JODHPUR INSTITUTE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution affiliated with Bikaner Technical University, Bikaner)

Accredited by NAAC with 'A' Grade

JIET Universe, N.H. - 62, Mogra, Pail Road, Jodhpur – 342802 (Raj.)

Tel: 0291-2868152/53, *E-mail: info@jietjodhpur.ac.in*Web: www.jietjodhpur.ac.in

B. Tech. (Electrical Engineering)

Scheme and Syllabus

I to VIII Semester

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I Year: Electrical Engineering
I Semester

S.N.	Category	Course Code	Name of subject	Periods per week			Marks			Total Credits
				L	T	P	IA	ETE	Total	
1.	BSC	1FY2-01	Calculus & Vector Analysis	3	1	-	60	140	200	4
2.	BSC	1FY2-03	Engineering Chemistry	3	1	-	60	140	200	4
3.	ESC	1FY3-04	Programming for Problem Solving	3	-	-	45	105	150	3
4.	ESC	1FY3-07	Mechanical Engineering	3	1	-	60	140	200	4
5.	BSC	1FY2-22	Engineering Chemistry Lab	-	-	2	30	20	50	1
6.	ESC	1FY3-23	Computer Programming Lab	-	-	3	45	30	75	1.5
7.	ESC	1FY3-26	Engineering Graphics and Machine Drawing	-	-	2	30	20	50	1
8.	HSMC	1FY1-28	Language Lab	-	-	3	45	30	75	1.5
9.	SODECA	1FY8-00		-	-	-			25	0.5
			Total	**12**	**3**	**10**			**1025**	**20.5**

S.N.	Category	Course Code	Name of subject	Periods per week			Marks			Total Credits
				L	T	P	IA	ETE	Total	
1.	MC*	1FY9-MC1	Personality Development Skills	-	-	2	100	-	100	0
2.		1FY9-MC2	Techno Communication	-	-	2	100	-	100	0
4.		1FY9-MC3	Graphics Programming in C	-	-	2	100	-	100	0

Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The modules are related to Hands-on practical skills and Quantitative and Aptitude skills, etc. The names of the subjects are as follows:

1. Fundamental of Electrical Engineering
2. Electrical Workshop
3. Quantitative and Qualitative Aptitude

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I Year: Electrical Engineering
II Semester

S.N.	Category	Course Code	Name of subject	Periods per week			Marks			Total Credits
				L	T	P	IA	ETE	Total	
1.	BSC	2FY2-01	Linear Algebra & Differential Equations	3	1	-	60	140	**200**	**4**
2.	BSC	2FY2-02	Engineering Physics	3	1	-	60	140	**200**	**4**
3.	ESC	2FY3-04	Python Programming	3	-	-	45	105	**150**	**3**
4.	ESC	2FY3-05/ 2FY3-06	Civil Engineering*/Electrical & Electronics Engineering	3	-	-	45	105	**150**	**3**
5.	HSMC	2FY1-08	Human Values and Ethics in Engineering	2			30	70	**100**	**2**
6.	BSC	2FY2-21	Engineering Physics Lab	-	-	2	30	20	**50**	**1**
7.	ESC	2FY3-23	Python Programming Lab	-	-	2	30	20	**50**	**1**
8.	ESC	2FY3-24/ 2FY3-25	Civil Engineering Lab*/Electrical & Electronics Engineering Lab	-	-	2	30	20	**50**	**1**
9.	ESC	2FY3-27	Workshop- Manufacturing Practices	-	-	2	30	20	**50**	**1**
10.	SODECA	2FY8-00		-	-	-			**25**	**0.5**
			Total	**14**	**2**	**8**			**1050**	**20.5**

S.N.	Category	Course Code	Name of subject	Periods per week			Marks			Total Credits
				L	T	P	IA	ETE	Total	
1.	MC*	2FY9-MC1	Analytical and Logical Thinking Skills	-	-	2	100	-	100	0
2.		2FY9-MC2	Technical Writing	-	-	2	100	-	100	0
3.		2FY9-MC3	GUI Programming using Tkinter (Python)	-	-	2	100	-	100	0
4.		2FY9-MC4	Basics of Management	-	-	2	100	-	100	0

Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The modules are related to Hands-on practical skills and Communication skill. . The names of the subjects are as follows:

1. Mini Project Lab
2. Soft Skill

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II Year: Electrical Engineering
III Semester

S.No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	BSC	3EE2-01	Integral Transforms and Complex Variables	3	0	0	**45**	**105**	**150**	**3**
2	ESC	3EE3-02	Electrical Power Generation	3	0	0	**45**	**105**	**150**	**3**
3	PCC	3EE4-03	Electromagnetic Field Theory	3	0	0	**45**	**105**	**150**	**3**
4		3EE4-04	Analog Electronics	3	0	0	**45**	**105**	**150**	**3**
5		3EE4-05	Electrical Circuit Analysis & Synthesis	3	0	0	**45**	**105**	**150**	**3**
6		3EE4-06	DC Machines and Transformers	3	0	0	**45**	**105**	**150**	**3**
7	PCC	3EE4-21	Analog Electronics Lab	0	0	2	**30**	**20**	**50**	**1**
8		3EE4-22	Electrical Circuit Lab	0	0	2	**30**	**20**	**50**	**1**
9		3EE4-23	DC Machines and Transformers Lab	0	0	2	**30**	**20**	**50**	**1**
10	ESC	3EE3-24	Electronic Circuit Design Lab	0	0	2	**30**	**20**	**50**	**1**
11	PSIT	3EE7-30	Training Phase-I	0	0	2			**50**	**1**
12	SODECA	3EE8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0			**25**	**0.5**
Total				**18**	**0**	**10**			**1175**	**23.5**

S.No.	Category	Course Code	Course Title	Periods per week			Marks	Cr
				L	T	P		
13	MC	3EE9-MC1	Mandatory Non- Credit Course (Managerial Economics And Financial Accounting)	-	-	-	-	
14			MOOC courses/ Minor/ Specializations	-	-	-	-	
15			Seminars/ Clubs/ Library/Sports/ Tutor Meetings/Internet Lab/Free Class	-	-	-	-	

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment**, ETE**=End Term Exam and **Cr**=Credits

Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The module is related to Communication skills.
The names of the subjects are as follows:

1. Communication Skills

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II Year: Electrical Engineering
IV Semester

S.No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	BSC	4EE2-01	Numerical Methods and Applied Statistics	3	0	0	**45**	**105**	**150**	**3**
2	ESC	4EE3-02	Measurement & Instrumentation	3	0	0	**45**	**105**	**150**	**3**
3	PCC	4EE4-03	Signals & Systems	3	0	0	**45**	**105**	**150**	**3**
4		4EE4-04	Induction and Synchronous Machines	3	0	0	**45**	**105**	**150**	**3**
5		4EE4-05	Microprocessor and Computer Architecture	3	0	0	**45**	**105**	**150**	**3**
6		4EE4-06	Digital Electronics	3	0	0	**45**	**105**	**150**	**3**
7	PCC	4EE4-21	Induction and Synchronous Machines Lab	0	0	3	**45**	**30**	**75**	**1.5**
8		4EE4-22	Microprocessor Lab	0	0	3	**45**	**30**	**75**	**1.5**
9		4EE4-23	Digital Electronics Lab	0	0	2	**30**	**20**	**50**	**1**
10		4EE4-24	Measurement & Instrumentation Lab	0	0	2	**30**	**20**	**50**	**1**
11	SODECA	4EE8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0			**25**	**0.5**
Total				18	0	10			**1175**	**23.5**

S.No.	Category	Course Code	Course Title	Periods per week			Marks	Cr
				L	T	P		
12	MC	4EE9-MC1	Mandatory Non- Credit Course (Indian Traditions, Cultural and Society)	-	-	-	-	
13			MOOC courses/ Minor/ Specializations	-	-	-	-	
14			Seminars/ Clubs/ Library/Sports/ Tutor Meetings/Internet Lab/Free Class	-	-	-	-	

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Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The module is related to Programming skills.

The names of the subjects are as follows:

1. Programming Classes

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III Year: Electrical Engineering

V Semester

S.No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	BSC	5EE2-01	Engineering Materials	2	0	0	**30**	**70**	**100**	**2**
2	PCC	5EE4-02	Power Electronics	3	0	0	**45**	**105**	**150**	**3**
3		5EE4-03	Electrical Power Transmission & Distribution	3	0	0	**45**	**105**	**150**	**3**
4		5EE4-04	Control System	3	0	0	**45**	**105**	**150**	**3**
5		5EE4-05	Microcontroller	2	0	0	**30**	**70**	**100**	**2**
6	PEC	5EE5-11	Renewable Energy Sources	3	0	0	**45**	**105**	**150**	**3**
		5EE5-12	Industrial Electrical Systems							
		5EE5-13	Power System Instrumentation							
7	PCC	5EE4-21	MATLAB Programming and Simulation Lab	0	0	3	**45**	**30**	**75**	**1.5**
8		5EE4-22	Power Electronics Lab	0	0	2	**30**	**20**	**50**	**1**
9		5EE4-23	Power System Lab	0	0	2	**30**	**20**	**50**	**1**
10		5EE4-24	Microcontroller Lab	0	0	2	**30**	**20**	**50**	**1**
11	PSIT	5EE7-30	Training Phase-II	0	0	2			**125**	**2.5**
12	SODECA	5EE8-00	Social Outreach, Discipline & Extra Curricular Activities						**25**	**0.5**
Total				16	0	11			**1175**	**23.5**

S.No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
13	MC	5EE9-MC1	Mandatory Non- Credit Course (Digital Marketing)	2	0	0	100	0	100	0

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Cr=Credits

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The names of the subjects are as follows:

1. Technical Classes
2. Quantitative & Qualitative Aptitude

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III Year: Electrical Engineering

VI Semester

S. No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	HSMC	6EE1-01	Technical Communication	3	0	0	**45**	**105**	**150**	**3**
2	PCC	6EE4-02	Power System Analysis	3	0	0	**45**	**105**	**150**	**3**
3		6EE4-03	Modern Control System	3	0	0	**45**	**105**	**150**	**3**
4		6EE4-04	Electric Drives	3	0	0	**45**	**105**	**150**	**3**
5		6EE4-05	Machine Learning	3	0	0	**45**	**105**	**150**	**3**
6	PEC	6EE5-11	Wind and Solar Energy Systems	3	0	0	**45**	**105**	**150**	**3**
		6EE5-12	Soft Computing Techniques							
		6EE5-13	High Voltage Engineering							
7	PCC	6EE4-21	PLC & SCADA Lab	0	0	3	**45**	**30**	**75**	**1.5**
8		6EE4-22	Computer Based Power System Lab	0	0	3	**45**	**30**	**75**	**1.5**
9		6EE4-23	Electric Drives Lab	0	0	2	**30**	**20**	**50**	**1**
10		6EE4-24	Machine Learning Lab	0	0	2	**30**	**20**	**50**	**1**
11	SODECA	6EE8-00	Social Outreach, Discipline & Extra Curricular Activities						**25**	**0.5**
Total				18	0	10			**1175**	**23.5**

S.No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
12	MC	6EE9-MC1	Mandatory Non- Credit Course (Cyber Law & Intellectual Property Rights)	2	0	0	100	0	100	0

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The names of the subjects are as follows:

1. Advanced Programming Classes
2. Quantitative & Qualitative Aptitude

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IV Year: Electrical Engineering

VII Semester

Sr. No	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	PCC	7EE4-01	Power System Protection	3	0	0	**45**	**105**	**150**	**3**
2	PEC	7EE5-11	Electric Vehicle Drives	2	0	0	**30**	**70**	**100**	**2**
		7EE5-12	Special Electrical Machines							
		7EE5-13	Power System Dynamics and Control							
3	OE	7EE6-60	Open Elective-I	3	0	0	**45**	**105**	**150**	**3**
4	PCC	7EE4-21	Embedded Systems Lab	0	0	3	**45**	**30**	**75**	**1.5**
5		7EE4-22	Power System Protection Lab	0	0	2	**30**	**20**	**50**	**1**
6	PSIT	7EE7-30	Internship Training & Seminar	0	0	2			**325**	**6.5**
7		7EE7-50	Project Phase-I	0	0	4	**60**	**40**	**100**	**2**
8	SODECA	7EE8-00	Social Outreach, Discipline & Extra Curricular Activities						**25**	**0.5**
Total				8	0	11			975	**19.5**

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Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The modules are related to higher studies, GATE classes Digital Marketing and Quantitative and Aptitude skills.

The names of the subjects are as follows:

1. Technical Classes
2. Digital Marketing Classes
3. Innovation Lab (Phase-II)
4. Placement Preparation Classes
5. Quantitative & Qualitative Aptitude

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IV Year: Electrical Engineering

VIII Semester

S. No.	Category	Course Code	Course Title	Hours			Marks			Cr
				L	T	P	IA	ETE	Total	
1	PCC	8EE4-01	HVDC Transmission System	3	0	0	**45**	**105**	**150**	**3**
2	PEC	8EE5-11	Electrical Vehicle Charging Systems	3	0	0	**45**	**105**	**150**	**3**
		8EE5-12	Smart Grid							
		8EE5-13	Advanced Power System Protection							
3	OE	8EE6-60	Open Elective-II	3	0	0	**45**	**105**	**150**	**3**
4	PCC	8EE4-21	Energy Lab	0	0	3	**45**	**30**	**75**	**1.5**
5		8EE4-22	High Voltage Lab	0	0	3	**45**	**30**	**75**	**1.5**
6	PSIT	8EE7-50	Project Phase-II	0	0	8	**90**	**60**	**150**	**3**
7	SODECA	8EE8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0			**25**	**0.5**
Total				9	0	14			775	**15.5**

L = Lecture, **T =** Tutorial, **P =** Practical, **IA=**Internal Assessment**, ETE=**End Term Exam and

Cr=Credits

Note: As per the suggestions received from the members of Board of Studies, the department imparts knowledge of additional learning modules for bridging the Industry-Academia gap and making the students industry ready. The modules are related to The module is related to higher studies.

The names of the subjects are as follows:

1. Technical Classes

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1st Year: Electrical Engineering

I Semester

1FY2-01: Calculus and Vector analysis

Credit: 4 **Max. Marks: 200 (IA: 60, ETE: 140)**

3L+1T+0P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives and outcomes	**1**
1	**Differential Calculus-I:** Asymptotes (Cartesian coordinates only), Curve tracing (Cartesian and standard Polar curves- Cardioids, Lemniscates of Bernoulli, Limacon, and Equiangular Spiral only).	**6**
2	**Differential Calculus-II:** Partial differentiation - Homogeneous functions and Euler's theorem, Chain Rule, Total derivative - Change of variables. Partial differentiation of implicit functions, Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers.	**7**
3	**Integral Calculus-I:** Improper integrals (Beta and Gamma functions) and their properties. Applications of Definite integrals to evaluate surface area and volume of solid of revolutions.	**8**
4	**Integral Calculus-II:** Double integrals -Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves, Volume of solids – Evaluation of triple integrals -Dirichlet's integral.	**8**
5	**Vector analysis:** Gradient and directional derivatives, divergence and curl– Irrotational and solenoidal Vector fields, Line integrals, Surface integrals, Volume integrals. Green, Gauss divergence and Stokes theorems (without proof) and their applications.	**10**
	TOTAL	**40**

TEXT BOOK:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Alan Jeffrey, Advanced Engineering Mathematics, University of Newcastle, Academic Press, Sydney, 2002.

