programs step-wise by defining functions and calling them.
4. Use Python lists, tuples, dictionaries for representing compound data.
5. Read and write data from/to files in Python.

Note: This is only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Unix /Linux and Shell Programming Lab **Max Marks: 50**
Course Code: OEC-EE-432/PCC-CSE-433 **University Exam: 25**
Duration of Exam: 2 hours **Internal Assessment: 25**
Credits: 1[0-0-2]

Lab Objective: The lab course will address the demand for Information technology professionals with UNIX training and experience.

List of Experiments:

1. Using the visual editor (vi) and the Pico editor.
2. Setting file and directory permissions.
3. Controlling user processes.
4. Managing, printing, and archiving large files.
5. Accessing and touring graphical desktops.
6. Administering a Linux PC system.
7. General administration issues, root account, creating user in Linux, changing password, deleting user, disabling user account, Linux Password & Shadow File Formats System Shutdown and Restart creating groups, Custom Configuration and administration issues.
8. Practicing various Commands, Using various editors, Shell programming, Networking and TCP/IP on Linux.
9. Common Network Troubleshooting on Linux.
10. FTP and Telnet settings, Web server configuration.

Lab Outcomes: Upon completion of this course, the student will be able to:

1. Run various UNIX commands on a standard UNIX/LINUX Operating system (We will be using Ubuntu flavor of the Linux operating system).
2. Run C / C++ programs on UNIX.
3. Do shell programming on UNIX OS.
4. Understand and handle UNIX system calls.

Note: This is only the suggested list of experiments. Instructor may frame additional experiments relevant to the course contents

Course Title: Linear Integrated Circuits Lab **Max Marks: 50**
Course Code: OEC-EE-433/PCC-ECE-433 **University Exam: 25**
Duration of Exam: 3 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

List of Experiments

1. Study of OP AMPs – IC 741, IC 555, – Functioning, Parameters and Specifications.
2. To demonstrate the relationship between input and output for the inverting and non-inverting configuration of the Op-Amp 741
3. To perform the Application operation – Adder, Subtractor, Comparator Circuits using IC741.
4. To design a square wave and triangular wave generator using Op-amp's.
5. Active Filter Applications – LPF, HPF (first order & 2^{nd} order)
6. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
7. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
8. IC 555 Timer – Monostable Operation Circuit.
9. IC 555 Timer – Astable Operation Circuit.
10. Schmitt Trigger Circuits – using IC 741 and IC 555.
11. IC 565 – PLL Applications.

Course Outcomes:

After completion of the course student will be able to:

CO1. Establish relationship between input and output for the inverting and non-invertingconfiguration of the Op-Amp 741
CO2. Perform arithmetic operation using IC-741
CO3. Design 1^{st} order and 2^{nd} order active filters using IC-741
CO4. Implement Schmitt trigger circuits using IC-741 & IC-555
CO5. Design square wave and triangular wave generators using op-amps

Note: This is only the suggested list of experiments. Instructor may frame additional experiments relevant to the course contents

Semester V

Course Title: Power System-I **Max. Marks: 100**
Course Code: PCC-EE-521 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to develop an understanding of the diverse concepts of power system generation, transmission and distribution. It also involves the study of various power transfer methods and phenomenon associated with power system.

Detailed Contents:

Unit-I

Electric Supply System: Typical A.C. Power Supply Scheme, Comparison of D.C. and A.C. Transmission, Advantages of High Transmission Voltage, Various Systems of Power Transmission, Economic Choice of Conductor Size, Economic Choice of Transmission Voltage, Requirements of satisfactory electric supply, Main components of Overhead Lines, Conductor Materials, Bundled Conductors, Line Supports, Insulators, Type of Insulators, Potential Distribution over Suspension Insulator, String Efficiency, Methods of Improving String Efficiency, Corona, Factors affecting Corona, Advantages and Disadvantages of Corona, Methods of Reducing Corona Effect, Sag in Overhead Lines, Calculation of Sag, Some Mechanical principles.

Unit-II

Distribution System: Classification of Distribution Systems, Methods of obtaining 3-wire D.C. System, Connection Schemes of Distribution System, Requirements of a Distribution System, Design Considerations in Distribution System. Types of D.C. Distributors, D.C. Distribution Calculations, D.C. distributor fed at one end (concentrated loading), Uniformly loaded distributor fed at one end, Distributor fed at both ends(concentrated loading), Uniformly loaded distributor fed at both ends, Distributor with both concentrated and uniform loading, Ring Distributor, Ring main distributors with Interconnector, 3-wire D.C. system, Current distribution in 3-wire D.C. System, Balancers in 3-wire D.C. system, Booster, Comparison of 3-wire and 2-wire D.C. distribution, Ground detectors. A.C. Distribution Calculations, Methods of solving A.C. Distribution Problems, 3-phase unbalanced loads, 4-wire, star-connected unbalanced loads, Ground detectors.

Unit-III

Line Parameter Calculations: Resistance of a Transmission Line, Skin effect, Flux Linkages, Inductance of a Single Phase Overhead Line, Inductance of a 3-Phase Overhead Line, Concept of self-GMD and mutual GMD, Inductance Formulas in terms of GMD, Electric Potential, Capacitance of a Single Phase Overhead Line, Capacitance of a 3-Phase Overhead Line.

Unit-IV

Classification of overhead Transmission Lines: Performance of Single Phase Short Transmission Lines, Three-Phase Short Transmission Lines, Effect of load p. f. on Regulation and Efficiency, Medium Transmission Lines, End Condenser Method, Nominal T Method, Nominal Π Method, Long Transmission Lines, Analysis of Long Transmission Line, Generalised Constants of a Transmission Line, Determination of Generalised Constants for Transmission Lines.

Unit-V

Underground Cables: Construction of Cables, Insulating Materials for Cables, Classification of Cables, Cables for 3-PhaseService, Laying of Underground Cables, Insulation Core Cable, Dielectric Stress in a Single Core Cable, Most Economical Conductor Size in a Cable, Grading of Cables, Capacitance Grading, Inter sheath Grading, Capacitance of 3-Core Cables, Measurement of Cc and Ce, Current carrying capacity of underground cables, Thermal resistance, Thermal resistance of dielectric of single-core cable, Permissible current loading, Types of cable faults, Loop tests for location of faults in underground cables, Murray loop test, Varley loop test.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the various concept of power system and realize its importance.

CO2. Understand the working of various distribution systems

CO3. Understand the various constants of transmission lines

CO4. Evaluate performance analysis on transmission lines

CO5. Understand various Underground Cables

Text Books/References:

1. **J. Grainger and W. D. Stevenson**, "Power System Analysis", McGraw Hill Education, 1994.
2. **O. I. Elgerd**, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. **A. R. Bergen and V. Vittal,** "Power System Analysis", Pearson Education Inc., 1999.
4. **D. P. Kothari and I. J. Nagrath**, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. **B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac**, "Electric Power Systems", Wiley, 2012.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Signals & Systems **Max. Marks: 100**
Course Code: PCC-EE-522 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to study and analyze the characteristics of continuous, discrete signals and systems**.**

Detailed contents:

Unit-I

Introduction: Definitions of a signal and a system, Signals and systems everyday life, Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Signal properties: periodicity, absolute integrability, determinism and stochastic character.

Unit-II

Time-domain representations for LTI systems–1: Convolution and its significance, impulse response representation, Convolution Sum and Convolution Integral, Relationship between LTI system properties and the impulse response i.e., Causality, Stability, Step response

Unit-III

Fourier representation for signals: Fourier representation for signals, Continuous -time Fourier series and their properties, Application of Fourier Series to LTI systems, Continuous – time Fourier Transform & its properties, Applications of Fourier Transform to LTI systems, Fourier transform of periodic signals, Discrete-time Fourier Transform and its properties.

Unit-IV

Laplace Transforms-1: Introduction, Laplace transform, Region of convergence (ROC) and its properties, properties of Laplace transforms, inverse Laplace transform using partial fraction method, Transform analysis of LTI Systems, unilateral, Initial and final value theorems, Poles and Zeros of a system.

Unit-V

The Z Transform: Z-Transform- Unilateral and Bilateral, Properties of the Z-transform, Transform analysis of LTI Systems, Unilateral Z-transform and its application to difference equations with zero and non-zero initial condition. Block diagram representation in Z-Domain.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the concepts of continuous time systems.
CO2. Understand the time domain representation of LTI system using convolution.
CO3. Analyze systems in complex frequency domain.

CO4. Understand s-domain representations of systems and its applications to analyze electrical circuit.

CO5. Understand Z-transform in context with digital signals.

Text Books/References:

1. **V. Oppenheim, A. S. Willsky and S. H. Nawab**, "Signals and systems", Prentice Hall India, 1997.
2. **J. G. Proakis and D. G. Manolakis**, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. **H. P. Hsu**, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. **S. Haykin and B. V. Veen**, "Signals and Systems", John Wiley and Sons, 2007.
5. **A. V. Oppenheim and R. W. Schafer**, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. **M. J. Robert** "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. **B. P. Lathi**, "Linear Systems and Signals", Oxford University Press, 2009.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit

Course Title: Electrical Machine-II **Max. Marks: 100**
Course Code: PCC-EE-523 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course has been designed to get student acquainted with basic concepts, principles and applications of AC Machines. Emphasis is given to latest technologies.

Detailed Contents:

Unit-I

Fundamentals of AC machine windings: Physical arrangement of windings in stator and cylindrical rotor; concentrated winding, distributed winding. Sinusoidally distributed winding, winding distribution factors. Revolving magnetic field by three windings spatially displaced by 120 degrees (carrying three-phase balanced currents).

Unit-II

Induction Machines: Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency).

Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Unit-III

Synchronous machines: Constructional features, cylindrical rotor synchronous machine-generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Unit-IV

Single-phase induction motors: Constructional features and principal of operation of single-phase induction motors. Double revolving field theory, field produced by spatially displaced windings by 90 degrees.Equivalent circuit of single-phase induction motors. Short and blocked rotor tests in single phase induction motors. Different types of self-starting methods of single-phase induction motors and their applications.

Unit-V

Special Machines

Universal motors-application and speed control, reluctance motors, Hysteresis motors,
Stepper motors and its types, Permanent magnet DC motors, BLDC motors.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the fundaments of ac machine winding.

CO2. Understand the concepts of rotating magnetic fields.

CO3. Understand the operation and characteristics of 3-phase Induction machines.

CO4. Understand the operation and characteristics of 1-phase Induction machines.

CO5. Understand the constructional features, operation and characteristics of Synchronous machines.