REFERENCES BOOKS:

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition, 2016.

2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

1FY2-03: Engineering Chemistry

Credit: 4 **Max. Marks: 200 (IA: 60, ETE: 140)**

3 L+1T+0P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Material Chemistry:** Nano materials: Definition, Classifications, Properties (Optical and Electrical), Methods of preparation. Introduction to techniques of preparation and details of chemical vapor deposition technique and overview of applications in various fields.(Engineering, Medicine, Food) **Lubricants**: Types of lubrication, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Refractory: Silica and fire clay refractory, Seger cone and RUL tests. **Introduction to Green Chemistry:** Principles, Atom Economy, Matrices of Greenness, R4M4 Model.	**9**
2	**Boiler Troubles:** Introduction to Boiler troubles. Hardness, determination of hardness by Complex metric (EDTA method), Degree of hardness. Water softening: Lime-Soda process, Numerical problems based on Hardness, EDTA, Lime-Soda. Introduction to Municipal water supply, steps of treatment. Breakpoint chlorination.	**6**
3	**Electrochemistry:** Cell, Electrode potential, cell potential, Types of electrodes. **Corrosion**: Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion. Prevention against corrosion: Conventional and advanced methods. **Battery**: Primary and secondary (Lead Acid and Nickel cadmium) Basics of Electrical double layer super capacitor. **Fuel Cell**: Introduction to AFCs, PEMFs, SOFCs, MCFCs, construction and working.	**9**

4	**Fuels** Solid fuels: Determination of Calorific value of coal by Bomb Calorimeter. Liquid fuels: Cracking (thermal and catalytic cracking), Synthetic petrol (Bergius process and Fisher- Tropsch Process), knocking Octane number, Cetane number Gaseous fuels: DeterminationofcalorificvalueofgaseousfuelsbyJunker'scalorimeter.Analysis of flue gases by Orsat's apparatus. Numerical problems based on determination of calorific value (Bomb calorimeter/Junkers calorimeter/ Dulong's formula, and combustion of fuel.	**8**
5	**Analytical Techniques:** Spectroscopy: Electromagnetic Spectrum, UV-Vis spectroscopy: Beer- Lambert's law, Instrumentation, types of transition, concept of auxo chrome and chromophores, factors affecting λ_{max} and, Woodward-Fisher Rules for calculation of λ_{max} in diene systems; IR spectroscopy: Instrumentation, types of vibration, Hooks law, detection of functional groups like C=C, -OH, -NH2 and -C=O [Propanone,Oct-1-ene,Propanol,Butanoic Acid &Methyl Acetate] NMR Spectroscopy: Basics of NMR Spectroscopy: Theory, Instrumentation, Chemical shift, Shielding-de shielding effect, Structural elucidation of simple compounds [Ethanol, Propanol, Propanone, MethylAcetate,1-Chlorobutane,2-Chlorobut-1-ene,Butanoic Acid, Bromoethane]	**7**
	TOTAL	**40**

TEXT BOOKS:

1. Engineering Chemistry, Jain and Jain, DR Publications.
2. Engineering Chemistry, Sunita Rattan, SKK sons.

REFERENCES BOOKS:

1. Engineering chemistry Wiley-India
2. Advanced Physical Chemistry, Bahl and Tuli, Rastogi Publications.
3. Organic Spectroscopy, Y.R. Sharma, S. Chand
4. Spectroscopy of Organic Compounds by P. S. kalsi ,New Age International
5. Engineering Chemistry, S.S. Dara, Rastogi Publications.

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1FY3-04: Programming for Problem Solving

Credit: 3 **Max. Marks: 150 (IA: 45, ETE: 105)**

3 L+0T +0P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Fundamentals of Computer:** Basic principle of working of a computer, building blocks of a computer – CPU, memory, Input-output. Hardware v/s software. Idea of editor, commands, operating system, compiler. Input and output devices. **Concept of a Program**, algorithm vs. program, flow-chart, High level vs. Low level languages. **Basic structure of a C program,** declarations of data types, writing, editing, saving as file, compiling, and running a simple program.	**7**
2	**Arithmetic expressions and precedence, Decision and Iterative statements:** Writing and evaluation of expressions, Writing Decision making Statements (if, switch) and looping statements (for, while, do. While)	**8**
3	**Arrays**: Arrays (1-D, 2-D), Character arrays and Strings, Searching and Sorting Algorithms: (Bubble, Insertion and Selection)	**6**
4	**Dynamic memory allocation, and Pointers:** declaring pointers, accessing memory locations using pointers, pointer arithmetic. **Functions:** built-in and user defined functions, parameter passing in functions: call by value, call by reference. **Recursion:** Basic concepts of recursion, solving problems through recursion such as Factorial, Fibonacci series, Ackerman function etc.	**6**
5	**Structures:** Declaring structures and Array of Structures. Passing and returning structures to and from a function, use of Pointers in structures and arrays. **File handling**: Types of files, Opening and closing a file, Different modes of opening a file, Reading and writing into files (text and binary)	**8**
	TOTAL	**36**

TEXT BOOKS:

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

REFERENCES BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India

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1FY3-07 Mechanical Engineering

Credit: 4 **Max. Marks: 200 (IA: 60, ETE: 140)**

3 L+1T+0 P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Fundamentals:** Introduction to mechanical engineering, Industrial Engineering, Manufacturing Technology Basic concepts of thermodynamics: Definition, Energy, System, Types of System, States, Path, Process, Cycle, 1st Law of Thermodynamics, Work & Heat for non-flow processes, 2nd Laws of Thermodynamics, Entropy, Modes of Heat Transfer.	**8**
2	**Steam Boilers:** Introduction, formation of steam, classification of steam boilers and their applications, Advantages & Disadvantages of steam boilers Steam Turbine: Introduction, Classification of steam turbine & their applications, Compounding. Power plant: Introduction & its classification, Layout of power plant (Steam Power Plant, Diesel Power Plant, Hydro-electric Power Plant and Gas Power Plant)	**8**
3	**Pumps:** Introduction & their classification, Reciprocating & Centrifugal Pump I.C. Engine: Its Components & Classification, 2-stroke & 4-Stroke engines, Otto Cycle and Diesel cycle and its Efficiency. Refrigeration: Introduction, 1TR, COP, Air refrigeration, VCRS, VARS, Refrigerants, Applications	**6**
4	**Automobile Engineering**: Layout of an Automobile, Transmission, Clutch, Differential Power transmission: Introduction, types of belts & ropes, Tension Ratio, Gears	**6**
5	**Engineering Materials:** Introduction to various engineering materials, their properties Primary Manufacturing Processes: Metal casting: Introduction, Pattern & its types, Pattern Allowances, Methods of Casting Machining Process: Lathe, Drilling Metal Joining Process: Introduction, Welding & Its types, Brazing, Soldering	**7**
	TOTAL	**36**

TEXT BOOK:

1. Basic Mechanical Engineering, G. Shanmugam & S. Ravindran, Mc Graw Hill Education
2. Basic Mechanical Engineering, C. M. Agarwal, Wiley India Pvt. Ltd.
3. Manufacturing Technology Vol. 1: Foundry, Forming and Welding Vol. 1- P N Rao

REFERENCE BOOK:

1. Thermal Science & Engineering, D. S. Kumar, Katson Books
2. Power Plant Engineering, P. K. Nag, TMH
3. Fluid Mechanics and Hydraulic Machines, R. K. Bansal, Laxmi Publications
4. Fluid Mechanics and Hydraulic Machines, R. K. Rajput, S. Chand
5. Internal Combustion Engine, V. Ganeshan, TMH
6. Refrigeration and Air Conditioning, R. S.Khurmi, Eurasia Publishing
7. Automobile Engineering, Dr. Kripal Singh, Standard Publishers

1FY2-22 Engineering Chemistry Lab

Credit: 1 **Marks: 50 (IA: 30, ETE: 20)**

0L+0T+2P

S.N.	CONTENTS
1	To determine the viscosity of a given lubricating oil by Redwood viscometer.
2	To determine the flash and fire point, cloud and pour point of a given lubricating oil.
3	To determine the Hardness of given water sample by EDTA method.
4	To determine the strength of dissolved oxygen in given water sample.
5	To determine the strength of free residual chlorine in a given water sample
6	To determine the strength of Ferrous Ammonium Sulphate solution with the help of $K_2Cr_2O_7$ solution.
7	To determine the strength of given HCl solution by NaOH with the help of conductivity Meter and pH meter
8	To determine the strength of an unknown solution of CuSO4 with the help of Sodium Thiosulphate (hypo) solution and determine the amount of Cu in the copper ore.

TEXT BOOKS:

1. Vogel's Text Book of Quantitative Chemical Analysis - Orient Longman.

REFERENCES BOOKS:

1. Practical Chemistry –Giri Pandey Bajpai (S. Chand)

2. Practical chemistry –Sunita Rattan (Dhanpat Rai)

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1FY3-23: Computer Programming Lab

Credit: 1.5 **Max. Marks: 75 (IA: 45, ETE: 30)**

0L+0T+3P

S.N.	CONTENTS	EXERCISES*
1	Familiarization with programming environment, C Program Structure, Input Output statements, Data types, Simple computational problems using arithmetic expressions	Write hello world program. Calculates the area of a circle. Calculates simple interest. Swap two numbers. Converts Centigrade to Fahrenheit Takes hours and minutes as input, and calculates the total number of minutes.
2	Problems involving if-then-else, switch statements	Determines largest of 2 numbers, 3 numbers. Determines whether a number is even or odd. Finds whether a year is a leap year Finds the roots of a quadratic equation. Implements a simple calculator
3	Problems involving loops	Generates and Finds if the given number is a prime number, Determines whether a number is Armstrong number or not Sum of first n natural numbers Finds GCD, LCM of a given number Computes sum of series like 1! +2! +3! +..N! etc.
4	Problems involving nested loops	Displays the multiplication table vertically from 1 to n. Displays Pascal's triangle, diamond shaped pattern, pyramid Pattern etc.
5	Array manipulation: 1D array	Performs Linear Search on a list of n elements. Finds largest, smallest element from a given list of elements Sorts a list of n elements in ascending/ descending order using bubble sort.
6	String operations	Finds length of a string, String reversing, String comparison, Finds whether the given string is palindrome or not
7	2D Array manipulation	Programs involving Matrix operations [addition, multiplication]
8	Pointers:	Demonstration the use of & (address of) and *(value at address) operator in a program. Storing n elements in an array and print them using pointer. Computing the sum of all elements in an array using pointers.
9	Functions: Programs involving simple functions	Swapping two numbers, Determining square and cube of a number using functions.

	involving return statement and no return statement	Determining number of vowels, consonants and special characters in a string.
10	Recursive functions	Finding Factorial, Fibonacci series, Ackerman function etc.
11	Structures	Arithmetic operations on Complex numbers, rational numbers, Operations on student records
12	File operations	Programs using the concepts of file handling

*These are suggestive exercises, depending on the requirement and availability of time the instructor can choose to do additional exercises.

TEXT BOOKS:

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

REFERENCES BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall of India.

1FY3-26: Engineering Graphics & Machine Drawing

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)**

0L+0T+2P

S.N.	CONTENTS	DESCRIPTION	Hours
1	Introduction to Engineering drawing orthographic projection	**Principles of engineering drawing**: Drawing instruments, types of lines, lettering and dimensioning. **Types of scales:** Plane scale, Vernier scale, diagonal scale and scale of chords. **Orthographic Projection:** Theory of projection, alignment of views, first angle and third angle method of projections, sectional views.	**6**
2	Projection of lines & Planes:	**Projection of lines**: lines parallel and perpendicular to reference plane, lines inclined to reference planes. Projection of planes: planes parallel, perpendicular and inclined to reference planes.	**6**

3	Isometric Projection:	**Basics of isometric projection**: Isometric projections of regular plane figure.	**6**
4	Computer Graphics:	**Introduction to Computer Aided Graphics** (different types of tools, commands, toolbars, constraints, menu, status bar etc.) and drawing of 2D and 3D problems on CAD software (AutoCAD/Pro-E /Creo3.0/Solid Works/Fusion-360).	**4**
5	Demonstration of a simple design project using CAD software (Group activity):	Students are required to perform a group activity based on CAD software.	**2**
		TOTAL	**24**

TEXT BOOKS:

1. N D Bhatt and V M Panchal, Engineering Drawing, 43rd Ed., Charator Publishing House, 2001.
2. Lakshmi narayan Mathur, A text of Machine Drawing, Jain Brothers.

REFERENCES BOOKS:

1 K Venugopal, Engineering Drawing and Graphics, 3rd Ed., New Age International, 1998.

2 M B Shah and B C Rana, Engineering Drawing, 2nd Ed., Pearson Education, 2009.

3. T E French, C J Vierck and R J Foster, Graphic Science and Design, 4th Ed., McGraw Hill, 1984
4. W J Luzadder and J M Duff, Fundamentals of Engineering Drawing, 11th Ed., PHI, 1995.
5. A.J. Dhananjay, Engineering Drawing, TMH, 2008.

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1FY1-28 Language Lab

Credit: 1.5 **Max.Marks:75 (IA: 45, ETE: 30)**

0L+0T+3P

S. No.	CONTENTS	Hours
1.	**Listening Skills:** Introduction and Importance, Practicing Pronunciations, Telephone Etiquette and Visual Story Interpretation.	4
2.	**Speaking Skills:** Extempore, Story-telling, Group Discussion-Introduction, Importance, Practicing GD on various topics and Role Play.	14
3.	**Reading Skills:** Importance of Reading, Implementing Reading Techniques, Visual Perception, Reading Skills and Reading Comprehension Passages.	9
4.	**Writing Skills and Vocabulary Building:** Sentence formation activities, Practicing the usage of Nouns, Pronouns, Verbs, Articles, Prepositions, Adjectives, Synonyms, Antonyms, Active and Passive voice , Homonyms, Tenses, Phrasal Verbs, Idioms and One word substitutions, E-mail Writing and Script Writing for Role Play.	9
	TOTAL	36

TEXTBOOKS:

1. Raymond Murphy, English Grammar in Use, Cambridge University Press, Cambridge.
2. Wren & Martin, High School English Grammar and Composition, S. Chand & Company.
3. S.T.Imam, Brush up Your English, Bharati Bhawan Publishers.

REFERENCEBOOKS:

1. Sudarshana, N.P. and Savitha, C., English for Engineers, Cambridge University Press, 2018.
2. Norman Lewis, Speak Better Write Better English.
3. Norman Lewis, Word Power Made Easy.
4. W.Stannard Allen, Keep up your English, BL Language Institute Publication.
5. Deepali Gupta, Spoken English Made Easy, Indra Publishing House, Bhopal, India.