Text Books/References:

1. **A. E. Fitzgerald and C. Kingsley**, "Electric Machinery", McGraw Hill Education, 2013.
2. **M. G. Say**, "Performance and design of AC machines", CBS Publishers, 2002.
3. **P. S. Bimbhra**, "Electrical Machinery", Khanna Publishers, 2011.
4. **I. J. Nagrath and D. P. Kothari**, "Electric Machines", McGraw Hill Education, 2010.
5. **A. S. Langsdorf**, "Alternating current machines", McGraw Hill Education, 1984.
6. **P. C. Sen**, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Applied Electronics **Max. Marks: 100**
Course Code: PCC-EE-524 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**

Credits: 4 [3-1-0]

Course Objective: The course is designed to introduce the students with advance electronic circuits and applications in fabrications of various devices.

Detailed Contents:

Unit-I

Low frequency transistor amplifier and multistage amplifier: Equivalent circuit of BJT using h parameter for CB, CE and CC &configuration, calculation of transistor parameter for CB, CE, & CC using h parameter, comparison of transistor amplifier configuration.

Unit-II

Multistage & Power Amplifier: Multistage Amplifier: General cascaded system, RC coupled amplifier and its frequency response merits and demerits cascade amplifier, Darlington compound configuration multistage frequency effect.

Class A Power Amplifier, Maximum value of efficiency of class A Amplifier ,Transformer coupled Amplifier, Transformer coupled Audio Amplifier , Push pull Amplifier, Complimentary symmetry circuits (Transformer less class B power amplifier).

Unit-III

Operational Amplifier fundamentals: Dc analysis of dual input balanced output configuration, Properties of other differential amplifier configuration (dual input unbalanced output), single ended input-balanced /unbalanced output), DC coupling and cascade differential amplifier stages, level translator.

Basis Op-Amp circuit ,Op-Amp parameters-Input and output voltage ,CMRR AND PSRR, offset voltages and currents ,input and output impedances ,slew rate and frequency limitations; biasing of Op -Amps.

Unit-IV

Linear &Non Inverting Application of OP Amps: Voltage followers, Non Inverter Amplifiers, Inverting, Summing Amplifiers, Integrator and differentiator, Difference amplifier.

Comparators, inverting Schmitt trigger circuits, Monostable and Astable multivibrator, Triangular and Square wave generators.

Unit V

Active Filters, Timers & Phase locked loops: Butter worth filters first order, second order LPF, HPF filter, band pass, Band Reject and all pass filter. Introduction to 555 timer, function diagram, Monostable and Astable operation and applications, Schmitt trigger. PLL– introduction, block

schematic, principal and description of individual block, 565 PLL, Application of PLL-Frequency multiplication, frequency translation.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Analyze BJT amplifiers in different configurations at low frequency.

CO2. Classify power amplifier and analyze performance of different power amplifiers. Also understand the concept of multistage amplifiers.

CO3. Understand the Operational amplifier fundamentals.

CO4. Design and analyze various circuits using operational amplifier.

CO5. Understand the concept of 555 timer and phase locked loop.

Text Books/References:

1. **A. S. Sedra and K. C. Smith**, "Microelectronic Circuits", New York, Oxford UniversityPress, 1998.
2. **J. V. Wait, L. P. Huelsman and G. A. Korn**, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. **J. Millman and A. Grabel**, "Microelectronics", McGraw Hill Education, 1988.
4. **P. Horowitz and W. Hill**, "The Art of Electronics", Cambridge University Press, 1989.
5. **P. R. Gray, R. G. Meyer and S. Lewis**, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Note: - For paper setter: the question paper shall comprise of ten questions. Two questions will be set each unit. The student has to attempt five questions. Select one question for each unit.

Course Title: Open Elective courses-III **Max. Marks: 100**
Course Code: OEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: _____

Open Elective Courses III

Course Title: Cyber-crime and Laws **Max. Marks: 100**
Course Code: OEC-EE-521/PEC-CSE-522 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objectives: To maintain an appropriate level of awareness, knowledge and skill required to minimize the occurrence and severity of incidents related to cybercrimes, digital forensics and cyber law.

Unit-I

Introduction to Cyber law and Computer Forensics: What is Cyber Law, Need for Cyber Law, Indian Cyber Law, Information Technology Act, Relevant Cyber Crimes other than IT Act, 2000, what is computer Forensics, Objectives of computer Forensics, Computer Forensics Services, Steps Taken by Computer Forensics Specialists, Who can use Computer Forensic Evidence, Problems with Computer Forensic Evidence.

Unit-II

Cyber Crimes: Introduction to Cyber Crime, Defining Cyber Crime, Frequently Used Cyber Crimes, Reasons for Cyber Crime, Cyber Criminals, Mode and Methods of Committing Cyber Crimes, Motive Behind Any Attack, Classification of Cyber Crime.

Unit-III

Computer Investigation Process: The concept of cyber security, meaning, scope and the frame work, Collecting and preserving Evidence.

Unit-IV

Constitutional & Human Rights Issues in Cyberspace: Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace –Access to Internet, Right to Privacy, Right to Data Protection

Unit- V

Intellectual Property in Cyberspace

The Concept of Intellectual Property, The World Intellectual Property Organization (WIPO)-History and structure, Fields of Intellectual Property Protection-Patents, Copyright and Related Rights, Trademarks, Protection Against Unfair Competition

Course Outcomes: On successful completion of this course students will be able to

1. Understand basic concepts of cyber laws.
2. Understand the various types of cybercrime.
3. Understand the concept of cyber security and methods for Collecting and preserving Evidence.
4. Understand the definition of Freedom of Speech and Expression in Cyberspace
5. Understand the concept of Intellectual Property.

Text Books:

1. **Marie - Helen Maras, Jones & Bartlett Learn,** Computer Forensics: Cybercriminals, Laws, and Evidence, ,1st Edition ,2011

2. Computer Forensics: Investigating Network Intrusions and Cyber Crime, EC Council Press Series, Cengage Learning , 2010
3. **Stuart McClure, Joel SeatnbraV and George Kurtz**, Hacking Exposed: Network Security Secrets & Solutions, , McGraw-Hill, 2005

Reference Books:

1. **Justice Yatindra Singh**, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
2. **Albert J. ,Marcella Jr** ,Cyber Forensics: from Data to Digital Evidence ,Wiley,1st Edition,2012.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit

Course Title: Internet of Things **Max. Marks: 100**
Course Code: OEC-EE-522/PEC-CSE-722 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course objectives: The main objectives of this course are:

1. To assess the vision and introduction of IoT.
2. To Implement Data and Knowledge Management and use of Devices in IoT Technology.
3. To Understand State of the Art - IoT Architecture.
4. To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Unit-I

Introduction to Internet of Things - What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

Unit -II

IoT Protocols: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Unit-III

IoT Architecture: IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Unit-IV

Web of Things - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

Unit-V

IoT Applications: IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

Course Outcomes: After completion of this course, the students will able to do following:

1. Interpret the vision of IoT from a global context.
2. Compare and contrast the use of Devices, Gateways and Data Management in IoT.
3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
4. To study and analyse data and to understand the security issues in IoT
5. To study IoT physical devices and end points and to understand the communications between components

Textbook:

1. **Honbo Zhou**, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. **Dieter Uckelmann, Mark Harrison, Michahelles, Florian** (Eds), "Architecting the Internet of Things", Springer, 2011.
3. **David Easley and Jon Kleinberg**, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
4. **Olivier Hersent, David Boswarthick, Omar Elloumi** , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

Reference Books:

1. **Vijay Madisetti and Arshdeep Bahga**, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
2. **Francis da Costa**, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013
3. **CunoPfister**, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Industrial Electronics **Max Marks: 100**
Course Code: OEC-EE-523/PEC-ECE-521 **University Exam: 60**
Duration of Exam: 3 hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The course has been designed for explaining the basic concepts and principles to the students. Applied and Industrial Aspects have been taken care of in an appropriate manner.

Unit-I

D.C. Motor Control: Control of DC motor using half controlled and fully-controlled single-phase and three-phase thyristor converters, control of DC motor using choppers of different configurations.

Unit-II

A.C. Motor Control: Stator voltage control of induction motors, control of induction motors using voltage source and current source inverters, slip-ring induction motor control.

Unit-III

Industrial circuits: Temperature control circuit, AC voltage regulators, fan regulators/ lamp dimmers, uninterrupted power supplies (UPS). Relays and Timers: The relay (basic construction), AC relay, Reed relay, Solid state relay, 555 timer and its industrial applications.

Unit-IV

Design of Printed Circuit Boards: Introduction to technology of printed circuit boards (PCB), General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

Unit-V

Industrial Appliances Design: Power Transformers and Voltage Stabilizers, Design of 0.5 and 1.0KVA Voltage Stabilizers, Design of Inverters and Battery Chargers for domestic use.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Control speed of DC motors.
- **CO2.** Control speed of AC motors.
- **CO3.** Gain knowledge of various Industrial Components.
- **CO4.** Understand PCB design rules. Design of PCB using computer aided tools.
- **CO5.** Design Power transformers, voltage stabilizer, inverter and battery charger.

Text Books:

1. **Mohan N Undeland, T.M. Robins, W.P**. "Power electronics- converters, application & design", John Wiley 1989
2. **Bose B.K**., "Power electronics and A.C Drives", Prentice Hail 1986.

Reference Books:

1. **Dubey G.K. Asarbada, E.R, K**., "Power electronics devices", IETE book, TMH.
2. **Murphy J. M. D Turnnbull, F.G,** "Power electronics control of A.C motors".

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Biomedical Instrumentation **Max Marks: 100**
Course Code: OEC-EE-524/PEC-ECE-725 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The aim of the course is to get the students acquainted with the Biomedical Instrumentation.

Unit-I

Introduction to biomedical instrumentation: Introduction of Biomedical Engineering, Biometrics, Man instrument system, Components of Man instrument system. Resting potential, action potential, typical wave form of action potential, propagation of action potential, recording of action potential.

Unit-II

Electrodes, Transducer and Amplifiers: Introduction of Bio-Electrodes, Properties of Bio-Electrodes, different types of electrodes, Sensors, Diaphragms, Force sensors. Introduction of transducers, classification of transducers, Biological Amplifiers (Instrumentation amplifies, chopper amplifiers)

Unit-III

Electro Potential Recording: The heart and cardiovascular system, ECG, EEG, EMG, lead systems and recording methods, typical waveforms and signal characteristics and block diagrams of ECG, EEG, EMG.

Unit-IV

Human Assist Devices: Cardiac pacemakers, Classification of Pacemakers, Defibrillators, AC Defibrillators, DC Defibrillators, Indirect measurement, direct measurement, automated indirect method, magnetic blood flow meters, ultrasonic blood flow meter.

Unit-V

Imaging Techniques: Introduction to X-rays, Properties of X-rays, Production of X-rays, Block Diagram of X-ray Machine, Ultrasound in medicine, physics of ultrasonic waves, types, A-mode, M-Mode, Doppler mode, Introduction of Computed tomography, Introduction of MRI.