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1FY9-MC1: Personality Development Skills

Mandatory Non-credit course

Credit: 0 **Max.Marks:100 (0L+0T+2P)**

S. N.	CONTENTS	Hours
1.	**Unit I:** SWOT Analysis a. What are strengths, weakness, opportunities and threats b. Importance of SWOT c. Tools used to identify SWOT d. SWOT in practice & Counselling	3
2.	**Unit II:** Goal Setting Spoken English a. How to enhance spoken English b. Spoken English activities c. Developing Reading habit for Knowledge Up gradation	3
3.	**Unit III:** Personality Development a. What is personality? b. Importance of personality c. Self – confidence and self- esteem d. Opportunity to interact with Personality live	4
4.	**Unit IV**: Interpersonal Skills a. Public speaking b. PowerPoint presentation skills c. Self-Introduction	3
5.	**Unit V:** Business Etiquettes a. Telephone etiquettes, Hand shake Etiquette, Cubical Etiquette b. Email & Letter Etiquettes, Business Card Etiquette, Dressing Etiquette	2
6.	**Unit VI :** Interview Skills a. What is an interview & how to face that? b. Expected general questions	6

	Body Language a. Basics of body language b. Hard skills v/s Soft skills	
7.	**Unit VII:** Professional writing Skills Resume Building, a. Basic resume formats b. Difference between resume , CV, Bio data c. Job Application/ Cover Letter, Email Writing	**3**
	TOTAL	**24**

TEXT / REFERENCES BOOKS:

1. Business Communication by R K Madhukar, published by Vikas Publication
2. IQ and Personality Test by Philip Carter, published by Kogan Page India
3. Personal development for life and work by Masters Wallace, published by
4. Spoken English, 4/e, M C Sreevalsan, published by Vikas Publication
5. Training in Interpersonal Skills by Stephen Robbins, published by Pearson Publication.

1FY9-MC2: TECHNO COMMUNICATION

Mandatory Non-credit course

Credit: 0 **Max.Marks:100**

(0L+0T+2P)

S. N.	CONTENTS	Hours
1.	**MS WORD**: Introductory commands : Cut, copy, font size, style, format painter, bold, italic, underline, find, Replace Inserting Shapes and Symbols, working with equations, Setting of Page layout, margins, page number, cover page, headers and footers, hands on practice, printing and viewing preferences, protection of files, review and tile files vertically and horizontally.	**6**
2.	**MS EXCEL**: Vocabulary status bar modes, keyboard navigation ribbon, clipboard Formatting cells : cells structures, Inserting, Deleting cells, Cell Size (Row	**6**

	Height/Column Width) Construction of an Equation , Type in the exact cell address, Use the mouse to point to the cell address, Mathematical Operations, AutoSum	
3.	**POWER POINT PRESENTATION:** Introductory commands, Insert table, chart, picture and shapes in presentation, Transition and animation, Use of Header & footer, Date and time, Page no, equation and symbols	**5**
4.	**MS PUBLISHER**: Getting started with Microsoft publisher, adding content to a publication, formatting text and paragraphs in a publication, managing text in a publication, working with graphics in a publication, preparing a publication for sharing and printing.	**7**
	TOTAL	**24**

TEXT / REFERENCES BOOKS:

1. Computer Fundamentals MS OFFICE by Anupam Jain and Navneet Mehra published by Vitasta Publishing Pvt. Ltd.
2. Mastering MS Office: Concise Handbook by Bittu Kumar published by V&S Publishers.
3. Microsoft Office 2019 by Wallace Wang published by Wiley publishers.
4. Ms-Office 2010 Training Guide by Satish Jain, M. Geeta, Kratika published by BPB Publications.

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1FY9-MC3: Graphics Programming in C

Mandatory Non-credit course

Credit: 0 **Max. Marks: 100**

(0L+0T+2P)

S. N.	CONTENTS	Hours
1.	Module I: Introduction to computer graphics & graphics systems Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; Basic structure of Graphics program.	4
2.	WAP to draw a pixel (x, y) and display the color in which pixel (x,y) is illuminated on the screen. Colors in graphic programming.	2
3.	Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm and Color fill algorithm. WAP to draw a Line and also draws different styles of lines in C.	3
4.	WAP to draw a Triangle and also a Rectangle using a function.	2
5.	WAP to draw Polygon of various shapes using a function and Hut using (line, triangle & rectangle) function.	2
6.	WAP to draw Ellipse. And also draw Candy.	2
7.	WAP to draw a Circle and also draw circles inside various circles.	3
8.	Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems. WAP to print text on screen with different colors and WAP to print text in different fonts.	3
9.	WAP to create bar charts, pie charts and progress bars and also any object and perform filling and Design a Project in Computer Graphics to implement a moving car using arrow keys.	3
	TOTAL	**24**

TEXT / REFERENCES BOOKS:

1. Hearn, Baker "Computer Graphics (C version 2nd Ed.)" – Pearson education.
2. Z. Xiang, R. Plastock – "Schaum's outlines Computer Graphics (2nd Ed.)" – TMH.

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Fundamentals of Electrical Engineering (I semester)

Total: 28 hours (Lecture: 2hrs per Week)

S. No.	Name of Experiment	Hours
1	Study about the advent of Electrical Engineering and its chronological development.	2
2	Concept of charge, electric field, potential, potential difference, current, resistance, power and energy. Basic study of conductors, semiconductors and insulating materials.	2
3	Study of electrical components (Wires, Switches, Fuses, sockets, plugs, lamps, lamp holders, rating of different accessories).	3
4	Study of different types of electrical wiring.	3
5	Study of conventional and inverter-based refrigerator and air conditioners.	3
6	Study of different generating stations, transmission systems and distribution networks.	3
7	A case study on the installation of solar panels for domestic purpose.	3
8	A case study on the installation of inverter system for domestic purpose.	3
9	Study of electric traction system. Also study the various components used in the traction system.	3
10	Study various terminologies used in the case of Illumination.	3
	Total	**28**

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Electrical Workshop (I semester)

Total: 28 hours (Lab: 2hrs per Week)

S. No.	Name of Experiment	Hours
1	(a) Discuss the precautionary steps to be adopted while working with the electrical equipments, to prevent accident/shock. (b) Study of various tools used in electrical systems.	2
2	Study of various measuring instruments like ammeter, voltmeter, multimeter, wattmeter and energy meter.	2
3	Study of basic concepts related to AC and DC supplies and electrical and electronic components.	2
4	Measurement of R, L, C, Z, Power, Power Factor, Energy by different methods – Single Phase & 3 Phase.	2
5	Comparative study of bulb, tube light, LED lamp and CFL.	2
6	Study of the different types of batteries and their specifications/ratings. Demonstrate the charging & discharging of battery. List the various applications of batteries.	2
7	Discuss the meaning of Ground, Earth and Neutral. Demonstrate the Pipe and Plate Earthing Schemes.	2
8	Study of different types of cables, wires, switches, fuses, fuse carriers, MCB, ELCB and MCCB with ratings.	2
9	Troubleshooting of domestic devices: Dismantling, Repairing, Assembling and testing of domestic appliance like electric iron, Room heater, Ceiling fan and Regulators.	2
10	Demonstration and measurement of power consumption of electric iron, mixer grinder, single phase pump, exhaust fan, etc.	2
11	Use of megger for insulation testing and continuity test of wiring installation and machines	2
12	Demonstration of the various hardware components used in the computers.	2
13	Industrial Visit (above 132kV GSS)	4
	Total	**28**

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Quantitative & Qualitative Aptitude (I Semester)

Total: 28 hours (Lecture: 2hrs per Week)

S.No	Topics	Hours
1	Percentage Questions Set with Solutions	**2**
2	Number Systems Basics	**1**
3	Reminder Theorem Questions with Solutions	**1**
4	Time Distance & Speed Questions	**2**
5	Profit and Loss with Question Set	**2**
6	Ratio & Proportions Question Set with Solutions	**2**
7	Average Questions with Solutions	**2**
8	Mixture & Allegation Questions with Solutions	**2**
9	Time and Work (Types Discussion)	**1**
10	Time and Work Questions with Solutions	**1**
11	Interest (SI + CI)	**2**
12	Counting of Figures	**1**
13	Series of Figures (Reasoning) Questions with Solutions	**1**
14	Number Series Questions with Solutions	**1**
15	Clocks	**1**
16	Calendar Questions with Solutions	**2**
17	Permutation & Combination Questions with Solutions	**2**
18	Paper Folding Questions (Reasoning) with Solutions	**1**
19	Paper Cutting and Folding Questions (Reasoning) with Solutions	
20	Series of Figures (Reasoning) Questions with Solutions	**1**
	Total	**28 Hrs**

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1st Year: Electrical Engineering

II Semester

2FY2-01: Linear algebra and Differential equations

Credit: 4 **Max. Marks: 200 (IA: 60, ETE: 140)**

3 L+1T+0 P **End Term Exam: 3**

Hours

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Matrices:** Rank of a matrix, rank-nullity theorem, System of linear equations, Symmetric, skew- symmetric and orthogonal matrices; Eigenvalues and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem.	**9**
2	**Ordinary differential equations of higher orders:** Linear Differential Equations of Higher order with constant coefficients, Simultaneous Linear Differential Equations.	**6**
3	**Second order linear differential equations with variable coefficients**: Homogenous and Exact forms, one part of CF is known, Change of dependent and independent variables, method of variation of parameters. Series solution including Legendre and Bessel differential equations.	**8**
4	**Partial Differential Equations – First order:** Order and Degree, Formation, Lagrange's Form, Non Linear Partial Differential equations of first order, Charpit's method, Standard forms.	**8**
5	**Partial Differential Equations– Higher order:** Classification of Second order partial differential equations, Separation of variables method to simple problems in Cartesian coordinates including two dimensional Laplace, one dimensional Heat and one dimensional Wave equations.	**8**
	TOTAL	**40**

TEXT BOOK:

1 Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

2 Alan Jeffrey, Advanced Engineering Mathematics, University of Newcastle, Academic Press, Sydney, 2002.

REFERENCES BOOKS:

1 Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

2 Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.

3 S.L.Ross, Differential Equations, III edition, Willey Students Edition, John Wiley & Sons, 2004.

4 Walter A. Stress, Partial Differential Equation, an Introduction, John Wiley & Sons, 1992.

2FY2-02: Engineering Physics

Credit: 4 **Max. Marks: 200 (IA: 60, ETE: 140)**

3 L+1T+0 P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Introduction to Optics:** Light Waves, coherent waves and sources, methods of producing coherent sources: division of wavefront and division of amplitude. Interference& Diffraction of Light: Principle of Superposition, Newton rings and its applications, Interference filter, Antireflection coating. Difference between Fresnel & Fraunhoffer Diffraction, Diffraction due to single slit, Fraunhoffer diffraction due to N slits: Diffraction grating, absent spectra, dispersive power of Grating, resolving power of prism and grating.	**9**
2	**Introduction to quantum mechanics**: Matter waves, De-Broglie hypothesis, Schrodinger's equation, concepts of Eigen vector&Eigen Value, Normalized and orthogonal wave function, Schrodinger's time dependent and independent wave equation, Particle in one dimensional box & three dimensional box and Degeneracy.	**7**
3	**Solid State Physics and Magnetic Properties of materials:** Formation of energy bands in solids: Metals, Semiconductors and Insulators; intrinsic and extrinsic semiconductors, Fermi energy levels for doped, undoped semiconductors and P-N junction; Tunnel diode, Zener diode. Fermi-level, doping, carrier concentration, mobility, junction diode functions and variants. Classification of magnetic materials: diamagnetic, paramagnetic, and ferromagnetic, anti-ferromagnetic, and ferromagnetic materials; Hard and soft magnetic materials: comparison, properties and applications.	**10**
4	**Superconductivity**: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), properties of superconductors & applications.	**5**

5	**Laser and fibre Optics:** Temporal and spatial coherence, Stimulated and spontaneous emission, Einstein's Coefficients, He-Ne Laser, Semiconductor Laser: Construction & working, Application of Lasers. Introduction to optical fibre, Propagation of light through fibre numerical aperture, step index and graded index fibres, application of optical fibres.	**8**
	TOTAL	**40**

TEXT BOOKS:

1. Engineering Physics: Malik and Singh (Tata McGraw Hill), second edition.
2. Engineering Physics: Naidu (Pearson), firth edition.

REFERENCES BOOKS:

1 Optics: Ajay Ghatak (Tata McGraw Hill), 3rd edition.
2. Concept of Modern Physics: A. Baiser (Tata McGraw Hill), 2015 edition.
3. Fundamental of Optics: Jenkins and White (Tata McGraw Hill) 2014 edition.
4. Material Science: Smith (McGraw Hill) sixth edition.
5. Solid state Physics: S.O. Pillai (New Age International) Seventh edition, 2015.

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2FY3-04: Python Programming for Problem Solving

Credit: 3 **Max. Marks: 150 (IA: 45, ETE: 105)**

3 L+0T + 0P **End Term Exam: 3 Hours**

Unit	CONTENTS	Hours
	Scope, objectives &outcomes	**1**
1	Features of python programming, Installation, Modes of programming, Python Interpreter, Python Shell, Setting up path, Python literals (True, False, Null), Identifiers, Identifier naming rules, keywords, Line and indentations, Comments, Python Variables, Types of Variable. Input-output statements, command line arguments.	**8**
2	Python Operators: Arithmetic, Comparison/ Relational Operators, Increment Operators, Logical operators, and Operators Precedence. Decision Making / Conditional Statements: Simple If Structure, if else structure, if elif structure and nested If Structure. Python Loop Statements: while loop, for loop, Nested Loop Structures. Break, continue, and pass.	**7**
3	String data type, accessing elements using index, slice, string operators and membership operations. Data structures: List, tuple, set, dictionary. Operations and manipulation of these data structures.	**8**
4	Functions and their types, parameters passing and returning. Recursive and lambda functions; function filter, map, and reduce. Nested functions.	**6**
5	File handling, reading and writing of files. Introduction to the object oriented programming.	**6**
	Total	**36**

TEXT BOOK

1. Let Us Python: Yashwant Kanetkar, Aditya Kanetkar 3rd edition bpb publication

REFERENCES BOOKS:

1. Core Python Programming Textbook by Wesley Chun Prentice Hall.
2. Python: The Complete Reference by Martin C. Brown Mac Graw-Hill, Oxford.

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2FY3-06: Electrical and Electronics Engineering

Credit: 3 **Max. Marks: 150 (IA: 45, ETE: 105)**

3 L+0T+0 P **End Term Exam: 3**

Hours

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Fundamentals of DC Circuits:** Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor, Kirchhoff's laws, Ideal sources –equivalent resistor, current division, voltage division, Mesh analysis, Nodal analysis, Superposition theorem, Thevenin's theorem, Maximum power transfer theorem.	**7**
2	**Fundamentals of AC Circuits:** Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, j operator. Analysis of R-L, R-C, R-L-C circuits. Introduction to three phase systems - types of connections, relationship between line and phase values for star and delta networks.	**8**
3	**Single-Phase Transformer:** Single phase transformer construction, principle of operation, EMF equation, voltage ratio, current ratio, kVA rating, losses in transformer. **Electrical Safety, Wiring and Installations:** Basic layout of Electrical power system, Safety procedures in Electrical Installations, Role and types of Fuse in electrical circuits, Role and types of earthing, Energy Efficiency in Different types of domestic loads (lighting load ,mechanical load), Star ratings in electrical appliances, Study of domestic Electricity bill	**7**
4	**Basic Electronics:** Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behavior of the PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Complete Analysis of Half and full-wave uncontrolled single-phase Rectifiers, Effect of L, C, and L-C filters on output voltage of rectifiers.	**7**
5	**Basics of Communication Systems:** Introduction, IEEE Spectrum for Communication Systems, Types of Communication, Amplitude and frequency Modulation. **Basics of Instrumentation**: Introduction to Transducers: Thermocouple, Resistive temperature detector (RTD), Strain Gauges.	**6**
	TOTAL	**36**

TEXT BOOKS:

1. Smarajt Ghosh, "Fundamentals of Electrical & Electronics Engineering", Second edition, PHI Learning, 2007.
2. Edward Hughes, Electrical and Electronic Technology, Pearson Publication

REFERENCES BOOKS

1. Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication.
2. Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH.
3. Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, Wiley India.

2FY1-08: Human Values and Ethics in Engineering

Credit: 2 **Max. Marks: 100 (IA: 30, ETE: 70)**

2 L+0T+0 P **End Term Exam: 2 Hours**

Unit	CONTENTS	Hours
	Scope, objectives & outcomes	**1**
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:** Understanding the need, basic guidelines, Self-Exploration - its content and process; 'Natural Acceptance' and Experiential Validation, Basic Human Aspiration-Continuous Happiness & Prosperity, Right understanding, Relationship and Physical Facilities, A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Practice Exercises- SWOT Analysis	**4**
2	**Understanding Harmony in the Human Being- Harmony in Myself:** Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body', Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Self Control and Health, correct appraisal of Physical needs, Programs to ensure self-control and Health. Practice Exercises- Case Studies/Stress management techniques will be taken up in Practice Sessions.	**5**

3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship:** Understanding harmony in the Family, Understanding values in human-human relationship; meaning of Justice, Trust and Respect; Difference between intention and competence, meaning of respect, Difference between respect and differentiation;, harmony in the society-comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society , Universal Order - from family to world family. Practice Exercises –Group Discussion (Choose any one current problem of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.)	**5**
4	**Understanding Harmony in the Nature:** Understanding the harmony in the Nature. Inter connectedness and Mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature. Holistic perception of harmony at all levels of existence Practice Exercises –Presentation (Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. – all these seem to be man-made problems threatening the survival of life on Earth. Prepare a PPT on any one issue and present)	**5**
5	**Professional Ethics:** Need for Professional Ethics, Issues in Professional Ethics, Plagiarism, Professional Responsibilities-Confidentiality, Collegiality, Whistle Blowing, Intellectual Property Rights-Trademark, Copyright, Patent. Practice Exercises- Case Studies will be taken up in Practice Sessions.	**5**
	TOTAL	**25**

TEXT BOOKS:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

REFERENCES BOOKS:

1 P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Common wealth Publishers.
2 A. N. Tripathy, 2003, Human Values, New Age International Publishers.
3 Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth - Club of Rome's report, Universe Books.

4 E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
5 M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

2FY2-21: Engineering Physics Lab

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)**

0L+0T+2P

S.N.	CONTENTS
1	To determine the wave length of sodium light by Newton's Ring.
2	To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
3	Determination of energy band gap using a P-N junction diode.
4	To determine the height of given object with the help of sextant.
5	To determine the dispersive power of material of a prism with the help of Spectrometer.
6	To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted).
7	To measure the numerical aperture of an optical fiber.
8	To verify the expression of Resolving Power of Telescope.

TEXT BOOKS:

1. Engineering Physics laboratory- Dr. S.S. Rawat & Soni, CBH Pub.

REFERENCES BOOKS:

1 Engineering Physics laboratory- Prof. Y.C Bhatt & Prof. K.B Sharma, Ashirwad Pub.
2 University Practical Physics- Dr. D.C. Tayal, Himalaya Pub.

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2FY3-23: Python Programming Lab

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)**

0L+0T+2P

S.N.	CONTENTS	EXERCISES*
1	Basics of Python	1. Write a Python commands to get the Python version you are using. 2. Write a Python commands to display the current date and time. 3. Write a Python program which accepts the radius of a circle from the user and compute the area. 4. Write a Python program that accepts an integer (n) and computes the value of n+ nn+ nnn. *Sample value of n is* 5 *Expected Result :* 615 5. Write a Python program to calculate number of days between two dates. *Sample dates* : (2014, 7, 2), (2014, 7, 11) *Expected output* : 9 days 6. Write a Python program to swap two variables
2	Decision Statement, Loops	1.Write a Python program to get the difference between a given number and 17, if the number is greater than 17 return double the absolute difference. 2.Write a Python program to test whether the input number is near 100 or 1000 or 2000. 3.Write a Python program to calculate the sum of three given numbers, if the values are equal then return three times of their sum. 4.Write a Python program to compute the greatest common divisor (GCD) of two positive integers. 5.Write a Python program to calculate the sum of the digits in an integer. 6.Write a Python function to find the maximum and minimum numbers from a sequence of numbers. Note: Do not use built-in function
3	String data type	1. Write a Python program that takes a string input and displays the string in a specific format. *Sample String:* "Twinkle, twinkle, little star, How I wonder what you are! *Output :*Twinkle, twinkle, little star, How I wonder what you are! 2. Write a Python program to accept a filename from the user and print its extension. *Sample input : abc.py Output: py*

		Write a Python program to get a new string from a given string where "Is" has been added to the front. If the given string already begins with "Is" then return the string unchanged
4	Data Structures :List, Tuple, Dictionary, Set	1. Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers. *Sample data :* 3, 5, 7, 23 *Output :* List : ['3', ' 5', ' 7', ' 23'] Tuple : ('3', ' 5', ' 7', ' 23') 2. Write a Python program that counts the frequency of a number x in a given list of n elements. 3. Write a Python program to print all even numbers from a given list of numbers in the same order and stop the printing the numbers that come after the number x in the sequence.
5	Data Structures : Dictionary, Set	1. Write a Python program that takes input in two sets [set A and set B] and prints out elements belonging to set A which are not present in set B. 2. Write a Python program to create a dictionary from a string and display in table format. 3. Write a Python program to print all unique values in a dictionary
6	Functions PART-1	1. Write a Python program to reverse a string. *Sample String*: "1234abcd" *Expected Output*: "dcba4321" 2. Write a Python function that takes a list and returns a new list with unique elements of the first list. *Sample List* :[1,2,3,3,3,3,4,5] *Unique List :* [1, 2, 3, 4, 5] 3. Write a Python program that accepts a hyphen-separated sequence of words as input and prints the words in a hyphen-separated sequence after sorting them alphabetically. *Sample Items*: green-red-yellow-black-white *Expected Result*: black-green-red-white-yellow
7	Functions PART -2	1. Write a Python program to make a chain of function decorators (bold, italic, underline etc.) in Python. 2. Write a Python program that squares and cubes every number in a given list of integers using Lambda. 3. Write a Python program to find if a given string starts with a given character using Lambda.
8	File handling	1. Write a Python program that reads an entire text file. 2. Write a Python program that reads first n lines and last n lines of a file 3. Write a Python program that reads a file line by line and stores it into a list.

		4. Write a Python program that counts the number of lines, words, and frequency of each character in a text file. 5. Write a Python program that copy the contents of a file to another file. 6. Write a Python program that removes newline characters from a file.
9	Regular Expressions	1. Write a Python program to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9) 2. Write a Python program that matches a string that has an *a* followed by zero or more b's 3. Write a Python program to find sequences of lowercase letters joined with a underscore 4. Write a Python program where a string will start with a specific number.
10	Introduction to OOP	1. Write a Python class named Rectangle constructed by a length and width and a method which will compute the area of a rectangle. 2. Write a Python class named Circle constructed by a radius and two methods which will compute the area and the perimeter of a circle. 3. Write a Python class to implement pow(x, n) 4. Write a Python class which has two methods get String and print String. get String accept a string from the user and print String print the string in upper case

*These are suggestive Exercises and the instructor may change as per the availability of time and requirement.

TEXT BOOK

1. Let Us Python: Yashwant Kanetkar, Aditya Kanetkar 3rd edition bpb publication

REFERENCES BOOKS:

1. Core Python Programming Textbook by Wesley Chun Prentice Hall.
2. Python: The Complete Reference by Martin C. Brown Mac Graw-Hill, Oxford.

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2FY3-25: Electrical & Electronics Engineering Lab

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)**

0L+0T+2P

LIST OF EXPERIMENTS

S.N.	CONTENTS
1	Assemble house wiring including earthling for 1-phase energy meter, MCB, ceiling fan, tube light, three pin socket and a lamp operated from two different positions. Basic functional study of components used in house wiring.
2	Study different types of electrical loads for domestic purposes and calculate monthly electricity consumption for residential applications.
3	Make suitable connection to verify Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) in a DC Network.
4	To verify Thevenin's theorem in a D.C. network.
5	To determine power factor of a given choke coil and to improve the power factor using suitable compensating capacitor.
6	Perform Open Circuit and Short Circuit tests on a single-phase transformer, to determine efficiency of the transformer.
7	Study the working of Analog/Digital Multi- Meters, Function/Signal Generator and Cathode ray oscilloscope (CRO), also measure frequency and magnitude of input signal with the help of CRO.
8	Identification, testing and application of Resistors, Inductors, Capacitors, PN-Diode. Zener Diode, LED, LCD, BJT, Photo Diode, Photo Transistor.
9	Make connections to draw the V-I Characteristics of a P-N Junction diode in Forward and Reverse bias conditions.
10	Make connections for a single-phase, half-wave and full-wave bridge rectifier and the analyses effect of L, C and L-C filters on the output voltage of the rectifiers.

TEXT BOOKS:

1. Laboratory Courses in Electrical Engineering, 5/e by P K Kharbanda, S B Bodkhe, S D Naik & S G Tarnekar, S. Chand.
2. Basic Electrical & Electronics Lab by Bharat Bhushan Jain and Harbeer Singh, N.K. Publishers.

REFERENCES BOOKS:

1 Basic Electrical & Electronics Engineering (Including lab experiments), by Dr. Neelam Sharma, Dr. A. K. Sharma and Neha Singh, Ashirwad Publications, third edition.

2 SmarajtGhosh, "Fundamentals of Electrical & Electronics Engineering", Second edition, PHI Learning, 2007.
3 Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
4 Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication
5 Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, Wiley India.

2FY3-27: Workshop-Manufacturing Practices

Credit: 1 **Max. Marks: 50 (IA: 30, ETE: 20)**
0L+0T+2P

S.N.	SHOPS	CONTENTS	Hours
1	MACHINE SHOP	Introduction of parts of Lathe Machine, its working principle and tools used in Machine Shop Making Plain turning, Taper turning, Step turning, Facing, Knurling, Drilling, Boring, Mini project – Demonstration of tool layout of different product as per given drawing	**4**
2	FITTING	Introduction of fitting practice and tools used in fitting shop; exercise involving marking, cutting, Fitting practice (Right Angles), tapping practice. Making Square T-Fitting and V- Fitting joints. Mini project – Demonstration of Fitting of different matting parts	**4**
3	CARPENTRY	Various types of timber and practice boards, defects in timber, seasoning of wood; tools, wood operation and various joints; exercises involving use of important carpentry tools to practice various operations and making joints Making T – Lap Joint and Cross Lap Joint. Mini project – Demonstration of different carpentry products	**4**
4	SHEET METAL	Shop development of surfaces of various objects; sheet metal forming and joining operations, joints, soldering and brazing; exercises involving use of sheet metal forming operations for small joints. Making rectangular tray. Mini project - Demonstration of Different sheet metal products	**4**
5	WELDING	Introduction to different welding methods; welding equipment; electrodes; welding joints; welding defects; exercises involving use of gas/electric arc welding. Making butt joint, Lap joint, T- fillet through Arc welding. Mini project - Demonstration of Different	**4**

		welding products	
6	FOUNDARY	Introduction to moulding materials; moulds; use of cores; melting furnaces; tools and equipment used in foundry shops; exercises involving preparation of small sand Moulds and casting. Making the molding and Casting. Mini project - Demonstration of Different casting products	**4**
		TOTAL	**24**

TEXT BOOKS:

1. H. Choudhury, Elements of Workshop Technology, Vol. I, Asia Publishing House, 1986.
2. B.S Raghuvanshi, A course in Workshop Technology volume I & II.

REFERENCES BOOKS:

1 H Gerling, All about Machine Tools, New Age International, 1995.
2 W A J Chapman, Workshop Technology, Oxford IBH, 1975.

2FY9-MC1: Analytical and Logical Thinking Skills

Mandatory- Non-credit course

Credit: 0
Max.Marks:100 0L+0T+2P

S.N.	CONTENTS	Hours
1	**Quantitative Reasoning:** (Permutation and Combination , Number System and Number Series, Remainder theorem and unit digit Concept, HCF and LCM of Numbers, Surds, Numbers And Divisibility, Simplification, Percentage, Average, Ratio and Proportion)	**10**
2	**Reasoning** : Sequences and Series, Coding and Decoding Problems, Calendars and Clocks, Counting of Figures (Square, Triangles, Rectangle etc.), Counting of Straight Lines, Series of Figure, Missing Figures, Mirror Image, Water Image	**10**
	TOTAL	**20**

TEXT BOOKS:

1. Quantitative Aptitude for Competitive Examinations with A Modern Approach to Logical Reasoning R S Agarwal S. Chand Publishing 2018 -2019

2. Quantitative Aptitude for All Competitive Examinations by Abhijit Guha, Publication : TMH
3. Text Book of Quickest Mathematics by Kiran Prakashan

REFERENCES BOOKS:

1. LOGITICA : Improve Your Critical Thinking and Problem Solving Skills: The Brain Behind the Brain Paperback – January 8, 2019 by Neelabh Kumar (Author)
2. Analytical Reasoning by M.K Pandey
3. Verbal and Non-Verbal Reasoning by Dr. RS Agarwal, Publisher : S. Chand

2FY9-MC2: Technical Writing

Mandatory Non-credit course

Credit: 0 **Max. Marks: 100**

(0L+0T+2P)

S. N.	CONTENTS	Hours
1.	**Introduction: objective, scope and outcome of the course.**	1
2.	**Proposals**: Some Preliminaries, Typical Scenarios for the Proposal, Common Sections in Proposals, Organization of Proposals, Format of Proposals, Special Assignment Requirements, Revision Checklist for Proposals.	6
3.	**Progress reports**: Functions and Contents, Timing and Format, Organizational Patterns, Other Parts of Progress Reports, Revision Checklist for Progress Reports.	5
4.	**Recommendation and feasibility reports:** Organizational Plans for Feasibility and Recommendation Reports, Revision Checklist for Feasibility and Recommendation Reports	4
5.	**Researched Reports:** Technical Background Reports, Technical Guides and Handbooks, Primary Research Reports, Technical Specifications, Literature Reviews.	8
	TOTAL	24

TEXT BOOKS:

1. Technical Report-Writing: Methods and Procedures, A.L. Moorthy C.R. Karisiddappa, Ess Ess Publications
2. *Technical Writing Essentials*, Suzan Last, Press books

REFERENCES BOOKS:

1. How to Write Reports and Proposals: Create Attention-Grabbing Documents that Achieve Your Goals, Patrick Forsyth, Kogan Page publishers.
2. **Report Writing,** MICHELLE REID, Red Globe Press.