Course Outcomes:

After completion of the course student will be able to:

- **CO1.** Understand biomedical instrumentation, propagation of action potential.
- **CO2.** Acquire knowledge of electrodes, transducers & amplifiers used in biomedical instrumentation.
- **CO3.** Apply the knowledge of science, engineering fundamentals & engineering specialization for electrode potential recording.
- **CO4.** Understand different human assist devices.
- **CO5.** Gain knowledge of different imaging techniques used in medical science.

Text Books:

1. **Khandpur, R.S**., "Handbook of Biomedical Instrumentation", TATA McGraw-Hill, New Delhi, 1997.

Reference Books:

1. **Joseph J. Carr and John M. Brown**, Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 1997.
2. **Leislie Cromwell**, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi, 2002

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Disaster Preparedness & Planning **Max Marks: 100**
Course Code: OEC-EE-525/PCC-CE-325 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [2-1-0]

Course Objective: To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences and to ensure skills and abilities to analyze potential effects of disasters and of the strategies and met to deliver public health response to avert these effects.

UNIT: I

Disaster and Hazards

Definition of vulnerability, risk, capacity, impact, prevention, mitigation. ecological fragility; Factors affecting vulnerability; Sustainable and environmental-friendly recovery; Reconstruction and development.

UNIT: II

Classification of Disasters

Natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.), Causes of natural disasters; Man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills), Causes and concern of man-made disasters.

UNIT III:

Disaster Impacts

Disaster impacts- Global (Climate change), regional (urban disasters) and local- environmental impacts (physical, social, ecological, economic, political, etc.), health impacts, psycho-social issues; demographic aspects (gender, age, special needs), Impact evaluation and analysis.

UNIT IV:

Disaster Risk Reduction: Disaster management cycle phases; prevention, mitigation, preparedness, relief and recovery; Structural and nonstructural measures; risk analysis, vulnerability and capacity assessment; Early warning systems, Post-disaster environmental response, Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V:

Disasters management and control: Management of natural disasters (Earthquake, flood and drought), Various components and their functions; Man-made disasters (Industrial and nuclear disaster)-management and control, preventives measures, regulatory aspects.

Course Outcomes: At the end of completion of subject students will able to understand:

1. Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.

2. Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

3. Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.

4. Capacity to manage the Public Health aspects of the disasters.

5. Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Text Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority). 64

2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

3. **Pradeep Sahni**, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.

Reference Books:

3. **Singh B.K.,** 2008, Handbook of Disaster Management: techniques & Guidelines, Rajat Publication.

4. **Ghosh G.K.,** 2006, Disaster Management, APH Publishing Corporation.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each Unit. The student has to attempt five questions at least one from each

Course Title: Biology& Life Science **Maximum Marks: 100**
Course Code: OEC-EE-526/PCC-CE-326 **University Examination: 60**
Duration of Exams: 3 hours **Internal Assessment: 40**
Credits 3 (2-1-0)

Course Objective: The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

Unit I

Basic Cell Biology: Introduction: Methods of Science-Living Organisms: Cells and Cell theory Cell Structure and Function, Genetic information, protein synthesis, and protein structure, Cell metabolism Homoeostasis- Cell growth, reproduction, and differentiation**.**

Unit II –

Biochemistry and Molecular Aspects of Life: Biological Diversity --Chemistry of life: chemical bonds-Biochemistry and Human biology--Protein synthesis—Stem cells and Tissue engineering.

Unit III

Enzymes and Industrial Applications: Enzymes: Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases—Photosynthesis

Unit IV

Mechanochemistry: Molecular Machines/Motors—Cytoskeleton—Bioremediation—Biosensors

Unit V

Nervous System, Immune System, and Cell Signaling: Nervous system--Immune system-General principles of cell signaling

Course Outcomes:

1. Students will understand the Basic of Cell.
2. To familiarize the students with the basic organization of organisms and subsequent building to a living being.
3. To impart an understanding about the machinery of the cell functions that is ultimately responsible for various daily activities.
4. To provide knowledge about biological problems that requires engineering expertise to solve them.
5. To provide knowledge Nervous System, Immune System, and Cell Signaling

REFERENCES/ TEXT BOOK

1. **S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan,** "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012.
2. **Jeremy M. Berg, John L. Tymoczko and Lubert Stryer,** "Biochemistry," W.H. Freeman and Co. Ltd., 6th Ed., 2006.
3. **Robert Weaver,** "Molecular Biology," MCGraw-Hill, 5th Edition, 2012.
4. **Jon Cooper**, "Biosensors A Practical Approach" Bellwether Books, 2004.
5. **Martin Alexander,** "Biodegradation and Bioremediation," Academic Press, 1994.
6. **Kenneth Murphy**, "Janeway's Immunobiology," Garland Science; 8th edition, 2011.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each Unit. The student has to attempt five questions at least one from each Unit.

Course Title: Electrical Machine Lab. **Max. Marks: 50**
Course Code: PCC-EE–531 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of the laboratory is to equip the students with the exposure to the working operation and characteristics of the A.C. Machines.

List of Experiments:

1. To obtain equivalent circuit, efficiency and voltage regulation of a single-phase transformer using O.C. and S.C. tests.
2. To study three-phase transformer connection (a) Star-star (b)Star-delta (c) delta-star (d)delta-delta
3. To obtain magnetization characteristics of a d.c. shunt generator.
4. To obtain speed-torque characteristics of a dc shunt motor.
5. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control.
6. To perform no load and blocked rotor tests on a three-phase squirrel cage induction motor and determine equivalent circuit.
7. To perform no load and blocked rotor tests on a single-phase induction motor and determine equivalent circuit.
8. To study speed control of three phase induction motor by varying supply voltage.
9. To determine V-curves and inverted V-curves of a three-phase synchronous motor.
10. To study speed control of switched reluctance motor.
11. To study speed control of BLDC Motor.

Laboratory Outcome:

At the end of this laboratory the

CO1. Get an exposure to common electrical machines and their ratings.
CO2. Understand the basic characteristics of single-phase / three-phase transformers.
CO3. Understand the basic characteristics of various A.C/ DC machines.
CO4. Student will be able to control speed of AC/DC machine with different means.
CO5. Understand various speed control methods of special machines.

Note: This is only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Applied Electronics Lab. **Max. Marks: 50**
Course Code: PCC-EE-532 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The student will be able to understand the functionality and characteristics of different types of Electronics devices.

List of Experiments:

1. To study bipolar transistor as a switch.
2. To plot a load line for a CE amplifier and show effect of input signal on Q-point.
3. To demonstrate use of a BJT in a CE amplifier circuit configuration and study its frequency response.
4. To study the characteristics of Class- AB amplifier.
5. To study the characteristics of Class- B push-pull amplifier.
6. Study of OP AMPs – IC 841, IC 555, – Functioning, Parameters and Specifications.
7. To demonstrate the relationship between input and output for the inverting and non-inverting configuration of the Op-Amp 841
8. To perform the Application operation – Adder, Subtractor, Comparator Circuits using IC 841.
9. To design a square wave and triangular wave generator using Op-amp's.
10. Active Filter Applications – LPF, HPF (first order & 2^{nd} order)
11. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
12. IC 555 Timer – Monostable Operation Circuit.
13. IC 555 Timer – Astable Operation Circuit.
14. Schmitt Trigger Circuits – using IC 841 and IC 555.

Laboratory Outcome:

The students should be

CO1. Able to devise simple circuit using BJTs, Op-Amp etc.
CO2. Able to understand characteristics of different electronics devices.
CO3. Able to perform different operations on devices.
CO4. Able to understand the applications of different types of filters and timer.
CO5. Able to finds many performance indices in the circuit.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Industrial Training-I **Max. Marks: 50**
Course Code: PROJ-EE-531 **University Exam: 0**
Internal Assessment: 50
Credits: 1 [0-0-0]

Course Title: Seminar **Max. Marks: 100**
Course Code: PROJ-EE-532 **University Exam: 0**
Internal Assessment: 100
Credits: 2 [0-0-0]

Semester VI

Course Title: Power Electronics **Max. Marks: 100**
Course Code: PCC-EE-621 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to have knowledge of basic concepts of power electronics devices and their operational and performance characteristics, along with converters.

Detailed Contents:

Unit I

Power Semiconductor Devices & their Characteristics: Application of power electronics, classification of power semiconductor devices, ideal switch, power diodes & thyristor with characteristics, two transistor model of thyristor, di/dt, dv/dt limitations and snubber circuits, other power semiconductor devices (DIAC, TRIAC, IGBT, MOSFET) with their characteristics.

Unit II

AC to DC Converters: Types of AC to DC converters, single phase half-wave and full-wave controlled rectifiers with resistive load, inductive load and freewheeling diode, detailed derivation of RMS, average value, harmonic factor, displacement factor, THD, crest factor. Introduction to three phase full and semi controlled rectifiers, dual converters.

Unit III

DC to DC Converters: Principle of chopper, control techniques of chopper (TRC and CLC), switching regulators: Buck, Boost, Buck-Boost, basic principles of SMPS and UPS, Introduction to resonant converters.

Unit IV

DC to AC Converters: Voltage-driven inverter, current-driven inverter, Single-phase inverter with resistive load, inductive load, Sinusoidal PWM Inverter, Introduction to resonant inverters, three phase inverter, 120–180-degree conduction.

Unit V

AC to AC Converters: AC Voltage Controllers: Single and three phase AC voltage controllers. Cycloconverters: Single phase to single-phase, three-phase to single-phase, three-phase to three-phase cycloconverter circuit and their operation.

Course Outcome:

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

CO1. Articulate the basics of power electronic devices and characteristics of SCR, DIAC, TRIAC, MOSFET and IGBT.

CO2. Express the design and control of converters.

CO3. Design of power electronic converters in power control applications.

CO4. Ability to design AC voltage controller, Chopper circuit, Inverter circuit and Cyclo-Converter.

CO5. Analyze the operation of DC-DC choppers and voltage source inverters.

Text Books/References:

1. **M. H. Rashid**, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. **N. Mohan and T. M. Undeland**, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. **R. W. Erickson and D. Maksimovic**, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. **L. Umanand**, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting one from each unit.

Course Title: Power System-II **Max. Marks: 100**
Course Code: PCC-EE-622 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: This subject familiarizes a student with the power system behavior and performance during normal and abnormal conditions.

Detailed Contents:

Unit-I

Per unit Representation, one line diagram and impedance diagram. Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control.

Unit-II

Symmetrical components of a three phase system, Evaluation of components, Three-phase power in terms of symmetrical components, Sequence impedances. Sequence network. Calculation of fault currents for unsymmetrical faults: Single Line to Ground, Line-to-Line, Double Line to Ground faults and for symmetrical 3-phase balanced faults,

Unit-III

Load flow analysis: Introduction, Bus classifications, Nodal admittance matrix (YBUS), Development of load flow equations. Load flow solution using Gauss-Seidel and Newton Raphson method, Approximation to N-R method. Calculation of line flows and line losses.