2FY9-MC3: GUI Programming using Tkinter (Python)

Mandatory Non-credit course

Credit: 0 **Max. Marks: 100**

(0L+0T+2P)

S. N.	CONTENTS	Hours
1.	**Introduction to Programming in Python:** Introduction to Programming in Python: What Is Python? Features of Python, Python environment set up: Installing Python, Running Python, Python Documentation, and Structure of a Python Program Basics of Programming in Python: Input statement, output statement, variables, operators, numbers, Literals, strings, lists and tuples, dictionaries.	1
2.	**Conditionals, Loops and Functions. Conditionals and Loops:** If statement, else Statement, elif Statement, while Statement, for Statement break Statement, continue Statement, pass Statement. Functions: Built-in Functions, User defined functions: Defining a Function, Calling a Function, Various Function Arguments.	6
	Files, Modules and Introduction to Advanced Python Files: File Objects, File Built-in Methods, File Built-in Attributes, Standard Files.	5

3.	Command-line Arguments Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages. Introduction to Advanced Python: Classes and objects declaration, Inheritance, Regular Expressions.	
4.	**Python GUI & CGI Programming and Python database connectivity:** Python GUI Programming (Tinder): Tkinter Programming example, Tkinter widgets, standard attributes, geometry management Python CGI Programming: CGI Architecture, First CGI Program, HTTP Header, CGI Environment Variables, GET and POST Methods, Simple FORM Example: Using GET Method, Passing Information Using POST Method Python database connectivity.	**4**
5.	**PROGRAMMING PROJECTS: sample projects-** **Project #1** is to design a console program in Python that solves a problem. **Project #2** is to design a simple animation program utilizing Python and the Pygame library. **Project #3** is to design a program using Python and the Tkinter graphical user interface library. **Project #4** is to design a fully functional, unique, 2D video game.	**8**
	TOTAL	**24**

TEXT/REFERENCE BOOKS:

1. Core Python Programming Wesley J. Chun Publisher: Prentice Hall PTR First Edition.

2. T. Budd, Exploring Python, TMH, 1st Ed, 2011.

3. Python Tutorial/Documentation www.python.or 2010.

4. Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: learning with Python, available online, 2015.

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2FY9-MC4: Basics of Management

Mandatory Non-credit course

Credit: 0 **Max. Marks: 100**

(0L+0T+2P)

Unit	CONTENTS	Hours
1.	**Nature of Management:** Concept, Significance, Role & Skills, Levels of Management, Concepts of POSDCORB (Planning, Organizing, Staffing, Directing, Coordinating, Reporting and Budgeting). Overview of Decision making, Evolution of Management thoughts, Contribution of F.W Taylor, Henri Fayoland Contingency Approach. Overview of Indian thoughts on Management, Management by Objectives (MBO).	8
2.	**Planning:** Meaning, Importance, Elements and Processes.	4
3.	**Organizing:** Concepts, Structure (Formal & Informal, Line & Staffand Matrix), Meaning, Advantages and Limitations of organizing. Department Process: Meaning, Basis and Significance. Span of Control: Meaning, Factors affecting span of Control, Centralization v/s Decentralization, Delegation: Authority & Responsibility relationship	6
4.	**Directing, Co-ordination and Controlling:** Leading: Concept of leadership, Directing: Meaning and Process, Co-ordination as an Essence of Management, Controlling: Meaning, Process and Technique.	6
5.	**Functional Management:** Introduction to different functional aspects of management-Finance, Operations, Marketing, Human Resource and Strategic Management.	6
	TOTAL	30

Text Books:

1. Koontz & Weihrich, Essentials of Management; Tata Mc Graw Hill.
2. Tripathy & Reddy, Principles of Management; Tata Mc Graw Hill.

Reference Books:

1. Kreitner & Mohapatra, Management; Biztantra.
2. Robbins, Decenzo & Coulter, Fundamentals of Management; Pearson Education.
3. Stoner, Freeman& Daniel R Gilbert, Management; Pearson Education.

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Mini Project Lab (P-2) (II Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Introduction to basic project components.
2	Testing of basic project active and passive components
3	Use of Power Project board, bread board, DC regulated power supply.
4	Use of CRO and function generator
5	Hands-On on Soldering and De-soldering.
6	Software (PCB Wizard and PCB Designing)
7	Diode and Transistor as Logic circuits
8	Use of relay-based circuits
9	Mini Project Assignment 1
10	Mini Project Assignment 2
11	Mini Project Assignment 3
12	Assessment

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Soft Skills (P-2) (II Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	**Soft Skills & their importance:** An introduction to the components of soft-skills Creativity, Self-awareness, Personality development, Communication Skills. Interpersonal Skills, Team Building, Leadership, Time management, Presentation Skills, Stress Management,
2	**Soft Skills & their importance:** Critical thinking skills, Problem solving skills, Decision-making, Employment communication & Workplace etiquette.
3	**Etiquettes for Public Speaking:** Informal versus formal conversations, self-introduction, opening and closing speeches, inviting, thanking, apologizing, giving and taking information. Role of body language, kinesics, proxemics, paralinguistic features of voice dynamics: pitch; intonation; stress & rhythm, chronemics, nuances of speech delivery, effective use of technological or audio-visual aids, delivering presentations, usage of prompts, dealing with questions and interruptions; conversation & dialogues. Building self-awareness, self-esteem & self-management [Through Johari window and other exercises.]
4	**Presentation Skills**: Introduction, difference between oral presentation and written report, analysis of locale; audience; modulating style & content and speaking with confidence.
5	**Presentation in action:** Process, planning, preparing & practicing for delivery of effective presentations.
6	**Presentation in action:** [Preparation, outlining, hints for efficient practice, last minute tasks,
7	**Presentation in action:** means of effective presentation
8	**Presentation in action:** language, gestures, posture, facial expressions, professional attire and delivering a presentation (For practice).
9	**Constructive criticism & steps for improvement:** Self-evaluation, self-criticism, recognition of one's own limits & deficiencies
10	**Constructive criticism & steps for improvement:** identifying the steps for improvement for effective delivery of presentation.

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JIET Universe, N.H. - 62, Mogra, Pail Road, Jodhpur – 342802 (Raj.)

Tel: 0291-2868152/53, *E-mail: info@jietjodhpur.ac.in*Web: www.jietjodhpur.ac.in

2nd Year: Electrical Engineering

III Semester

BSC 3EE2-01	Integral Transforms and Complex Variables	3L:0T:0P= 3 Cr.

Unit 1 - Laplace Transform (10 Hours)

Laplace transform with its simple properties, applications to the Solution of ordinary and partial differential equations having constant coefficients with special reference to wave and diffusion equations.

Unit 2 - Fourier Transform (8 Hours)

Discrete Fourier transform, Fast Fourier transform, Complex form of Fourier transform and its inverse applications, Fourier transform for the solution of partial differential equations having constant coefficients with special reference to heat equation and wave equation.

Unit 3 - Fourier Series (8 Hours)

Expansion of simple functions in Fourier series, half range series, changes of interval, harmonic analysis.

Unit 4 – Function of Complex Variables (8 Hours)

Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy's theorem, Cauchy's integral formula

Unit 5 – Power Series and Theory of Residues (8 Hours)

Taylor's series, Laurent's series, poles, Residues. Evaluations of simple definite real integrals using the theorem of residues. Simple contour integration.

Text Books:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Alan Jeffrey, Advanced Engineering Mathematics, University of Newcastle, Academic Press, Sydney, 2002.
3. John Bird, Higher Engineering Mathematics 5th edition, Elsevier publication, 2006.
4. Bali, Ayengar, A Text book of Higher Engineering Mathematics, 6th Edition Laxmi Publication, 2004.

Reference Books/URL:

1. Brian Davies, Integral Transform and their Applications, 3rd edition, Text in Applied Mathematics, Springer Publication 1978.
2. Jain R.K. and Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
4. Dennis G. Zill, A First Course in Complex Analysis with Applications, Jones and Bartlett publications, London 2003.
5. https://onlinecourses.nptel.ac.in/noc20_ma13/preview

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ESC 3EE3-02	Electrical Power Generation	3L:0T:0P = 3 Cr.

Unit 1 - Conventional Energy Generation Methods (10 hours)

(i) Thermal power plants: Basic schemes and working principle, (ii) Gas power plants: Open cycle and closed cycle gas turbine plants, Combined gas & steam plants-basic schemes, (iii) Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants, (iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

Unit 2 - New Energy Sources (8 hours)

Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming). Renewable and non-renewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.

Unit 3 - Loads and Load Curves (6 hours)

Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization.

Unit 4 - Power Factor Improvement and Power Plant Economics (8 hours)

Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers. Power Plant Economics: Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. Energy cost reduction: off peak energy utilization, co-generation, and energy conservation.

Unit 5 - Tariffs and Selection of Power Plants (10 hours)

Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two-part tariff, power factor dependent tariffs, three-part tariff. Spot (time differentiated) pricing. Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.

Text Books:

1. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication, 7/e, 2017.
2. S. L. Uppal, "Electrical Power", Khanna Publishers.
3. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co., 2008.
4. V. K. Mehta, Principles of Power system (3/e), S. Chand Publication

Reference Books/URL:

1. L. ElgerdOlle, Electric Energy Systems Theory, PHI

2. C. A. Gross, Power System Analysis, TMH
3. P.S.R. Murthy, "Operation and control of Power System", CRC Press, 2/e, 2011.
4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
5. https://nptel.ac.in/courses/112/107/112107291/

PCC 3EE4-03	Electromagnetic Field Theory	3L:0T:0P= 3 Cr.

Unit 1 - Review of Vector Calculus (7 hours)
Vector algebra-addition, subtraction, components of vectors, scalars and vector multiplication, triple products, three orthogonal coordinate system, (rectangular, cylindrical and spherical). Vector calculus, vector operator, divergence and curl: integral theorems of vectors. Conversion of vector from one coordinate system to another.

Unit 2 - Static Electric Field and Conductors, Dielectrics and Capacitance (13 Hours)
Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation.

Unit 3 - Static Magnetic Fields and Magnetic Forces (9 Hours)
Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions.

Unit 4 - Time Varying Fields and Maxwell's Equations (7 Hours)
Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary conditions.

Unit 5 - Electromagnetic Waves (6 Hours)
Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text Books:
1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.
3. Plonsey, R. and Collin, R. E., "Principles and applications of Electromagnetic Fields", McGraw Hill, 1961.

4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.

References Books/URL:

1. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
2. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
3. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
2. 4 . E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
3. 5. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
4. https://nptel.ac.in/courses/108/104/108104087/
5. https://nptel.ac.in/courses/108/106/108106073/
6. https://nptel.ac.in/courses/117/103/117103065/
7. https://nptel.ac.in/courses/115/101/115101005/

PCC 3EE4-04	Analog Electronics	3L:0T:0P= 3 Cr.

Unit 1 – Diode Circuits (7 Hours)

Formation and operation of P-N Junction Diode, I-V characteristics of an ideal and a practical junction diode, clipping circuits and clamping circuits, a review of half-wave and full wave rectifiers, Zener diodes and voltage regulation using Zener diodes.

Unit 2 - BJT Circuits (9 Hours)

Structure, formation, current components in a BJT, CE, CB and CC configurations and I-V characteristics of a BJT, Current Gains: alpha, beta and gamma, BJT as a switch, biasing techniques, BJT as an amplifier without and with negative feedback, small-signal model and equivalent circuits, DC & AC load line and DC & AC analysis of single stage BJT amplifiers in various configurations.

Unit 3 – JFET & MOSFET Circuits (8 Hours)

Classification of FET, Construction and operation of JFET, MOSFET- Depletion type and Enhancement type, JFET as voltage variable resistor, MOSFET as a switch, MOSFET as an amplifier, common-source, common-gate and common-drain amplifiers; small signal model of MOSFET–determination of gain, input, output impedances and trans-conductance.

Unit 4 – Multi-stage transistor amplifiers and oscillators (8 Hours)

Analysis of differential amplifier using BJT in CE configuration, direct coupled and RC coupled multi-stage BJT amplifiers-need and concept of operation, Oscillators-concept of positive feedback, Barkhausen criterion, types of oscillators-tuned circuit oscillators and RC oscillators.

Unit 5 – Operational amplifiers and their applications (10 Hours)

Internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp(Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product), idealized analysis of op-amp circuits, Applications of op-amp: Inverting and non-inverting

amplifier, differential amplifier using op-amp, comparator, summing amplifier, differentiator, integrator, zero crossing detector, square-wave and triangular-wave generator, precision rectifier and peak detector using op-amp.

Text books:

1. R. L. Boylestad, Louis Nashelsky, Electronic Devices & Circuit theory, Pearson Education, 2007.
2. S. Salivahanan, N. Suresh Kumar, Electronic Devices & Circuit, 4th Edition, TMH, 2017.
3. A. S. Sedra and K. C. Smith, Microelectronic Circuits, 8th Edition, OUP, 2020.
4. Ramakant A. Gayakwad, Op-Amp & Linear Integrated Circuits, 3rd Revised edition Prentice-Hall, 1993.

Reference books/ URLs:

1. David Bell, Electronic Devices & Circuits, Oxford Publications, 2010.
2. Millman, Electronics Devices and Circuits, 4th Edition, TMH, 2015.
3. Millman Halkias, Integrated Electronics, TMH, 2002.
4. Cathey, Electronics Devices and Circuits, 3rd Edition, TMH, 2017.
5. A. S. Sedra and K. C. Smith, Microelectronic Circuits, 8th Edition, OUP, 2020.
6. Albert Malvino, Electronics principles, 7th, McGraw Hill Education, 2006.
7. Donald I. Schilling, Electronic Circuit Discrete and Integrated, 3rd revised edition, McGraw-Hill Inc., 1989.
8. https://nptel.ac.in/courses/117/103/117103063/
9. https://onlinecourses.nptel.ac.in/noc21_ee55/preview

PCC 3EE4-05	Electrical Circuit Analysis & Synthesis	3L:0T:0P= 3 Cr.

Unit 1 - Network Parameters and Network Theorems (10 Hours)

Ideal and practical voltage and current sources, Node and Mesh Analysis, Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources.

Unit 2 - First and Second order networks (10 Hours)

Solution of first and second order differential equations for Series and parallel R-L, R-C, RLC circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response. Analysis of simple circuits with non-sinusoidal excitation.

Unit 3 - Polyphase Circuits (6 Hours)

Analysis of three phase three wire and three phase four wire balanced and unbalanced circuits with symmetrical supply, Individual phase power factor and overall power factor, Measurement of active and reactive power in three phases balanced and unbalanced systems.

Unit 4 - Two Port Network and Network Functions (8 Hours)

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

Unit 5 – Filters (8 Hours)

Constant K filters. The m-derived filter. Image impedance of m-derived half (or L) sections, composite filters. Bands pass and band elimination filters. The problem of termination, lattice filters. Introduction to active filters.

Text Books:

1. K.M. Soni, "Network Analysis and Synthesis", S K Kataria and Sons, 1 January 2013.
2. Ravi Raj R. Singh, "Network Analysis and synthesis", McGraw Hill Education, 2007.
3. M. E. Van Valkenburg, An Introduction to Modern Network Synthesis, Wiley Eastern, 2014
4. Nagsarkar & Sukhija, Circuits & Networks, Oxford- 2011
5. A. Anand Kumar, "Network Analysis and Synthesis," PHI publication, 2019.

References Books/URL:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
4. Franklin F. Kuo, "Network Analysis and Synthesis," Wiley India Education, 2nd Ed., 2006.
5. Van, Valkenburg, "Network analysis," Pearson, 2019.
6. Sudhakar, A., Shyammohan, S. P., "Circuits and Network," Tata McGraw-Hill New Delhi, 1994.
7. A William Hayt, "Engineering Circuit Analysis," 8th Edition, McGraw-Hill Education.
8. https://nptel.ac.in/courses/108/105/108105159/

PCC 3EE4-06	DC Machines and Transformers	3L:0T:0P= 3 Cr.

Unit 1- Basics of magnetic circuits (6 Hours)

Introduction to magnetic circuits- mmf, magnetic field intensity, permeability, reluctance, permeance, magnetic flux, magnetic flux density, calculation of ampere- turns, comparison between magnetic and electric circuits, series and parallel magnetic circuits, leakage flux and fringing, B-H curve, hysteresis, induced emf, practical magnetic circuits, permanent magnet and their applications, Review of Ampere Law and Biot-Savart Law

Unit 2 - Electromagnetic force and torque (7 Hours)

Flux-linkage v/s current characteristic of magnetic circuits, linear and nonlinear magnetic circuits, energy stored in the magnetic circuit, force as a partial derivative of stored energy with respect to position of a moving element, torque as a partial derivative of stored energy with respect to angular position of a rotating element.