Unit-IV

Power System Stability, Transient and Steady State stability, Power Angle Equation, Swing Equation, Equal Area Criterion of Stability, Critical clearing angle, Factors affecting transient stability. Active and Reactive power control.

Unit-V

Travelling waves on transmission lines: Reflection and refraction coefficient, open-end line, Short-circuited line, Line terminated through impedance. Line terminated through cable, Surge Impedance loading, Bewley Lattice Diagrams.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the importance of Per unit representation in Power System

CO2. Understand various faults in Power System

CO3. Understand methods for Load Flow analysis

CO4. Understand the importance of Power System Stability

CO5. Understand the phenomenon of Travelling Waves on transmission lines

Text Books/References:

1. **J. Grainger and W. D. Stevenson**, "Power System Analysis", McGraw Hill Education, 1994.
2. **O. I. Elgerd**, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. **A. R. Bergen and V. Vittal**, "Power System Analysis", Pearson Education Inc., 1999.

4. **D. P. Kothari and I. J. Nagrath**, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. **B. M. Weedy,B. J. Cory, N. Jenkins**, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Electrical Measurement-II **Max. Marks: 100**
Course Code: PCC-EE-623 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The objective of this course is to expose the students to a broad knowledge of experimental methods and measurement techniques.

Detailed contents:

Unit-I

Potentiometers: Introduction, DC potentiometer-principle of operation, standardization of potentiometer, Crompton's & Duo range potentiometer, Applications of DC Potentiometer.

AC Potentiometer: Polar type & Co-ordinate type AC potentiometers, application of AC Potentiometers in electrical measurement

Unit-II

Transducers: Principe of operation, classification of transducers, Summary of factors influencing the choice of transducer. Qualitative treatment of Strain Gauge, Linear Variable Differential Transformer (LVDT), Thermocouple, Piezoelectric crystal & photoelectric transducers

Unit-III

Phase & Frequency Measurement: Frequency meters – vibrating reed type, electrical resonance type & Weston type frequency meters, Digital frequency meter, Analog & digital phase meters & their comparison.

Unit-IV

Digital Instruments: Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

Unit-V

Data Display & Recording Systems: Introduction to cathode ray tube, block Diagram of CRO. Measurement of voltage, current, phase & frequency using CRO, Dual Beam Oscilloscope, Dual Trace Oscilloscope Analog and Digital Recorders, Measurement systems applied to Micro and Nanotechnology

Course Outcome:

The fundamentals developed in this study will expose the students to a broad knowledge of experimental methods and measurement techniques. After completion of this subject the student will be able to:

CO1. Understand the principal, standardization and application of AC and DC potentiometer.

CO2. Analyze different types and applications of transducers.
CO3. Understand basic concepts of phase and frequency measurements.
CO4. Analyze digital instruments.
CO5. Analyze data recording systems.

Text Books/References:

1. **Albert D.Helfrick and William D. Cooper**, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.
2. **Ernest o Doebelin and dhanesh N manik**, "Measurement systems", 5thedition, McGraw-Hill, 2007.
3. **John P. Bentley**, "Principles of Measurement Systems", Fourth edition, pearson Education Limited, 2005.
4. **A. K. Sawhney**, "Course in Electrical and Electronic Measurement and Instrumentation", Dhanpat Rai Publisher, 2000.
5. **Bouwens,A.J**, "Digital Instrumentation", Tata Mc-Graw Hill, 1986.
6. **David A.Bell**, "Electronic Instrumentation and Measurements", Second edition,Prentice Hall of India, 2007.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting one from each unit.

Course Title: Control System **Max. Marks: 100**
Course Code: PCC-EE-624 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 4 [3-1-0]

Course Objective: The course puts an emphasis on the basics of control systems and Controller Design.

Detailed Contents:

Unit-I

Introduction to control problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Unit-II

Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Unit-III

Frequency-response analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Unit-IV

Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Unit-V

State variable Analysis: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.

Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the basics of control systems.

CO2. Understand the modeling of linear-time-invariant systems using transfer function.
CO3. Know the frequency response for stability analysis.
CO4. Design the controller.
CO5. Perform state-space representations for stability, controllability and observability.

Text Books/References:

1. **M. Gopal**, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. **B. C. Kuo**, "Automatic Control System", Prentice Hall, 1995.
3. **K. Ogata**, "Modern Control Engineering", Prentice Hall, 1991.
4. **I. J. Nagrath and M. Gopal**, "Control Systems Engineering", New Age International, 2009

Note for paper setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Professional Elective courses-I **Max. Marks: 100**
Course Code: PEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Professional Elective Courses-I

Course Title: Electrical Substation Design **Max. Marks: 100**
Course Code: PEC-EE-621 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to allow the students to grasp design and operation of sub-station and bus-bar systems.

Detailed Contents:

Unit-I
Sub-Station Design: General aspects of sub-station design, Site consideration, design consideration and environmental consideration of substation, layout with all equipments.

Unit-II
Bus-Bar Design: Bus bar arrangement with detailed layout-single bus-bar arrangement, single sectionalized bus-bar scheme, main and transfer bus-bar scheme, ring bus scheme, breaker and half scheme, double bus bar arrangement, double bus and transfer bus arrangement.

Unit-III
Switch Operation: Isolating switches, location, rating, selection, operation and control. Interlocking-mechanical and electrical, rating and selection of isolators.

Unit-IV
Transformers and Circuit Breakers: Voltage & Current Transformers. Governing specifications, rating & selection requirement of CT's & PT's for different protection schemes. Standard ratings & selection. Restricting voltage & recovery voltage, particular performance & testing of circuit breaker.

Unit-V
Control & Relay panels: Design of control & relay panels. Planning of control circuit. Voltage selection scheme. General Earthing of a substation. Complete design of Earthing grid.

Course Outcome:
By the end of this course, the student should be able to:
CO1. Explain the principles of design and operation of electric Sub-Station Design
CO2. Apply analytic techniques pertaining to primary Bus-Bar Design systems.
CO3. Use basic design principles for Switch Operation and facilities.
CO4. Examine primary Transformers and Circuit Breakers systems using computer-based modeling.
CO5. Discuss computational algorithms of Control & Relay panels' system analysis and operation.

Text Books/ References:

1. **P.S Satnam**, Substation Design.
2. **P.V Gupta**, Substation Design and Equipments. DhanpatRai Publications.
3. **John D. McDonald**Electric Power Substations Engineering, Third Edition, May 16, 2012.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Energy Audit and Management **Max. Marks: 100**
Course Code: PEC-EE-622 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course gives an overview of various aspects of conservation, management& audit of electrical energy.

Detailed Contents:

Unit-I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, longterm energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energystrategy for the future, air pollution, climate change. Energy Conservation, Energy Conservation Act and its features.

Unit-II

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Unit-III

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Unit-IV

Energy Efficiency in Industrial Systems: Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacityassessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fansand blowers: Types, performance evaluation, efficient system operation, Pumps and Pumping System: Types, performance evaluation, efficient system operation.
Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling

Unit-V

Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lightingcontrols, energy saving potential of each technology.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the current energy scenario and realize the need for new reforms to efficientlymanage the energy resources.

CO2. Learn various auditing techniques used for proper energy management.

CO3. Realize how energy conservation could be done in Electrical Systems by managing theenergy losses and malpractices.

CO4. Realize how energy conservation could be done in Industrial Systems by finding out thefactor affecting the performance of various industrial devices and mitigating the same.

CO5. How electrical energy management could be achieved using new energy efficient devices.

Text Books/Reference:

1. Guide books for National Certification Examination for Energy Manager / Energy AuditorsBook-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
3. **S. C. Tripathy**, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
4. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

Note for Paper Setter: -The Question paper shall comprise of 10 questions. Two questions will beset from each unit. The student has to attempt five questions at least one from each uni

Course Title: Power Engineering **Max. Marks: 100**
Course Code: PEC-EE-623 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to allow the students to grasp various methods of power generation, tariff calculations.

Detailed contents

Unit-1

Economic Aspects and Power Factor Improvement: Economics of generation, factors affecting the cost of generation, reduction of costs by interconnection of stations, curves useful in system operation, choice of size and number of generating units. Power factor disadvantages of low power factor, methods of improving power factor, location of power factor improvement apparatus, economics of power factor improvement.

Unit-II

Power Tariff: Cost of generating station, fixed capital, running capital annual cost running charges, fixed charges, methods of depreciation, factors influencing the rate of tariff, designing tariff, different types of tariff, flat rate tariff, block rate tariff, two part tariff maximum demand tariff, power factor tariff.

Unit-III

Thermal and Nuclear Power Plants: General layout, choice of site, super heater, air pre heater, economizer, coal handling plant, cooling towers, electrostatic precipitator, advantage and disadvantages. Introduction to nuclear energy, choice of site of the plant, advantages and disadvantages, main components of the plant and type of reactors.
Introduction to Diesel power stations and gas turbine plants.

Unit-IV

Hydroelectric power plants: Hydrology, load flow duration curve, hydro graph, mass curve, choice of site of the plant, advantages and disadvantages of the plant, layout of the plant, classification of the hydroelectric plant, introduction to mini & micro hydro.

Unit-V

Substations and Grounding: Neutral grounding, solid grounding resistance grounding, reactance grounding, are suppression coil grounding Earthing transformers, choice of methods of neutral grounding equipment, grounding for safety. Introduction to substations and substation equipment.

Course outcomes

This subject exposes. After the completion of this course student will be able to:

CO1. Understand economic aspects of power generation, transmission & transmission along with the advantages of power factor improvement.

CO2. Analyze different costs associated with power systems and ways to reduce it analyze various tariffs schemes.

CO3. Understand the layout and design considerations of thermal and nuclear plants.

CO4. Understand the layout and design considerations of hydroelectric plants.

CO5. Understand various types of substation groundings.

Text Books/Reference:

1. **Deshpande M.V**., Elements of power station design, TMH.
2. **H. Pratab**, The art and Science of Utilisation of Electric energy, PHI.
3. **Satnam**, Substation Design and Equipment.

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Industrial Electrical Systems **Max. Marks: 100**
Course Code: PEC-EE-624 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The course will give the fundamental knowledge about the Industrial Electrical Systems.

Detailed Contents

Unit-I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Unit-II

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, Earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, Earthing of commercial installation, selection and sizing of components.

Unit-III

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Unit-IV

Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit-V

Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. Understand various components of industrial electrical systems.

CO2. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.

CO3. Understand illumination and various deign scheme for energy systems.

CO4. Analyze and select the proper size of various electrical system components.

CO5. Study the basics of PLCC and SCADA systems.

Text/Reference Books

1. **S. L. Uppal and G. C. Garg**, "Electrical Wiring, Estimating &Costing", Khanna publishers, 2008.
2. **K. B. Raina**, "Electrical Design, Estimating & Costing", New age International, 2007.
3. **S. Singh and R. D. Singh**, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
4. Web site for IS Standards.
5. **H. Joshi**, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Computers in medicine **Max. Marks: 100**
Course Code: PEC-EE-625 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: Objective of this course is to get students aware with the importance and application of Computers in medicine.

Detailed Contents:

Unit-I

Introduction: Structure of Medical Informatics, Internet and Medicine, Security issues, Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics, Medical Informatics, Bioinformatics.

Unit-II

Computerized Patient Record: History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology, Application server provider, Clinical information system, Computerized prescriptions for patients.

Unit-III

Computers in Clinical Laboratory and Medical Imagining: Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System, Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging ultrasonography-computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance

Unit-IV

Computer Assisted Medical Decision-Making: Neuro-computers and Artificial Neural Networks application, Expert system, General model of CMD, Computer-assisted decision support system, production rule, system cognitive model, semester networks , decisions analysis in clinical medicine, computers in the care of critically patients, computer assisted surgery, designing.

Unit-V

Recent Trends in Medical Informatics: Virtual reality applications in medicine, Computer assisted surgery, surgical simulation, Telemedicine, Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics, Computer assisted patient education and health, Medical education and health care information.

Course Outcome:

After completing subject, Students will be able to

CO1. Understand the informatics related to hospital management and security concerns.

CO2. Understand the importance of Computerized Patient Record.

CO3. Understand the importance of computers in Clinical Laboratory and Medical Imagining.

CO4. Aware with the Recent Trends in Medical Informatics.

Text Books /References:

1. R.D. Lele Computers in medicine progress in medical informatics, Tata Mcgraw Hill Publishing computers Ltd, 2005, New Delhi.
2. Mohan Bansal, Medical informatics Tata Mcgraw Hill Publishing computers Ltd, 2003, New Delhi.

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Power System Lab. **Max. Marks: 50**
Course Code: PCC-EE-631 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of performing this laboratory course is to give broader idea about power system transmission and distribution.

List of Experiments:

1. To study the various types of components used in power transmission and distribution line.
2. To determine voltage distribution and string efficiency of string insulator with and without guard ring method.
3. To study the Ferranti effect of Long Transmission Line model.
4. Determination of the ABCD of short transmission line.
5. Determine the ABCD of medium transmission line for π network.
6. Determine the ABCD of medium transmission line for T network.
7. Determine the ABCD of long transmission line.
8. To locate fault in a cable by Murray Loop Test.
9. Measurement of power and power factor in a single-phase AC circuit and improvement of Power factor using capacitor.

Laboratory Outcome:

Students will

CO1. Get an exposure to common power system equipment's and components used in transmission line

CO2. Understand the need of compensation in Transmission lines

CO3. Understand the relation between I/p voltage and current with O/p voltage and current

CO4. Understand how to detect fault in underground cables.

CO5. Understand need of power factor improvement in power system.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Electrical Measurements Lab. **Max. Marks: 50**
Course Code: PCC-EE-632 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of performing this laboratory is to provide knowledge about various types of bridge and transducer for practical problems.

List of Experiments:

1. To measure frequency and phase of a signal from a Lissajous Pattern using CRO.
2. Measurement of Inductance by Maxwell's Bridge.
3. Measurement of small resistance by Kelvin's Bridge.
4. Measurement of Capacitance by Schering Bridge.
5. Measurement of medium resistance by Wheat Stone's Bridge.
6. To measure a Strain using a Strain Gauge Transducer.
7. To measure a Displacement using LVDT Transducer.
8. To measure a Temperature using Thermocouple Transducer.
9. To measure a Temperature using Thermistor Transducer.

Laboratory Outcome:

Students will

CO1. Get an exposure to common electrical and electronic measurements instruments systems and their ratings.

CO2. Able to measure frequency and phase of signal using CRO.

CO3. Understand the basic characteristics of various bridges to know the different network parameter.

CO4. Understand the usage of different type of transducers.

CO5. Able to measure different quantities using transducers.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Control system Lab. **Max. Marks: 50**
Course Code: PCC-EE-633 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of this laboratory is to understand different control scheme.

List of Experiments:

1. To study the performance of Relay control Combination of P,I and D control schemes in a typical thermal system.(oven)
2. To study the torque-speed characteristics of an AC servomotor.
3. To study the time response of a variety of simulated linear systems.
4. To study the role of feedback in a DC speed control system.
5. To study the role of feedback in a DC position control system.
6. To study the role of a combination of P, I and D control actions in a variety of simulated linear systems.
7. To study the computer simulation of a number of systems.
8. Use of MATLAB / SIMULINK /Control System tool boxes.

Laboratory Outcome:

The students should know about various control systems and able to

CO1. Analysis various open loop and close loop control systems.
CO2. Understand performance characteristics of servo motors.
CO3. Check the response of various performance indices of various controllers used in the digital control system.
CO4. Able to understand DC speed and position control.
CO5. Learn about MATLAB Simulink.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Semester VII

Course Title: Power System Protection **Max. Marks: 100**
Course Code: PCC-EE-721 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course makes the student familiar with various types of protection schemes &equipment's used for protection of electrical power system.

Detailed Contents:

Unit-I

Relays: Function of protective relaying, fundamental principles, primary and backup relaying, functional characteristics. Operating principles and characteristics of the following electromechanical relays: Current, voltage, directional, current balance, voltage balance, differential relays, and distance relays.

Unit-II

Protection of Generators &Transformers: Short-circuit protection of stator windings, Overheating protection, Overvoltage protection, Protection against vibration, protection against motoring over speed.

Short circuit protection, over current and earth-fault protection differential protection. Use of biased relay for differential protection, self-balance system protection, differential magnetic balance protection, Buchholz relay, protection of parallel transformer banks.

Unit-III

Protection of Feeders, Bus-bars and Transmission Lines: Protection of feeders, time limit fuse, over current protection for radial feeders, protection of parallel feeders, differential protection for parallel feeders, differential pilot wire protection, Circulating current protection, protection for bus-bars.

Unit-IV

Fuses: Fusing element, classification of fuses, current carrying capacity of fuses, high rupturing capacity (H.R.C.) cartridge fuses, characteristics of H.R.C. fuses, selection of HRC fuses. MCBs. Types of MCBs.

Unit-V

Circuit Breaker: Types of circuit breakers, basic principle of operation, phenomena of arc, initiation of a arc, maintenance of arc, arc extinction, d.c. circuit breaking, a.c. circuit breaking, arc voltage and current waveforms in a.c. circuit breaking, restricting and recovery voltages, de-ionization and current chopping, ratings of circuit breakers, oil circuit breakers, air blast circuit breakers, SF6 Circuit breakers, Vacuum breakers.

Course Outcome:
This course will enable student to:

CO1. Understand the importance of various types of relays.
CO2. Understand the protection scheme for generators and transformers.
CO3. Understand the protection scheme of feeder, bus-bar and transmission lines.
CO4. Understand the concept and use of fuses.
CO5. Understand the use of circuit breaker in protection schemes of various power system equipments.

Text Books/References:

1. **C.R Mason**, The Art and Science of Protective Relaying, John Wiley & Sons
2. **Badri Ram,** Power System Protection and switchgear, TMH
3. **J. L Black. Burn**, Protective relaying, Principles and Applications.

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Electrical Drives **Max. Marks: 100**
Course Code: PCC-EE-722 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The Objectives to introduce the basic concepts of DC electric drives and AC electric drives and their closed-loop operation including microprocessor-based arrangements.

Detailed contents:

Unit-I

Types of Drives and Load: Introduction, advantages of electric drives, components of electric drives, modes of operation, characteristic of different types of mechanical load, steady state stability of motor load system, fluctuating loads and load equalization, thermal loading of motor, estimation of motor rating for continuous, intermittent, and short time duty loads.

Unit-II

DC Drives I: Characteristics of DC motors. Conventional methods of speed control: rheostatic, field and armature control. Electric braking of DC drives: Regenerative braking, Plugging and dynamic braking. Phase control of fully controlled DC drives, continuous and discontinuous conduction modes of operation.

Unit-III

DC Drives II: Chopper controlled drives. Comparison of phase and chopper controlled drives. Review of feedback control, closed loop configurations in electric drives: current limit control, torque control, speed control of multi-motor drives and position control. Closed loop control of phase and chopper-controlled dc drives.

Unit-IV

AC Drives I: Review of three phase induction motor characteristics. Electric braking of induction motor drives: Regenerative, Plugging, AC and DC dynamic braking. Methods of speed control of induction motors: stator voltage control, variable frequency control, and pole changing and pole amplitude modulation.

Unit-V

AC Drives II: Speed control of wound rotor induction motor: rotor resistance control (conventional and static), slip power recovery schemes. Closed loop control of induction motor drives: VSI control, static rotor resistance control, static Scherbius and Kramer drives, current regulated VSI drives. Introduction to vector control.

Course Outcome:

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

CO1. Apply the knowledge of drives and use them effectively.

CO2. Able to control the speed of DC motor and Induction motor.

CO3. Able to realize different braking methods in AC/ DC drive.

CO4. Suggest the particular type of AC/DC drive system for an application.

CO5. To apply close loop control in AC/DC Drive.

Text Books/References:

1. **G. K. Dubey**, Fundamentals of Electric Drives, Narosa Publications, New Delhi.
2. **B. K. Bose**, Power Electronics and variable frequency drives, PHI.
3. **R. Krishnan**, "Electric Motor Drives: Modeling, Analysis and Control", PHI.

4. **M. Ahmad**, High Performance AC Drives: Modelling, Analysis and Control, Springer.

Note for Paper Setter: The Question paper shall comprise of 10 questions. Two questions will be set from each unit .The student has to attempt five questions at least one from each unit.

Course Title: Microprocessors & Interfacing **Max. Marks: 100**
Course Code: PCC-EE-723 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Objective: The objective of this course is to introduce to the students the fundamental of 8085 and 8086 microprocessors and their interfacing.

Unit-I

Introduction to 8085: History and Evolution, types of microprocessors, 8085 Microprocessor, Architecture, Bus Organization, Registers, ALU, Control section, Instruction set of 8085, Instruction format, Addressing modes, Types of Instructions.

Unit-II

8085 Assembly Language Programming and Interrupts: Assembly language programming in 8085, Microprocessor timings, Machine cycles, T states, Timing diagram for different machine cycles. Interrupts in 8085, RST instructions, multiple interrupts and priorities, Interrupt handling in 8085 with RIM and SIM, Enabling, disabling and masking of interrupts

Unit-III

8085 Interfacing: Parallel data transfer using 8155. Programmable parallel ports and handshake input/output, Asynchronous and Synchronous data transfer using 8251A. DMA transfer, cycle stealing and burst mode of DMA, 8257 DMA Controller. Interfacing of keyboard, LED and seven segment displays with 8085.