Unit 3 - DC Generators (8 Hours)

Introduction, construction features, armature and field windings, lap and wave windings, emf equation, armature reaction, commutation, methods of improving commutation, equalizer rings, demagnetizing and cross- magnetizing ampere- turns, operating characteristics of DC generator, voltage build up, critical field resistance and critical speed, losses and efficiency, condition for maximum efficiency, applications.

Unit 4 - DC Motors (9 Hours)

Introduction, principle of operation, types, equation of back emf, equation of torque, characteristics of shunt, series and compound motors, Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series, Speed control methods, basic idea of solid state devices in speed control, starting methods, braking methods, losses and efficiency, condition for maximum efficiency, load test and back-to-back test, applications.

Unit 5 - Transformers (12 Hours)

Introduction, constructional features, principle of operation of single-phase transformers, emf equation, equivalent circuits, phasor diagrams, voltage regulation, losses and efficiency, condition for maximum efficiency. Open and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses. Autotransformers - construction, principle, applications and comparison with two winding transformer, Three- phase transformer-construction, types of connection and their comparative features, parallel operation, magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, phase conversion - Scott connection, three-phase to six-phase conversion.

Text Books:

1. Husain Ashfaq, Electrical Machines, Dhanpat Rai & Sons
2. Kothari & Nagrath, Electric Machines, 3/e, TMH
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. J. B. Gupta, "Electrical Machines-I", Katson Books.

Reference Books/URL:

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. https://nptel.ac.in/courses/108/105/108105155/

PCC 3EE4-21	Analog Electronics Lab	0L:0T:2P= 1 Cr.

1) To study the following apparatus: (a) Digital multimeter (b) Function generator, (c) Regulated DC power supply and (d) Study of CRO and DSO (measurement of time period, amplitude and frequency for an input signal), and explore their utility in the laboratory as input, output and measuring devices.
2) To study and implement the application circuits of Diode as clippers & clampers: unbiased-series and shunt clippers, biased-series and shunt clippers, unbiased clampers, biased clampers and double-ended clippers & to plot their output waveforms.

3) To study the operation of Zener diode as series and shunt voltage regulator and to measure line and load regulation and ripple factor.
4) To plot the gain-frequency characteristics of BJT amplifier in common emitter configuration and to determine the bandwidth, gain bandwidth products & gain at 1 kHz without and with negative feedback.
5) To plot the gain-frequency characteristics of FET amplifier in common source configuration and to determine the bandwidth, gain bandwidth product & gain at 1 kHz.
6) To implement the circuit of Hartley oscillator, calculate the resonant frequency of oscillation and observe the effect of variation of C on oscillator frequency.
7) To implement the circuit of Colpitts oscillators, calculate the resonant frequency of oscillation and observe the effect of variation of C on oscillator frequency.
8) To implement the circuit of transistor RC- phase shift oscillator, calculate the resonant frequency and observe the effect of variation in R & C on oscillator frequency and compare with theoretical values.
9) To implement the following circuits using op-amp and plot their input versus output waveforms: a) non-inverting amplifier, b) inverting amplifier and c) summing amplifier.
10) To implement the following circuits using op-amp and plot their input versus output waveforms: a) differentiator and b) integrator.

Reference Books:

1. Millman Halkias, Integrated Electronics, TMH, 2002.
2. R. L. Boylestad, Louis Nashelsky, Electronic Devices & Circuit theory, Pearson Education, 2007.
3. David Bell, Electronic Devices & Circuits, Oxford Publications, 2010.
4. Millman, Electronics Devices and Circuits, 4th Edition, TMH, 2015.

PCC 3EE4-22	Electrical Circuit Lab	0L:0T:2P= 1 Cr.

1) To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law in DC circuits.
2) To verify Thevenin's and Norton's theorem in DC circuits.
3) To verify Superposition theorem in DC circuits.

4) To understand the concept of Maximum Power Transfer Theorem to the network consisting of a fixed internal resistance R_S and a variable load resistance R_L and if maximum power is drawn by the network, then it is to be proved that $R_L = R_S$.
5) To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law in AC circuits.
6) To verify Thevenin's and Norton's theorem in AC Circuit.
7) To verify Superposition theorem in AC circuits.
8) To verify the resonance condition for RLC series and parallel circuits.
9) To measure the power factor, inductance and inherent resistance of a given choke coil.
10) To measure the active power consumed by a 3 phase load, using 1 wattmeter, 2 wattmeter and three wattmeter method.
11) To determine the Z and Y parameters of a Two-port network.
12) To design the active filters circuits viz. low pass filter and high pass filter, band pass filter and band reject filter.

Reference Books:

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

PCC 3EE4-23	DC Machines and Transformers Lab	0L:0T:2P= 1 Cr.

1) Control the speed of DC shunt motor below rated speed using armature voltage control method and above rated speed using field current control method. Obtain the graph showing the curve between speed v/s field current and speed v/s armature voltage. Comment upon the results.
2) Determine the efficiency of a DC shunt motor at no load by performing Swinburne's test. Also determine the efficiency of the motor at quarter load, half load, full load and 1.25 times full load. Obtain the graph showing the curve between efficiency v/s load. Comment upon the results.
3) Control the speed of DC shunt motor above and below rated speed in forward as well as reverse directions using Ward– Leonard method. Obtain the graph showing the curve between

speed v/s field current and speed v/s armature voltage in both forward and reverse directions. Comment upon the results.

4) Determine the efficiency of two identical DC shunt machines by considering one machine as motor and another as generator by coupling both mechanically and electrically in parallel using Hopkinson's test. Obtain the graph between efficiency v/s load current for both machines. Comment upon the results.

5) Determine the shunt and series parameters of single- phase transformer using:

(a) Open Circuit Test at rated voltage keeping HV winding open

(b) Short Circuit Test at rated current keeping LV winding short

Draw the equivalent circuit of the given single- phase transformer. Also, evaluate its voltage regulation and efficiency. Comment upon the results.

6) Determine the efficiency and voltage regulation of a single- phase transformer at rated voltage by increasing the load current from no load to rated full load. Obtain the graph between efficiency v/s load current. Comment upon the results.

7) Separate hysteresis and eddy current losses in a single- phase transformer by varying the supply voltage and frequency such that the ratio V/f remains constant. Obtain the graph between input power divided by frequency v/s frequency. Comment upon the results.

8) Perform Sumpner's test (Back to Back test) on two identical single- phase transformers at rated voltage and rated current in order to determine the efficiency, maximum efficiency and series & shunt parameters. Also, obtain the graph between efficiency v/s load. Comment upon the results.

9) Connect two identical single- phase transformers in parallel with proper polarity in order to study the load sharing between the two machines.

10) Perform heat run test on a three- phase transformer and calculate the final steady state temperature rise and time constant. Also obtain the graph between temperature rise v/s time. Comment upon the results.

11) Transform three-phase ac supply to two-phase ac supply by employing two identical single-phase transformers using Scott connection (T-T connection).

Reference Books:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

ESC 3EE4-24	Electronic Circuit Design Lab	0L:0T:2P= 1 Cr.

1) Introduction to Datasheet reading of various electronic components(PN Diode, Zener Diode, Fast switching Diode, BJT, MOSFET, IC- 7805, IC- LM 317T, IC- 555, LDR, Thermistor, etc.)
2) Introduction to Soldering – De-soldering process & tools and the method of PCB fabrication.
3) To observe the characteristics of half wave and full wave rectifier circuits with and without filters on Bread Board and PCB. Calculate the performance parameters (ripple factor, rectification efficiency) of the circuit.
4) Design a fixed DC power supply using IC 78xx (both positive & negative voltage) and observe the effect of various parameter used in the circuit. Validate it on Bread Board and PCB.
5) Design a variable voltage power supply using LM317T IC and observe the effect of various parameter used in the circuit. Validate it on Bread Board and PCB.
6) Design a timer circuit for operating a DC motor using 555 Timer IC in astable mode.
7) Design a circuit to build a motion detection circuit using 555 Timer IC in monostable mode.
8) Design a circuit for Automatic Street light control using LDR & Relay and validate on Bread Board or PCB.
9) Design a circuit of a temperature control DC fan using Op amp IC and thermistor on breadboard and PCB.
10) Design a battery voltage level indicator circuit using dot/ bar display driver - LM3914 IC and validate it on Bread Board and PCB.

Reference Books:

1. A. S. Sedra and K. C. Smith, " Microelectronic circuits" , Oxford University Press, 2007.
2. P. Horowitz and W. Hill, " The Art of Electronics" , Cambridge University Press, 1997.
3. H.W.Ott, " Noise Reduction Techniques in Electronic Systems" , Wiley, 1989.
4. W.C. Bosshart, " Printed Circuit Boards: Design and Technology" , Tata McGraw Hill, 1983.

5. G.L. Ginsberg, " Printed Circuit Design" , McGraw Hill, 1991. Simon Monk, Programming Arduino: Getting Started with Sketches, McGraw-Hill Education TAB, 2ndEdition.
6. M. Sharma, 555 Timer and its Applications, BPB Publications

MC 3EE9-MC1	Managerial Economics And Financial Accounting	Mandatory Non- Credit Course

Unit 1 - Introduction and Demand Analysis
Basic economic concepts: Economy- Meaning and types- Capitalist, Socialist and Mixed Economy. Economics- Meaning, Definition of economics and Nature and scope of economics, Economic problems: scarcity and choice. Nature and scope of economics, Meaning of Firm, Industry and Joint stock company. Demand analysis -Demand- Meaning & types of demand, determinants of demand, demand function, Law of Demand, Elasticity of demand.

Unit 2 - Supply analysis
Supply- Meaning and definition, determinants of supply, supply function, Law of supply, Elasticity of supply.

Unit 3 - Production and Cost analysis
Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, iso-quants. Cost and revenue concepts, Break- Even Point analysis.

Unit 4 - Market structure and pricing theory
Price and output determination under Perfect competition and Monopoly competition.

Unit 5 - Financial Accounting
Trading Account and related concepts, profit and loss Account and related concepts, Balance sheet and related concepts and simple problems. capital budgeting techniques- Pay- back period, Net present value, Internal Rate of Return and Average Rate of Return.

Text Books:
1. Samuelson,Paul A and Nordhaus, William. D. Economics, McGraw Hill (2009)
2. Krugman,Paul and Wells Robin, Economics, W.H. Freeman and co. ltd. Fourth edition.(2015)
3. Salvatore,D. and Srivastav,R, Managerial economics: Principles and worldwide applications, Oxford University press, sixth edition, (2008).
4. Pindyck,R.S and Rubinfeld, D.I, Microeconomics, Mcmillan(2007)
5. Prasanna Chandra, Fundamentals of financial management, Tata mc Graw Hill Publishing ltd., fourth edition

References books:
1. Managerial Economics and Financial Accounting- Prof. B. K. Garg, Dr. Kusumlata Bhardwaj, Dr. Surbhi Garg, Ashirwad's Publication
2. Business Economics- Prof. M.D.Agarwal and Prof. Som deo
3. Business Economics- Saraswat, Lodha and Sharma
4. Financial Accounting- prasan chand
5. Accounting for managers- Prof. J. J.Kuppapalli

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COMMUNICATION SKILLS

VERBAL COMMUNICATION SKILL UPGRADATION

PROGRAMME (PROGRESSIVE LEARNING)

Units	Literary Activities	Process *	Methodology	Hours
1	a) Ice breaking activities viz. Introducing oneself b) Common Mistakes and their remedies while speaking/writing **AUXILIARY:** • **Video recording of self-introduction.** • **Explanation of structure of a sentence.** • **Make sentences out of jumbled words.** • **Discussion of various types of sentences.** • **Spell-bee**	(i) In the first turn, each student will introduce himself/ herself (ii) Sentence-making on given words (iii) Speaking the sentence	**Teaching-20 minutes** **Writing- 10 minutes** **Speaking (Practice) -20 minutes** **Writing- 20 minutes** **Corrective Speaking - 30 minutes** **Assignment-for next turn- 20 minutes**	**06**
2	Understanding and Writing Technical Concepts	(i) Read, understand and explain examination questions (ii) Study, write and present answers	**Teaching-20 minutes** **Read, understand and write the question-15 minutes** **Explain - 20 minutes** **Study and write answers (Team)- 15 minutes** **Presentation (Team) – 30 minutes**	**04**

			Assignment-for next turn- 20 minutes	
3	Listening, writing and presenting (Student will use his mobile & earphones to listen an interesting narrative and reproduce it) AUXILIARY: • Practice pronunciation of some complex words. • Pictionary (To interpret an image and write sentences based on that). • News-paper article reading/ news reporting. • Discussion on some commonly used sentences. • Framing of questions from a given paragraph or comprehension passage.	(i) Listening, understanding and reproducing a narrative (ii) Discussing and presenting ideas on the given topic	**Teaching-20 minutes** **Listening and Writing- 20 minutes** **Presentation -20 minutes Design a group discussion and practice (Team)- 20 minutes** **Presentation (Team) – 20 minutes Assignment-for next turn- 20 minutes**	**02**

4	Email writing and then speaking about what he has written AUXILIARY: • Usage of Riddles, idioms and paraphrases.	(i) Writing email on given topic and then presenting it.	**Teaching-20 minutes** **Writing- 10 minutes** **Explanation (Practice) - 20 minutes** **Corrective Writing(Team)- 10 minutes** **Corrective Speaking (Team)- 10 minutes** **Presentation (Team) – 30 Minutes** **Assignment-for next turn- 20 minutes**	**04**
5	Group Discussion	(i) The students will write on the topic given (on previous turn) and present it. (ii) Each team (having 4 students) will discuss on the given topic and then present it.	**Teaching-20 minutes** **Presentation -20 minutes** **Design a group discussion and practice (Team)- 20 minutes** **Presentation (Team) – 20 minutes** **Open discussion-20 minutes** **Assignment-for next turn- 20 minutes**	**2**
6	Extempore AUXILIARY: • Learn about body language and usage of stage. • Nukkad-natak	(i) The students will write on the topic given instantaneously and present it. (ii) The same procedure to be repeated for another topic.	**Teaching-10 minutes** **Writing -10 minutes** **Presentation- 20 minutes** **Corrective Writing (Team)- 10 minutes** **Corrective Speaking (Team)- 10 minutes** **Writing -10 minutes**	**2**

	• Short power-point presentation (3-4 slides) on given topic. • Subject-topic based presentation. • Poem recitation.		**Presentation- 20 minutes** **Corrective Writing (Team)- 10 minutes** **Corrective Speaking (Team)- 10 minutes** **Assignment-for next turn- 10 minutes**	
7	Telephonic conversation	(i) Formation of a team of 2 members (one customer and other Customer Care Person) and decide their domain. (ii) Actual conversation between the team members	**Teaching-10 minutes** **Discussion and Writing - 20 minutes** **Conversation- 40 minutes** **Assignment-for next turn- 10 minutes**	**2**
8	Writing a story from a given visual and the narrating it in front of other students AUXILIARY: • To draft the plot of any web-series / movie/ short story.	(i) A visual would be displayed to all students. (ii) Each student would write a short story on it and then present it.	**Teaching-10 minutes** **Writing- 15 minutes** **Speaking (Practice) -20 minutes** **General Discussion on common mistakes- 10 minutes** **Writing- 15 minutes** **Speaking (Practice) -20 minutes** **General Discussion on common mistakes- 10 minutes** **Assignment- 20 minutes**	**2**
		TOTAL		**24**

* **<u>WORDMANIA (To enhance the vocabulary) - At the beginning of each session.</u>**
* AUXILIARY portions could be taken up depending on the level of the students, their interest and as and when time permits.