Unit-IV

8086 Microprocessor: Overview of 8086 features, architecture of 8086: execution unit and bus interface unit, flags and general purpose register, 8086 pin diagram, Memory segmentation, Minimum and Maximum mode operation, Addressing modes.

Unit-V

8086 Assembly Language Programming and Interrupts: 8086 instruction set, assembler directives, macros. Assembly language programming involving arithmetic, logical, branch & call instructions, string manipulations. 8086 interrupts.

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

1. Describe the various architectural aspects of 8085 Microprocessor.
2. Understand the interrupt phenomenon, timing diagram and write basic assembly language programming in 8085
3. Elaborate the synchronous and asynchronous data transfer and Direct Memory Access in 8085 and interfacing of 8085 with external devices.
4. Describe the various architectural aspects of 8086 Microprocessor.
5. Understand the interrupt phenomenon and write basic assembly language programming in 8086

Text Books:

1. **R. S. Gaonkar**, Microprocessor Architecture, Programming & applications with the 8085/8086A, Wiley Eastern Ltd.
2. **Douglas V Hall**, Microprocessors & Interfacing, TMH

Reference Books:

1. **A. P. Mathur**, Introduction to Microprocessor, Tata McGraw Hill.
2. **Yu-Cheng Liu** & **G A Gibson**, µprocessor System, Arch Programming & Design.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit

Course Title: Design of Electric Machines **Max Marks: 100**
Course Code: PCC-EE-724 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to make students familiar with various designing procedures involved in designing electrical machines.

Detailed Contents:

Unit-I

Introduction: Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

Unit-II

Transformers: Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Unit-III

Induction Motors: Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Unit-IV

Synchronous Machines: Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Unit-V

Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to **c**omplex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. Understand the construction and performance characteristics of electrical machines.
CO2. Understand the various factors which influence the design: electrical, magnetic and thermal loading of Transformer.
CO3. Understand the various factors which influence the design: electrical and magnetic loading of Induction motor and synchronous machine.
CO4. Understand the principles of electrical machine design and carry out a basic design of synchronous machines.
CO5. Use software tools to do design calculations.

Text Books/References:

1. **A. K. Sawhney**, A Course in Electrical Machine Design, Dhanpat Rai Publication.
2. **V. N. Mittle**, Design of Electrical Machines, Standard Publishers Distributors.
3. **R. K. Agarwal**, Principles of Electrical machine Designs. K. Kataria & Sons
4. **S. K. Sen**, Principles of Electrical machine Design, Oxford & Ibh Publishing Co. Pvt Ltd

Note for Paper Setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one from each unit.

Course Title: Minor Project **Max. Marks: 150**
Course Code: PROJ-EE-721 **University Exam: 0**
Internal Assessment: 150
Credits: 3 [0-0-0]

Detailed contents

At the start of VII semester every student shall be allotted a Minor Project under the supervision of an allotted mentor. Students are required to do preliminary exercise of survey of literature and preparation of a road map of the selected Major Project under the supervision of their allotted mentor. Students are required to complete the Minor Project during semester VII. Minor Project shall be evaluated internally as per university statutes by a committee consisting of:

1. Three Member Committee constituted by HoD
2. Coordinator(s)/Supervisor(s) of minor project/training.

Course Title: Professional Elective courses-II **Max. Marks: 100**
Course Code: PEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Professional Elective Courses-II

Course Title: Wind and Solar Energy Systems **Max. Marks: 100**
Course Code: PEC-EE-721 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to have overall knowledge about the various technologies for wind and solar power generation.

Detailed Contents:

Unit-I
Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.
Unit-II
Wind generator topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.
Unit-III
The Solar Resource and Solar photovoltaic: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Technologies-Amorphous, mono-crystalline, polycrystalline; V-I characteristics of a PV cell, PV Units, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.
Unit-IV
Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.
Unit-V
Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.
Course Outcome:
At the end of this course, students will demonstrate the ability to
CO1. Understand the basic physics of wind.
CO2. Understand the various wind generation topologies.
CO3. Understand the sun characteristics and solar photovoltaic systems.
CO4. Understand the power electronic interfaces for wind and solar generation.
CO5. Understand concentrated solar photo voltaic technology.

Text Books/ References:

1. **T. Ackermann**, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. **G. M. Masters**, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.

3. **S. P. Sukhatme**, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.
4. **H. Siegfried and R. Waddington**, “Grid integration of wind energy conversion systems” John Wiley and Sons Ltd., 2006.
5. **G. N. Tiwari and M. K. Ghosal**, “Renewable Energy Applications”, Narosa Publications, 2004.
6. **J. A. Duffie and W. A. Beckman**, “Solar Engineering of Thermal Processes”, John Wiley & Sons, 1991.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: EHV AC and DC Transmission **Max. Marks: 100**
Course Code: PEC-EE-722 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to provide in-depth knowledge of various electrical aspects associated with AC & DC transmission of power at Extra High Voltages.

Detailed contents:

Unit-I

Introduction: Historical background, Component of EHV-AC transmission network. Need of EHV transmission, comparison of EHV Ac & Dc transmission, mechanical considerations of transmission line, Overview of present transmission system in India, future plan in transmission.

Unit-II

EHV AC Transmission: Parameters of EHV line, over-voltage due to switching, Ferro-resonance, line insulator and clearance, corona, long distance transmission with series & shunt. Principle of half wave transmission. Flexible ac transmission. EHV AC transmission system, transmission planning and its correlation with generation. Compensations, principle of half wave transmission flexible ac transmission.

Unit-III

EHV DC Transmission: Types of dc links, terminal equipment and their operations, HVDC system control reactive power control, harmonics, multi-terminal dc (MTDC) system, ac/dc system analysis, protection of terminal equipments.

Unit-IV

Design of EHV transmission: Transmission network, selection of operating voltage and conductor, calculation of voltage gradient, corona loss, radio interference level.

Unit-V

Control of EHV system: Basic principle of control, control implementation, converter firing control system, value blocking and by passing, stopping and power flow reversal.

Course Outcome:

This course will allow the students to:

CO1. Understand the need of EHV transmission.

CO2. Analyze different parameters of EHV AC transmission systems and study of various compensation methods.

CO3. Understand different EHVDC transmission systems and various associated protection schemes.

CO4. Study and understand the design of EHV transmission system.

CO5. Realize the need for control of EHV systems and implementing the corresponding control strategies.

Text Books/References:

1. **Rakesh Das Begmudre,** Extra High Voltage AC Transmission Engineering, Wiley Eastern Limited.
2. **Padiyar K.R.**, HVDC Power Transmission System? Wiley Eastern Limited.
3. **Kimbark E.W.**, EHV-AC and HVDC Transmission Engineering & Practice, Khanna. Publishers.

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.

Course Title: Control System Design **Max. Marks: 100**
Course Code: PEC-EE-723 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to study and analyze the design specifications of control systems in time domain and frequency domain along with the study of design in state space model.

Detailed contents:

Unit-I

Design Specifications: Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

Unit-II

Design of Classical Control System in the time domain: Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

Unit-III

Design of Classical Control System in frequency domain: Compensator design in frequency domain to improve steady state and transient response.
Feedback and Feed forward compensator design using bode diagram.

Unit-IV

Design of PID controllers: Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

Unit-V

Control System Design in state space: Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Course Outcome:

At the end of this course

CO1. Students will demonstrate the ability to understand various design specifications.

CO2. To understand the role of compensators in classical control system.

CO3. To study design of compensators in frequency domain using bode plot.

CO4. Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).Design controllers using the state-space approach.

CO5. To understand state space design of control system.

Text Books/References:

1. **N. Nise**, "Control system engineering", John Wiley, 2000.
2. **I. J. Nagrath and M. Gopal**, "Control system engineering", Wiley, 2000.
3. **M. Gopal**, "Digital Control Engineering", Wiley Eastern, 1988.

4. **K. Ogata**, “Modern Control Engineering”, Prentice Hall, 2010.
5. **B. C. Kuo**, “Automatic Control system”, Prentice Hall, 1995.
6. **J. J. D’Azzo and C. H. Houpis**, “Linear control system analysis and design (conventional and modern)”, McGraw Hill, 1995.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Energy Economics and Planning **Max. Marks: 100**
Course Code: PEC-EE-724 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course creates awareness among students about energy economics and planning. It familiarizes students about financial performance of renewable energy systems.

Detailed contents:

Unit-I

Introduction: Basics in economics; Resources scarcity; Concept of opportunity cost; Law of demand; Derivation of demand curve; Different elastic's of demand; Theory of firm; Production function, Output maximization, cost minimization and profit maximization principles; Input demand function; Different cost concept; Supply curve; Theory of market.

Unit-II

Energy Economics: Basic concept of energy economics; Calculation of Unit cost of power generation from different sources with examples; Eco-ground rules for investment in energy sector; Payback period, NPV, IRR, and benefit-c.ost analysis with example; Overview of national energy use, energy supply and renewable energy program during different plan period.

Unit-III

Modelling of energy systems and Policies: Basic concepts of Econometrics and statistical analysis; Econometric techniques used for energy analysis and forecasting with case studies from India; Operation of computer package Basic concept of Input-output analysis; Concept of energy multiplier; Optimization and simulation methods; Energy & development.

Unit-IV

Rural energy economics: Rural economic and social development considerations; Technologies, costs and choice of technology, Demand and benefits forecasting and program development; Economics, financial analysis, and bottlenecks of various decentralized renewable energy electrification program; Analysis of models controlled by local bodies.

Unit-V

Financing of renewable energy systems: Financial performance; uncertainties and social cost-benefit analysis of renewable energy systems; financing mechanism of different renewable energy systems; case studies; renewable energy projects for reduction in CO2 emissions.

Course Outcome:

At the end of this course, students will be able to:

CO1. Understand the law of demand subject to resource scarcity.

CO2. Basic concepts of Energy economics subject to eco ground rules.

CO3. Understand the econometric forecasting of energy resources.

CO4. Analyze economics sector of rural area.

CO5. Analyze financing performance of non-conventional energy systems.

Text Books/References:

1. **M. Munasinghe and P. Meier** (1993): Energy Policy Analysis and Modeling, Cambridge University Press.
2. **Dixon, et ai, Economic Analysis of Environmental Impacts**, Eartscan Publications Ltd., London,.
3. **T.E. Kandpal, H. P. Garg, Rnancial** Evaluation of Renewable Energy Technology,

Macmilan India Ltd. New Delhi, 4003.

4. **White J. A**., et.aI. Principles of Engineering of Economic Analysis, John Wiley and Sons. Inc. 1989.

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.

Course Title: Restructuring of Power System **Max. Marks: 100**
Course Code: PEC-EE-725 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course is to allow the students to understand fundamental concepts of deregulated systems. This course also allows students to study deregulated models across the globe along with the cost mechanisms of transmitting power.

Detailed Contents:

Unit-I

Introduction: Basic concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.

Unit-II

Power System Restructuring: An overview of the restructured power system, difference between integrated power system and restructured power system. Explanation with suitable practical examples. Restructuring reforms in India etc.

Unit-III

Deregulation of Power Sector: Separation of ownership and operation, Deregulated models, pool model, pool and bilateral trades model, multilateral trade model. Risk Analysis and Hedging.

Unit-IV

Competitive electricity market: Independent System Operator activities in pool market, wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market Power and its Mitigation Techniques, Bilateral trading, Ancillary services.

Unit-V

Transmission Pricing: Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, postage stamp method, contract path method, boundary flow method, MW-mile method, MVA-mile method, comparison of different methods.

Course Outcome:

The restructuring and deregulation of the power utility industry is resulting in significant competitive, technological and regulatory changes. Independent power producers, power marketers and brokers have added a new and significant dimension to the task of maintaining a reliable electric system. This course been made to get students familiar with new ways of restructuring of power system. This course will enable student to:

CO1. Basic concept of deregulated system.

CO2. Differences between regulated and deregulated system.

CO3. Study various deregulated models present worldwide.

CO4. How demand and supply bids are auctioned.

CO5. Study various transmission pricing mechanisms.

Text Books/References:

1. **Loi Lei Lai**, Power System Restructuring and Deregulation, John Wiley & Sons. Ltd.
2. **Lorrin Philipson and H. Lee Wilis**, Understanding Electric Marcel Dekker Inc, New York Utilities and Deregulation.

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.

Course Title: Power System Protection Lab. **Max. Marks: 50**
Course Code: PCC-EE-731 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The laboratory will give the overall idea about the protection scheme involve in power systems.

List of Experiments:

1. Study of various types of relays.
2. Characteristics of different relays, Directional over current relay
3. Characteristics of inverse time over current relays, under voltage relay.
4. Time graded protection using inverse time O/C relays
5. Study of circuit breakers.
6. Study of differential protection scheme. Percentage biased deferential relay.
7. Study of an oil circuit breaker.
8. Experiment on Digital Protection. Microprocessor based over voltage/ under voltage relay.

Laboratory Outcome:
Student will able

CO1. Get an exposure to different types of protecting relays.
CO2. Understand the basic characteristics of Time graded protection system.
CO3. Understand the usage of different type of circuit breaker.
CO4. To understand digital protection.
CO5. To understand microprocessor based over voltage/ under voltage relay.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Power Electronics and Drives Lab. **Max. Marks: 50**
Course Code: PCC-EE-732 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of this laboratory is to equip student with various characteristics of power electronics drives.

List of Experiments:

1. To study R, RC and UJT triggering firing circuit for SCR.
2. To obtain SCR, MOSFET, IGBT and BJT characteristics.
3. To perform AC phase control using SCR.
4. To perform full wave AC phase control using TRIAC.
5. To analyze the performance of Cyclo-Converter.
6. Speed control of DC motor using IGBT voltage source Inverter.
7. V/f control of 3-phase induction motor using V/f controller.
8. V/f control of 3-phase induction motor using IGBT voltage source Inverter.
9. Speed control of BLDC motor using IGBT voltage source Inverter.
10. Speed control of Switched Reluctance motor using IGBT voltage source Inverter.
11. Speed control of Multiphase Inverter Drive.

Laboratory Outcome:

At the end of the laboratory the students will be able to

1. Obtain the characteristics of SCR, TRIAC, MOSFET and IGBT.
2. Implement the phase-controlled switching using TRIAC.
3. To realize different type of triggering circuits for application.
4. Control the speed of DC and BLDC motor.
5. V/F control of induction motor drives.

Note: These are only the suggested list of experiments. Instructor may add or change some experiments relevant to the course contents.

Course Title: Microprocessor & Interfacing Lab. **Max. Marks: 50**
Course Code: PCC-EE-733 **University Exam: 25**
Duration of Exam: 2 Hours **Internal Assessment: 25**
Credits: 1 [0-0-2]

Laboratory Objective: The objective of this laboratory is to Understand and apply various operations using assembly level programming on microprocessors.

List of Experiments

1. Study of 8085 and 8086 Microprocessor Kit.
2. Write a program to add and subtract two 8-bit and 16-bit number using 8085.
3. Write a program to multiply two 8 bit numbers by repetitive addition and rotation method using 8085.
4. Write a program to generate Fibonacci series using 8085.
5. Write a program to sort series using bubble sort algorithm using 8085.
6. To find the largest signed number in a given series of data using 8085.
7. To copy a block of data from one memory to another using 8085.
8. Write a program to add and subtract two 8-bit and 16-bit number using 8086.
9. Write a program to multiply two 8 bit numbers by repetitive addition and rotation method using 8086.
10. Write a program to generate Fibonacci series using 8086.
11. Write a program to sort series using bubble sort algorithm using 8086.
12. To find the largest signed number in a given series of data using 8086.
13. To copy a block of data from one memory to another using 8086.

Course Outcomes:

After completion of the course student will be able to:

1. Understand the various features of 8085 and 8086 microprocessor kits.
2. Write various arithmetic and logical based assembly language programs in 8085 and 8086.
3. Write various string manipulation based assembly language programs in 8085 and 8086.
4. Write basic data transfer programs using 8085 and 8086.
5. Function effectively as a team.

Note: This is only the suggested list of practical. Instructor may add or change some practical relevant to the course contents.

Course Title: Industrial Training-II **Max. Marks: 50**
Course Code: PROJ-EE-731 **University Exam: 0**
Internal Assessment: 50
Credits: 1 [0-0-0]

Semester VIII

Course Title: Entrepreneurship Development & Management **Max. Marks: 100**
Course Code: PCC-EE-821 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: Course is designed to acquaint the students with the skills required to become entrepreneurs and to create an awareness of the need for systematic management of projects.

Detailed Contents:

Unit-I

Entrepreneurship Development: Meaning, objectives, type of entrepreneurs, importance of entrepreneurship training, factors affecting entrepreneurship, linkage between entrepreneurship and economic development, problem of increasing unemployment, balanced regional growth, harnessing locally available resources, New Industrial Policy and innovation in enterprises.

Unit-II

Entrepreneurship Support System: Small Industries Development Bank of India, Small Industries service Institute, State Small Industries and Export Corporation, District Industrial Centre's and other supporting agencies.

Unit-III

Project Report Preparation: Identifying business opportunities, Project report and its importance, various contents of project report: managerial and entrepreneurial capabilities, socio-economic benefits, Demand analysis, technical feasibility and financial viability.

Unit-IV

Introduction to Marketing Management: Brief introduction to various types of product strategies, pricing strategies, Channel strategies and Promotional strategies.
Introduction to Production Management: Types of production systems, production planning and control, functions of Production Manager and Materials Management.

Unit-V

Introduction To Human Resource Management: Manpower Planning, Recruitment, selection, placement and induction, training and development, compensation.
Introduction to Financial Management: source of finance and Working Capital management.

Course Outcome:

After completion of this subject student will be able to:

CO1. Understand the meaning, objectives and types of entrepreneurs.
CO2. Understand the Entrepreneurship Support System.
CO3. Prepare to Project Report.

CO4. Analyze business opportunities, technical feasibility and financial viability in context to entrepreneurship.

CO5. Plan the business.

Text Books/References:

1. **Holt David H**, Entrepreneurship: New Venture Creation, PHI (4000).
2. **Saini Jasmer Singh**, Entrepreneurship Development Programmes and Practices, Deep and Deep Publications, New Delhi (1998).
3. **Dollinger**, Entrepreneurship Strategies and Resources, Pearson Education (4003).
4. **Jose Paul & Kumar Ajith N**, Entrepreneurship Development and Management, Himalaya Publishers, New Delhi (4000).
5. **Hisrich Robert D and Micheal Peters P**, Entrepreneurship, TMH, (4002).

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit

Course Title: Major Project **Max. Marks: 500**
Course Code: PROJ-EE–821 **University Exam: 200**
Internal Assessment: 300
Credits: 9 [0-0-0]

After the university Exam of semester VII every student shall be allotted a Major Project pertaining to his/her stream under the supervision of an allotted mentor. Students are required to report in their respective departments to do preliminary exercise of survey of literature and preparation of a road map of the selected Major Project under the supervision of an allotted mentor. Students are required to complete the Major Project during semester VIII. Depending upon the infrastructure, Computing and other laboratories facilities the students shall be offered in house project on campus are they can complete their project work in any organization/industry outside the campus. Major Project shall be evaluated internally as well as externally as per university statues.

Course Title: Professional Elective courses-III **Max. Marks: 100**
Course Code: PEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Title: Professional Elective courses-IV **Max. Marks: 100**
Course Code: PEC-EE-(---) **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Professional Elective Course–III & IV

Course Title: Electrical and Hybrid Vehicles **Max. Marks: 100**
Course Code: PEC-EE-821 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The main objective of this course is to equip students with the knowledge of Electrical Hybrid Vehicles, their requirement with respect to changing energy needs.

Detailed Contents:

Unit-I

Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit-II

Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit-III

Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Unit-IV

Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy

management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Unit-V

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the models to describe hybrid vehicles and their performance.
CO2. Understand the suitability of particular drive for electrical traction.
CO3. Understand the different possible ways of energy storage.
CO4. Understand the different strategies related to energy storage systems.
CO5. Analyze various implemented case studies across globe.

Text Books/ References:

1. **C. Mi, M. A. Masrur and D. W. Gao**, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. **S. Onori, L. Serrao and G. Rizzoni**, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. **M. Ehsani, Y. Gao, S. E. Gay and A. Emadi**, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.
4. **T. Denton**, "Electric and Hybrid Vehicles", Routledge, 2016.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Power Quality and FACTS **Max. Marks: 100**
Course Code: PEC-EE-822 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course to equip students with power quality issues and their mitigation along the use of FACT devices.

Detailed Contents:

Unit-I

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.

Unit-II

Thyristor-based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Unit-III

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Inter-phase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

Unit-IV

Application of FACTS: Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using aSTATCOM.

Unit-V

DSTATCOM: Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1. Understand the basic concepts of power quality.

CO2. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.

CO3. Understand working of various VSC.

CO4. Study the applications of FACTs.

CO5. Understand the working of DSTATCOM along with its control.

Text Books/References:

1. **N. G. Hingorani and L. Gyugyi**, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. **K. R. Padiyar**, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
3. **T. J. E. Miller**, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
4. **R. C. Dugan**, "Electrical Power Systems Quality", McGraw Hill Education, 2012.
5. **G. T. Heydt**, "Electric Power Quality", Stars in a Circle Publications, 1991.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: Virtual Instrumentation **Max. Marks: 100**
Course Code: PEC-EE-823 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: In this course the student gets an in depth knowledge of Virtual Instruments and their applications in the field. The students will be familiarized to programming techniques and different applications of virtual instruments.

Detailed contents:

Unit-I
Virtual Instrumentation: Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

Unit-II
Programming Techniques: VIs and sub-VIs, loops and charts, arrays, dusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in the web.