JODHPUR INSTITUTE OF ENGINEERING & TECHNOLOGY

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Tel: 0291-2868152/53, *E-mail: info@jietjodhpur.ac.in*Web: www.jietjodhpur.ac.in

VERBAL COMMUNICATION: SKILL UPGRADATION PROGRAMME
(ROADMAP FOR EXPERIENTIAL LEARNING)- 12 Hours

ROLE PLAY

Session No.	ACTIVITY
1	Formation of teams of 2 members each, from the entire batch.
	Explanation of the scope of work to be done during the current and upcoming sessions; by the teacher/instructor; highlighting the importance of Role Play in the final play to be presented towards the end of the sessions, progressively incrementing the number of students in each group. (To begin with, the team size will be 2, and as the sessions progress the team size would increase by clubbing of the groups.)
	Stage 1 (With team size= 2): Identification of theme and topics for the Role play on the basis of suggestions by the teacher and those proposed by the students.
	General discussion regarding the do's and the don'ts of role play and the various steps: 1. Writing the script of the play. 2. Practice the dialogues with appropriate expressions. 3. To maintain the time and space coordination. 4. To work on synchronization as a team. 5. Do the rehearsal of the play.
2	Performance of the mini-play by each team with the usage of all the audio-visual support systems.
	Incrementing the team size. (Clubbing of two teams for the next stage.)
3	**Stage 2 (With team size= 4):** Performance of the mini-play by the new teams with all the audio-visual support systems (competition mode).
	Formation of teams for the next turn. (By clubbing two/ three teams)
4	Preparation for mini play by each team.
5	Enacting of play by each team (Competition mode). [/ Interaction with Technical expert from theatre so as to get more insights into the performance of the play.]
6	Interaction with Technical expert from theatre so as to get more insights into the performance of the play.

7	Stage 3 (With the complete batch working as a team): Finalization of the main play, assignment of duties and roles to all the team-members. Discussion on further planning and chalk-out the time frame-based plan regarding preparation for the upcoming sessions: 1. Completion of the final script. 2. Practice the dialogues with appropriate expressions. 3. To maintain the time and space coordination. 4. To work on synchronization as a team. 5. Do the rehearsal of the play
8	Preparation of the final script of the main play and dialogues as per the flow.
9	Stage 4: Final Practice Sessions Practice session-1
10	Practice session-2
11	Stage 5: Final Rehearsal Sessions using appropriate dresses, props and auxiliary items. Dress rehearsal Session -1
12	Dress rehearsal Session -2
13	Final enacting of the play amidst audience where the performance would be judged.

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Tel: 0291-2868152/53, *E-mail: info@jietjodhpur.ac.in*Web: www.jietjodhpur.ac.in

2nd Year: Electrical Engineering
IV Semester

BSC 4EE2-01	**Numerical Methods and Applied Statistics**	**3L:0T:0P= 3 Cr.**

Unit 1 - Interpolation and Numerical Solution of Equations (8 hours)

Forward backward and central difference. Newton's forward and backward differences interpolation formulae. Sterling's formulae, Lagrange's interpolation formula. Solution of non-linear equations in one variable by Newton Raphson and Simultaneous algebraic equation by Gauss and Regula Falsi method. Solution of simultaneous equations by Gauss elimination and Gauss Seidel methods. Fitting of curves (straight line and parabola of second degree) by method of least squares.

Unit 2 - Numerical Differentiation & Integration (11 hours)

Numerical differentiation, numerical integration trapezoidal rule, Simpson's one-third and one eighth rule. Numerical Integration of ordinary differential equations of first order, Picard's method, Euler's & modified Euler's methods. Miline's method and Runga Kutta fourth order method. Simple linear difference equations with constant coefficients.

Unit 3 - Calculus of Variation (7 hours)

Functional, strong and weak variations, simple variation problems, Euler's equation

Unit 4 - Statistics & Probability (8 hours)

Elementary theory of probability, Baye's theorem with simple applications, Expected value, variance and moments. Theoretical probability distributions – Binomial, Poisson and Normal distributions.

Unit 5 - Correlation, Regression & Z Transforms (8 hours)

Lines of regression, co-relation and rank correlation. Fitting of curves (straight line and parabola of second degree) by method of least squares. Z-transforms, its inverse, simple properties and application to difference equation.

Text Books:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Alan Jeffrey, Advanced Engineering Mathematics, University of Newcastle, Academic Press, Sydney, 2002.
3. John Bird, Higher Engineering Mathematics 5th edition, Elsevier publication, 2006.
4. Bali, Ayengar, A Text book of Higher Engineering Mathematics, 6th Edition Laxmi Publication, 2004.

Reference Books/URL:

1. Jain R.K. and Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Srimantha Pal and Bhunia, S.C, Engineering Mathematics, Oxford University Press, 2015.
3. R. W. Hamming, Numerical Methods for scientist and engineers, McGraw Hill Book Company Inc. London, 1962.

4. W.J. Decoursey, Statistics and Probability theory for engineering applications, Newnes, Elsevier pub., 2003.
5. https://onlinecourses.nptel.ac.in/noc20_ma13/preview

ESC 4EE3-02	Measurement & Instrumentation	3L:0T:0P= 3 Cr.

Unit - 1 Measuring Instruments (12 hours)

Introduction, Methods of Measurement, Analog Instruments- Brief introduction of moving coil, moving iron, electro-dynamic and induction instruments-construction, working principle, torque equation, limitation of analog instruments. Digital Measurement of Electrical Quantities- Concept of digital measurement, Block diagram, SAR & Ramp type Analog to digital converter, Frequency meter, Digital voltmeter, Power analyzer, LCR meter and digital energy meter. Error Analysis: Classification of errors, limiting error & numerical.

Unit - 2 Instrument Transformers (6 hours)

Construction, operation of current and potential transformers. Expression of Ratio and phase angle errors and their minimization techniques. Application of CTs and PTs.

Unit - 3 Potentiometers (8 hours)

Construction, operation and standardization of DC Crompton potentiometers. Use of Crompton potentiometer for measurement of resistance, calibration of voltmeter and ammeter. Construction, operation and standardization of AC potentiometer – Polar Potentiometer & Gall Tinsley potentiometer. Applications of AC potentiometers.

Unit - 4 Measurement of Resistances (8 hours)

Classification of resistance, Measurement of medium resistances – ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances – Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Price's Guard wire method. Measurement of earth resistance.

Unit - 5 AC Bridges (8 hours)

Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. De Sauty bridge for capacitance measurement. Wien's bridge for capacitance and frequency measurements. Wagner earth device.

Text Books:

1. A K Sawhney, "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Co. (P) Limited (1 January 2015).
2. J. B. Gupta, "Electronics Measurements and Instrumentation", S.k. Kataria & Sons. Edition: 5, Year: 2015 ISBN: 8188458260

3. EW Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", AW Wheeler & Co. Pvt. Ltd. India
4. R.K.Rajput, "Electrical measurements and measuring instruments", S. Chand Publications.

References Books/URL:

1. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
2. M. Stout , "Basic Electrical Measurement", Prentice Hall of India
3. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
4. BC Nakra& K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2ndEdition
5. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH.
6. https://nptel.ac.in/courses/108/105/108105153/

PCC 4EE4-03	Signals & Systems	3L:0T:0P= 3 Cr.

Unit 1 - Introduction to Signals and Systems (14 hours)

Signals and Systems seen in everyday life and in various branches of engineering and science. Definition of signal, Signal properties and classification. Some special signals: the unit step signals, the unit impulse the sinusoid, the complex exponential, Definition of system. System properties and classification. Continuous time and discrete time LTI System, impulse and step response, convolution, block diagram representation of system through differential and difference equation

Unit 2 - Laplace transform and Z transform (9 hours)

Definition of Laplace transform for continuous time signals, ROC of Laplace transform, properties of Laplace transform, system function, solution of differential equations and system behavior. The z-transform for discrete time signals and systems, system functions, properties of z- transform, poles and zeros of systems and sequences, z-domain analysis.

Unit 3 - Fourier analysis (9 hours)

Fourier series representation of continuous time and discrete time signal. Calculation of Fourier coefficient. Continuous time and discrete time Fourier transform and their properties. Transfer function analysis of system using Fourier transform.

Unit 4 - State-space representation of system (5 hours)

State space analysis, Multi-input multi-output representation. State transition matrix and its Role.

Unit 5 - Sampling and Reconstruction (5 hours)

The sampling Theorem and its implications, spectra of sampled signals. Reconstruction: ideal interpolation, zero-order hold, first-order hold. Aliasing and its effects.

Text Books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
3. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

Reference Books/ URL:

1. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
2. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.
4. https://nptel.ac.in/courses/108/104/108104100/
5. https://nptel.ac.in/courses/117/101/117101055/
6. https://nptel.ac.in/courses/108/106/108106163/

PCC 4EE4-04	Induction and Synchronous Machines	3L:0T:0P= 3 Cr.

Unit 1 - Fundamentals of AC machine windings (9 Hours)

Introduction, physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch and short- pitch coils, concentrated and distributed windings, winding axis, 3D visualization of the above winding types, generated emf in full- pitched and short- pitch coils, emf polygon, distribution factor, pitch factor, winding factor, elimination of harmonics, mmf produced by distributed and concentrated windings.

Unit 2 – Three- phase Induction Motors (11 Hours)

Introduction, rotating magnetic field, construction, types, principle of operation, speed and slip, rotor frequency, voltage, current, power, torque, starting and maximum torque, torque- slip characteristics, equivalent circuit. phasor diagram, losses and efficiency, power flow diagram, no- load and blocked rotor test, methods of starting, braking and speed control, double- cage induction motors, cogging and crawling, applications.

Unit 3 - Single-phase Induction Motors (6 Hours)

Introduction, constructional features, revolving field theory, equivalent circuit, torque and power equations, determination of parameters. starting methods, maximum starting toque conditions, applications.

Unit 4 – Three- phase Synchronous Generators (10 Hours)

Introduction, advantages of rotating field system, constructional features, types, principle of operation, excitation system, flux and mmf phasor, armature reaction, generated emf, phasor diagram, open circuit and short circuit characteristics, zero power factor characteristics and

Potier triangle, voltage regulation, two- reaction theory of salient- pole machines, phasor diagram, power- angle characteristics, parallel operation, synchronization and load sharing.

Unit 5 – Three- phase Synchronous Motors (6 Hours)
Introduction, construction, principle of operation, equivalent circuit, phasor diagram, torque, power flow equations, effect of varying field current, effect of load changes, starting methods, V-curves and inverted V- curves, hunting, synchronous compensators, applications of synchronous motors.

Text Books:
1. Husain Ashfaq, Electrical Machines, Dhanpat Rai & Sons
2. Kothari & Nagrath, Electric Machines, 3/e, TMH
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. J. B. Gupta, "Electrical Machines-II", Katson Books.

Reference Books:
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. https://nptel.ac.in/courses/108/105/108105131/

PCC 4EE4-05	Microprocessor and Computer Architecture	3L:0T:0P= 3 Cr.

Unit 1 - Introduction to 8085 Microprocessor Architecture (10 Hours)
CPU, address bus, data bus and control bus, Input/output devices, buffers, encoders, latches and memories. Internal Data Operations and Registers, Pins and Signals, Architecture of 8085, Peripheral Devices and Memory Organization, Interrupts: Interrupt classification, structure, interrupt related instructions.

Unit 2 - 8085 Microprocessor Instructions (7 Hours)
Classification of instructions: Operations performed by instructions, length of instruction bytes, and addressing modes, Timing Diagrams, Counters & Timers, Programming and Debugging.

Unit 3 – 16 and 32 bit microprocessors (7 Hours)
Register sets in 80x80 microprocessor, Programming model, 80x86 Architecture, Concurrent operation of EU and BIU, Memory Segmentation, Pipelining, Addressing modes of 80x86, Instruction set of 80x86, IA – 32 and IA – 64.

Unit 4 - Interfacing IC (8 Hours)
Programmable Interrupt Controller (8259), DMA Controller (8257), Programmable Peripheral Interface (8255), Programmable Interval Timers (8253) chips and their applications, Keyboard and display interface (8279).

Unit 5 - Introduction to Computer Architecture (10 Hours)

Computer architecture and function of general computer system, CISC vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation, Control unit operation.

Memory Classification- volatile and non-volatile memory, primary and secondary memory, static and dynamic memory, Memory organization, System memory, Cache memory - types and organization, Virtual memory and its implementation, Magnetic Hard disks and Optical Disks.

Text Books:

1. R. S. Gaonkar, Microprocessor Architecture, programming and Applications with the 8085, Pen Ram International Publishing 5th Ed.
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, The 8051 Microcontroller and Embedded Systems, Using Assembly and C, Pearson Education, 2007.
3. Computer Organization and Architecture – Designing for Performance by W Stallings – Pearson
4. Computer Architecture and Organization by J P Hayes – McGraw-Hill
5. Douglas V. Hall, Microprocessors and Interfacing, Revised Second Edition (SIE), MGH.
6. B. Ram, Advanced Microprocessor & Interfacing. MGH.

Reference Books/URL:

1. K. J. Ayala ,8051 Microcontroller, Delmar Cengage Learning, 2004
2. Ray. A. K. & Burchandi, K. M.: Advanced Microprocessors and Peripherals, Architecture, Programming and Interfacing, MGH.
3. M. Rafiquzzaman, Microprocessors-Theory and applications, PHI
4. Computer Organization and Design – The Hardware/Software Interface (ARM Edition) by D A Patterson and J L Hennessy – Morgan Kaufmann.
5. Structured Computer Organization by A S Tennenbaum – Prentice Hall
6. Computer Organization by Carl Hamacher, Zvonko Vranesic and Safwat Zaky – McGraw Hill
7. Computer Architecture – A Quantitative Approach by D A Patterson and J L Hennessy – Morgan Kaufmann.
8. https://nptel.ac.in/courses/108/105/108105102/
9. https://nptel.ac.in/courses/106/102/106102062/

PCC 4EE4-06	Digital Electronics	3L:0T:0P= 3 Cr.

Unit 1 - Fundamentals of digital systems and logic families (9 Hours)

Digital signals, digital circuits, Number systems-binary, signed binary, octal, hexadecimal number systems & their interconversions. Logical operators & logic gates: AND, OR, NOT, NAND, NOR and Exclusive-OR operations, realization of other gates using universal gates, examples of gates ICs, binary arithmetic, (r-1)'s and r's complement arithmetic, codes- BCD codes, Gray codes, Excess-3 codes, ASCII & EBCDIC codes, error detecting and correcting codes, BCD arithmetic, Characteristics of digital integrated circuits, Logic families: DTL, RTL, TTL, TTL with totem pole, Schottky TTL and CMOS logic and tri-state logic.

Unit 2 - Minimization techniques (7 Hours)

Boolean algebra, laws of Boolean algebra, standard representation for logic functions (SOP & POS), Min-terms and Max-terms, minimization of logical functions using the laws of Boolean algebra, K-map representation and simplification of logic functions using K-map, Don't care conditions, Quine McCluskey/ Tabular method of function realization.