Unit-III
Data Acquisition Basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirement.

Unit-IV
Chassis Requirements: Common Instrument Interfaces: Current loop, RS *232C/* RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Fire wire. PXI system controllers, Ethemet control of PXI. Networking basics for office & Industrial applications, VISA and M.

Unit-V
Applications: Virtual instrumentation Toolsets, Distributed I/O Units. Application of Virtual Instrumentation: Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

Course outcome:
At the end of this course, the student will be able to:
CO1. Understand the historical perspective, architecture and data flow techniques involved in virtual instruments.
CO2. Analyze techniques of programming along with publishing measurement data in the web.

CO3. Understand sampling techniques, ADC and DAC in data acquisition systems.

CO4. Understand fundamental concepts of networking in addition with common instrument interfaces.

CO5. Analyze the importance and application of virtual instruments.

Text Books/ References:

1. **Gary Johnson**, "LabViEW Graphical Programming, 2nd Edition, McGraw Hill, New York, 1998.
2. **Usa K. Wells & Jeffrey Travis**, "LabViEW for everyone', Prentice Hall, New Jersey, 1998.
3. **Jane W. S. Liu**, "Real-time Systems~ Pearson Education India, 4001.
4. **Jean J. Labrosse**, "Embedded Systems Building Blocks: Complete and ready-to-use units in CN.

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.

Course Title: Neural Networks and Fuzzy Systems **Max. Marks: 100**
Course Code: PEC-EE-824 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course familiarizes students with the introduction and application of neural networks and Fuzzy Systems.

Detailed Contents:

Unit-I

Introduction to neural networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch- Pitts Model, Historical Developments, Potential Applications of ANN.

Unit- II

Essentials of artificial neural networks: Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

Unit–III

Learning Paradigms: Introduction to various learning algorithms, back propagation algorithm, pattern classification, clustering, Kohonen self-organizing feature map, radial basis function network, support vector machines, Hopfield network, Associative memory and BAM, Applications of ANN models to engineering problems.

Unit –IV

Fuzzy systems: Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions and its types. Fuzzification, defuzzification. Methods of defuzzification. Fuzzy inference systems.

Unit –V

Hybrid Intelligent Systems: Genetic algorithms, neuro-fuzzy systems, adaptive neuro-fuzzy inference system, evolutionary neural networks, fuzzy evolutionary systems. Illustration of these systems with examples from power system etc.

Course Outcome:

The course is aimed to introduce students to neural networks and fuzzy theory from an engineering perspective and their application real world control problems. This course will enable student to learn:

CO1. Introduction to Neural networks and various neural network models

CO2. Various important concepts related with neural networks

CO3. Various learning paradigms in artificial neural networks

CO4. How fuzzy systems are used to solve problems of uncertainties.

CO5. How various artificial intelligence methods are clubbed to introduce hybrid systems.

Text Books/References:

1. **Jacek M. Zurada**, Introduction to Artificial Neural Systems, PWS Publishing Company, (2001)
2. **S. S Haykin**, Neural Networks: A Comprehensive Foundation, Pearson Education.
3. **ValluruRao**, C++ Neural Networks and Fuzzy Logic, Honary Holt & Co *(1998)*
4. **Freeman**, Neural Networks, Pearson Publication (2003).
5. **Rajasekaran&Pai**, Genetic Algorithms; Synthesis and applications, Prentice Hall of India (2004).

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.

Course Title: Optimization Techniques **Max. Marks: 100**
Course Code: PEC-EE-825 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The course has been designed for explaining the various optimization techniques being used for solving various problems of engineering.

Detailed Contents:

Unit-I
Introduction: An overview of optimization problems, Need of Optimization, How to solve optimization problems with some illustrative examples.

Unit-II
Linear Programming: Introduction, graphical method, simplex method, method of artificial variables, alternate optima, redundancy in linear programming, degeneracy and cycling, the simplex tableau in condensed form.

Unit-III
Nonlinear programming: Introduction, Lagrange multipliers, Karaush-Kuhn-Tucker (KKT) optimality conditions, convexity, sufficiency of the KKT conditions, Duality and convexity.

Unit-IV Approximation Techniques
Introduction, line search methods, gradient-based methods, approximation under constraints.

Unit-V
Dynamic Programming: Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP); Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP.

Course Outcome:
This will enable student to:
CO1. Learn the basics about optimization problem.
CO2. Solve linear problems using optimization.
CO3. Solve non-linear problem using optimization.
CO4. Use various approximation techniques for problem solving.
CO5. Use dynamic programming for problem solving.

Text Books/References:
1. **Pablo Pedregal** ,Introduction to optimization, Publisher: Springer

2. **Suresh Chandera, Jaydeva, and Aparna Mehta**, Numerical optimization with applications, Publisher: Narosa
3. **Edvin K.P. Chong, and Stanislaw H. Zak**, An Introduction to optimization, Publisher: John Wiley.
4. **Mohan C. Joshi and Kannan M Moudgalya**, Optimization theory and practice, Publisher: Narosa.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Power System Transients **Max. Marks: 100**
Course Code: PEC-EE-826 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course makes a student familiar with the transient phenomenon occurring in electrical power system-their origin, effects and control. It also familiarizes students with simulation of surge diverters in power system transients.

Detailed Contents:

Unit-I

Surges and Transients: Origin and nature of transients and surges, Surge parameters of plan. Equivalent circuit representations. Lumped and distributed circuit transients.

Unit-II

Transient Control: Line energization and de-energization transients. Earth and earth wire effects. Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients.

Unit-III

Wave Control: Lightening Phenomenon. Influence of tower footing resistance and earth resistance. Traveling waves in distributed parameter multi conductor lines, parameters as a function of frequency.

Unit-IV

Simulation: Simulation of surge diverters in transient analysis. Influence of pole opening and pole reclosing.

Unit-V

Insulation coordination: Insulation Co-ordination: Over voltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arces, and metallic contacts.

Course Outcome:

This course will enable students to:

CO1. Understand nature and origin of surges and transients in power system.
CO2. Analyze the effects of Earthing and controlling of power surges.
CO3. Understand lightning phenomenon and travelling waves in multi-conductor lines.
CO4. Understand breakdown phenomenon and dielectric properties of insulating materials.
CO5. Analyze various phenomenon involved in breakdown of gaseous insulation along with basics of over voltage limiting devices.

Text Books/ References:

1. **Lou van der Sluis,** Transients in Power Systems John Wiley & Sons.
2. **Vanikov V. A.,** Transients in Power Systems by, Mir Publications, Moscow.
3. **Bewley L.V.,** Traveling Waves on Transmission Lines Dover Publications Inc., New York.
4. **RavinderaArora,WolfgangMosch**, High Voltage Insulation Engineering, New Age International Publishers Limited.
5. **Greenwood A.** Electrical Transients in Power Systems John Wiley & Sons.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions selecting at least one question from each unit.

Course Title: Line-Commutated Active Rectifiers **Max. Marks: 100**
Course Code: PEC-EE-827 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: The objective of this course to give Fundamental knowledge about the operations of PWM rectifier and Line commutated rectifier.

Detailed Contents:

Unit-I

Diode and Thyristor rectifiers with passive filtering: Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter; continuous and discontinuous conduction, input current wave shape, effect of source inductance; commutation overlap.
Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current wave shape.

Unit-II

Multi-Pulse converter: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.

Unit-III

Single-phase ac-dc single-switch boost converter: Review of dc-dc boost converter, power circuit of single-switch ac-dc converter, steady state analysis, Unity power factor operation, closed-loop control structure.

Unit-IV

Ac-dc bidirectional boost converter: Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and Unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.

Unit-V

Isolated single-phase ac-dc fly back converter: Dc-dc fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc fly back converter, steady state analysis, Unity power factor operation, closed loop control structure.

Course Outcome:

At the end of this course, students will demonstrate the ability to

CO1 Analyze different rectifier circuit with passive filter.

C02. Express the design and control of 6 pulse and 12 pulse converter.
CO3. Analyze the operation of single phase AC/DC single switch converter.
C04. Understand the working and control of AC/DC bi directional boost converter.
CO5. Analyze the operation of Isolated AC/DC fly back converter.

Text Books/ References:

1. G. De, "Principles of Thyristorised Converters", Oxford & IBH Publishing Co, 1988.
2. J.G. Kassakian, **M. F. Schlecht and G. C. Verghese**, "Principles of Power Electronics", Addison-Wesley, 1991.
3. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
4. N. Mohan and **T. M. Undeland**, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
5. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2001.

Note for paper setter: The question paper shall comprise of 10 questions. Two questions will be set from each unit. The student has to attempt five questions at least one question from each unit.

Course Title: High Voltage Engineering **Max. Marks: 100**
Course Code: PEC-EE-828 **University Exam: 60**
Duration of Exam: 3 Hours **Internal Assessment: 40**
Credits: 3 [3-0-0]

Course Objective: This course familiarizes the students with working principles, operation, measurement and testing of high voltage systems and equipment.

Detailed Contents:

Unit-I

Conduction and Breakdown in Gases: Gases as insulators, ionization, current growth, Townsend's criterion for breakdown, electro-negative gases, Paschen's Law, Streamer breakdown mechanism, corona discharges, post breakdown phenomena, practical considerations in using gases for insulating materials.

Unit-II

Conduction and Breakdown in Liquid Dielectrics: Classification of liquid dielectrics, conduction and breakdown in pure liquids and in commercial liquids.

Unit-III

Breakdown in Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, breakdown of composite insulation, solid dielectric used in practice.

Unit-IV

Applications of insulating materials in different electrical apparatus: Applications in power transformers, rotating machines, circuit breakers, cables, power capacitors, electronic equipment.

Unit-V

Generation & Measurement of High Voltages and Currents: Generation of high d.c. and a.c. voltages, generation of impulse voltages and currents.
Measurement of high d.c., a c. and impulse voltages, Measurement of high d.c, a.c and impulse currents.

Course Outcome:

At the end of this module students will be able to:

CO1. Understand different breakdown mechanisms in gases as well as post breakdown mechanisms.
CO2. Analyze different conduction and breakdown mechanisms in liquid dielectrics.
CO3. Analyze different conduction and breakdown mechanisms in solid dielectrics.
CO4. Foresee applications of different insulating materials in electrical apparatus.

CO5. Analyze the different techniques of generation and measurement of high voltage and current.

Text Books/ References:

1. **E. Kuffel, W.S Zaengl**, High Voltage Engineering Fundamentals, TMH.
2. **M.S. Naidu, V. Karamraju**, High Voltage Engineering, TMH.
3. **Dieter kind, Kurt Feser**, High voltage test techniques.
4. **Subir Ray**, An Introduction to High Voltage Engineering.

Note for paper setter: The question paper shall comprise of ten questions. Two questions will be set from each unit. The student has to attempt five questions, selecting one question from each unit.