Unit 3 - Combinational digital circuits (8 Hours)

Combinational circuits: Adders, subtractors, multiplexers, demultiplexers, encoders, decoders, carry look ahead adder, serial adder, parallel adders and subtractors, BCD adder, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices- BCD to 7-segment display decoder, Design of minimal combinational systems and realization & design of multiple output combinational systems.

Unit 4 - Sequential digital circuits (11 Hours)

Introduction to sequential circuits, Latches: A 1-bit memory element, the circuit properties of latch, un-clocked and clocked flip-flops, Flip-flops: the clocked SR flip flop, J- K, T and D flip-flops-their logic circuits, truth-table, excitation-table and state-diagram of flip-flops, interconversion of flip-flops, applications of flip flops, Registers: buffer/ storage registers, shift registers, bidirectional shift registers, applications of shift registers. Counters and their types- Asynchronous (ripple) counters and synchronous counters, design of asynchronous and synchronous sequential counters using flip-flops: Up/ down synchronous counters, state-table and state-diagram of counters, ring counter, twisted ring counter and applications of counters.

Unit 5 - A/D converters and D/A converters (7 Hours)

Digital to analog converters: specifications for DACs, weighted resistor /converter, R-2R ladder DAC & sample and hold circuit. Analog to digital converters: specifications of ADCs, quantization and encoding, parallel comparator ADC, successive approximation ADC, counting ADC, dual slope ADC, examples of ADC and DAC ICs and their applications.

Text books:

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. A. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
3. G.K. Kharate, "Digital Electronics", Oxford Higher Education, 2010
4. P. Malvino, Electronics Principles, 7th edition, McGraw-Hill Higher Education, 2006

Reference books/ URL:

1. Anil K. Maini, "Digital Electronics Principles, Devices and Applications", Wiley, 2007.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
3. William H. Gothmann, Digital Electronics, 9th edition, Pearson, July 28, 2011.
4. https://onlinecourses.nptel.ac.in/noc20_cs67/preview
5. https://nptel.ac.in/courses/117/106/117106086/
6. https://nptel.ac.in/courses/108/105/108105132/

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PCC 4EE4-21	Induction and Synchronous Machines Lab	0L:0T:3P= 1.5 Cr.

1) Study the working and operation of starters used in the starting of three- phase induction motors: i) DOL starter ii) Star – Delta starter and iii) Auto transformer starter
2) Perform load test on a three- phase induction motor at rated voltage and by varying the load current till full load rated value. Obtain the graphs between efficiency v/s load current, power factor v/s load current, speed v/s load current and torque v/s speed. Comment upon the results.
3) Determine the shunt and series parameters of a three- phase induction motor using:
   (a) No load test at rated voltage
   (b) Block Rotor test at rated current

   Draw the equivalent circuit of the given three- phase induction motor. Also, evaluate its full load efficiency. Comment upon the results.
4) Perform load test on a single- phase induction motor at rated voltage and by varying the load current till full load rated value. Obtain the graphs between efficiency v/s load current, power factor v/s load current, speed v/s load current and torque v/s speed. Comment upon the results.
5) Determine the shunt and series parameters of a single- phase induction motor using:
   (a) No load test at rated voltage
   (b) Block Rotor test at rated current

   Draw the equivalent circuit of the given three- phase induction motor. Also, evaluate its full load efficiency. Comment upon the results.
6) Perform open circuit and short circuit tests on a three- phase synchronous generator. Also determine the voltage regulation by using synchronous impedance method. Plot OCC and SCC for the given machine. Comment upon the results.
7) Determine direct axis synchronous reactance X_d and quadrature axis synchronous reactance X_q of a given three- phase salient pole synchronous machine using slip test. Comment upon the results.
8) Plot V-Curve (armature current v/s field current) and inverted V-Curve (power factor v/s field current) for a three- phase synchronous motor for different values of loads. Comment upon the results.

9) Determine the voltage regulation of a three- phase synchronous generator at different load conditions. Comment upon the results.
10) Synchronize a two three- phase synchronous generator using two bright and one dark lamp method.
11) Synchronize a three- phase synchronous generator with infinite bus bar manually as well as automatically.

Reference Books:

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. P. S. Bimbhra, "Generalized Theory of Electrical Machine", Khanna Publishers, 2012

PCC 4EE4-22	Microprocessor Lab	0L:0T:3P= 1.5 Cr.

1) Study the hardware, functions, memory structure and operation of 8085 Microprocessor kit.
2) Write an assembly language program to perform addition/subtraction of two 8-bit /16 bit numbers with display of carry / borrow using 8085 microprocessor.
3) Write an assembly language program transfer of a block of data in memory to another place in direct order and reverse order using 8085 microprocessor.
4) Write an assembly language program to search a number in a user defined array and find the occurrence of the data using 8085 microprocessor.
5) Write an assembly language program to sort an array in ascending order and descending order using 8085 microprocessor.
6) Write an assembly language program to multiply two 8–bit numbers with and without carry using 8085 microprocessor.
7) Write an assembly language program to divide two 8–bit numbers with and without remainder using 8085 microprocessor.
8) Write an assembly language program to insert a user defined number at correct place in a sorted array using 8085 microprocessor.

9) Write an assembly language program to generate and sum 15 Fibonacci numbers using 8085 microprocessor.

10) Write an assembly language program by interfacing microprocessor to Programmable Peripheral Interface IC (PPI) for generating different patterns (Sequential light, Running light, Disco light) on LED of the study card using 8085 microprocessor.

Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture, programming and Applications with the 8085, Pen Ram International Publishing 5th Ed.
2. B. Ram, Advanced Microprocessor & Interfacing. MGH.
3. Douglas V. Hall, Microprocessors and Interfacing, Revised Second Edition (SIE), MGH.

PCC 4EE4-23	Digital Electronics Lab	0L:0T:2P= 1 Cr.

1) To study the characteristics of various TTL and CMOS ICs using their data-sheets and verify the truth table of various two and three input logic gates: NAND, NOR, NOT, AND, OR, XOR, X-NOR using the Digital IC trainer kit and to understand the difference between the implementation of logic circuits using TTL & CMOS ICs.

2) To implement and verify the truth tables of various logic gates using universal logic gates i.e. NAND & NOR gates.

3) To implement the logic circuits for given sum of product (SOP) & product of sum (POS) expressions using And-Or-Invert (AOI) logic.

4) To realize the logic circuits of half-adder & half-subtractor and full-adder & full-subtractor using NAND & NOR gates and verify their truth tables.

5) To implement the logic circuits and verify the truth tables of 4 x 1 multiplexer (MUX) and 1 x 4 demultiplexer (DE-MUX). And to design an 8 x 1 MUX and 1 x 8 DE-MUX using blocks of 4 X 1 MUX and 1 x 4 DE-MUX respectively.

6) To design and implement the logic circuits and to verify the truth tables for:

a) Binary to Gray conversion & b) Gray to Binary conversion

7) To design and implement the logic circuit for: Binary Coded Decimal (BCD) to Excess-3 code converter and to verify the truth table.
8) To design and realize a combinational circuit that will accept a 2421 BCD code and drive a TTL-312 seven segment display.
9) To implement the logic circuits of the un-clocked and clocked R-S, J-K, T & D flip flops using basic logic gates and to verify their truth tables.
10) To design a counter using D-flip flops that goes through the states: 0, 1, 2, 4, 6, 0. (Assuming that the undesired state goes to 0 on next pulse).

Reference books:

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
3. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

PCC 4EE4-24	Measurement & Instrumentation Lab	0L:0T:2P= 1 Cr.

1) To study the construction and working principle of Digital Storage Oscilloscope (DSO). Analyze the signal using DSO for waveform shape, amplitude, phase, frequency and Total Harmonic Distortion (THD). Also, record the waveform/ signal using DSO in a pen-drive. Discuss the applications of DSO.
2) To study the construction and working principle of Meggar and Tong Tester. Discuss their applications and limitations. Identify the problems arises in measurement of high resistance. Measure the current of given circuit using Tong Tester.
3) To study the construction and working principle of P.F. Meter and Phase Shifter. Discuss their applications and limitations. Identify the problems arises in measurement of these instruments. Measure the power factor of given circuit using P.F. Meter.
4) To perform phantom loading test on a single phase circuit energized by two different single phase sources and calibrate a single-phase energy meter by standard electrodynamometer type wattmeter & phase shifter. The calibration will be on different power factors, achieved by variation in phase shifting transformer.

5) To perform calibration of ammeter with the help of Crompton potentiometer energized by two different dc sources. Standardization of Crompton potentiometer in course and fine mode with the help of standard battery cell potential. Use volt ratio box to achieve high resolution based accuracy in calculation of ammeter reading.
6) To perform calibration of voltmeter with the help of Crompton potentiometer energized by two different dc sources. Standardization of Crompton potentiometer in course and fine mode with the help of standard battery cell potential. Use volt ratio box to achieve high resolution based accuracy in calculation of voltmeter reading.
7) To measure magnitude of low resistance with the help of standardized Crompton potentiometer. Also to standardize the Crompton potentiometer circuit by two different dc sources. Use volt ratio box to achieve high resolution based accuracy in calculation of resistance reading.
8) To measure magnitude of low resistance by Kelvin's double bridge method. Balance the bridge by variation of potentiometer provided for resistance. Also analyze delta-star conversion method to calculate the theoretical magnitude of resistance under measurement and compare to that to obtained result by experiment.
9) To measure earth resistance using fall of potential method. It will also be take proper measures while recording experimental results as electrodes must be placed at pre calculated distance and depth must be appropriate. The texture, humidity and kind of soil also alter experimental readings.
10) To measure magnitude of Capacitance of a capacitor by De Sauty's bridge. It will also to achieve précised null detection at detector. It is followed by limitations of this method.
11) To measure of inductance, capacitance and resistance of specimen by LCR meter.
12) To measure magnitude, frequency & total harmonic distortion of voltage, current and power waveforms of a given electrical circuit by the use of single phase power analyzer.

Reference Books:

1. A K Sawhney, "Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Co. (P) Limited (1 January 2015).

2. J. B. Gupta, "Electronics Measurements and Instrumentation", S.k. Kataria & Sons. Edition: 5, Year: 2015 ISBN: 8188458260
3. EW Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", AW Wheeler & Co. Pvt. Ltd. India
4. R K Rajput, "Electrical measurements and measuring instruments", S. Chand Publications.
5. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
6. M Stout , "Basic Electrical Measurement", Prentice Hall of India
7. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International

MC 4EE9-MC1	Indian Traditions, Cultural And Society	Mandatory Non- Credit Course

Unit 1 - Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusartha, Varnashrama System, Ashrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Unit 2 - Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali, Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature, Malayalam Literature, Sangama Literature Northern Indian Languages & Literature, Persian And Urdu , Hindi Literature.

Unit 3 - Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Unit 4 - Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India
Pyrotechnics in India Trade in Ancient India/India's Dominance up to Pre-colonial Times

Unit 5 - Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema.

Reference Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, Indian Art and Culture, Oxford University Press, India
3. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
4. Romila Thapar, Readings In Early Indian History Oxford University Press, India

5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation,Velliarnad, Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India(fourth edition), Delhi, Motilal Banarsidass,

Programming Classes (Placement Specific) (P-2) (IV Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Familiarization with the language covering following points for C/C++/ Python: Variables, assignments, Simple input, Main program, If-statement, Logical operators and Loops
2	Familiarization with the language covering following points for C/C++/ Python: Output formatting, Functions, Parameters, return values, Lists, Strings and Dictionary
3	Familiarization with the language covering following points for C/C++/ Python: Values and references, Basics of program design, Programming style, Exceptions, File handling, Classes and objects
4	To input the values from the user and create an array/list/ dictionary/ matrix and to read/display/ output a specific cell/ address value.
5	To sort an array/list in ascending and descending order and to display/output maximum and minimum values.
6	To create a Fibonacci series taking input the values from the user.
7	Create a function to compute the factorial of a number.

8	Making use of Inbuilt functions find the roots of a quadratic equation.
9	To solve the simultaneous linear equation with three variables using Cramer's Rule.
10	To read and write excel files for any Data Wrangling Process/ Task using python inbuilt libraries. Using inbuilt libraries for plotting, implement/ explore data exploration/ visualization
11	Identify and illustrate the significance of the programming languages (python) over each other (C/C++)
12	What are the applications of programming languages in Electrical Engineering field. (1 hr.)

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III Year: Electrical Engineering
V Semester

BSC 5EE2-01	**Engineering Materials**	**2L:0T:0P= 2 Cr.**

Unit 1 - Elementary Materials Science Concepts (5 Hours)

Bonding and types of bonding and classification of solids, crystalline state and their defects.

Unit 2 - Conductivity of Metals (6 Hours)

Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals, classical theory of electrical and thermal conduction in solids, temperature dependence of resistivity.

Unit 3 - Dielectric properties of Insulators in Static and Alternating field (6 Hours)

Dielectric constant of Mono-atomic gases, poly-atomic molecules and solid, internal field in solids and liquids, properties of Ferro-Electric materials, Polarization, Piezoelectricity, Frequency dependence of Electronic and Ionic Polarizability, complex dielectric constant of non-dipolar solids, dielectric losses.

Unit 4 - Magnetic Properties and Superconductivity (6 Hours)

Magnetization of matter, Magnetic material classification, Ferromagnetic origin, Curie-Weiss Law, Soft and Hard Magnetic Materials, Superconductivity and its origin, Zero resistance and Meissner Effect, critical current density, skin effect.

Unit 5 - Semiconductor Materials (5 Hours)

Classification of semiconductors, semiconductor conductivity, temperature dependence, carrier density and energy gap, Hall effect, Trends in materials used in Electrical Equipment.

Text Books:

1. S. O. Kasap, Principles of Electronic Materials and Devices, McGraw Hill, 4th edition.
2. S. P. Seth, A course in Electrical Engineering Materials, Dhanpat Rai Publications, 2019.

Reference Books:

1. S. M. Gupta and Nishu Gupta, Advanced Electrical and Electronics Materials-*Processes and Applications*, Wiley,
2. Indulkar and Thiruvengadam, Electrical Engineering Materials, S. Chand, New Delhi, Revised edition 2011.
3. NPTEL - Introduction to Materials Science and Engineering, IIT Delhi, Prof. Rajesh Prasad, https://nptel.ac.in/courses/113102080

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PCC 5EE4-02	Power Electronics	3L:0T:0P= 3 Cr.

Unit 1 - Power Semiconductor Devices (8 Hours)

Power Diode, Power Transistor, Thyristor, MOSFET and IGBT: Construction, Principle of operation, I-V Characteristics and applications. Switching characteristics of thyristor, Two-Transistor Model of Thyristor, Firing circuit for thyristor.

Unit 2 – Controlled Rectifiers (8 Hours)

Single-phase half-wave and full-wave rectifiers, Single-phase full bridge thyristor rectifier with R-load, RL-load and RLE-load; Three-phase full-bridge thyristor rectifier with R-load and RL-load

Unit 3 - DC-DC Converter (8 Hours)

Principle of operation and control strategies, Step Up/Down Copper, Chopper Configurations, Buck converter and Boost Converter: analysis and waveforms at steady state, duty ratio control of output voltage. Voltage and current commutation techniques.

Unit 4 - AC Voltage Controllers and Cycloconverters (8 Hours)

Principle of Phase Control, Principle of On-Off control, Single- phase bi-directional controllers with R-load and RL-load, Three-phase full wave AC voltage controllers with R load.

Basic principle of operation of step-up and step-down cycloconverters (both mid-point and bridge type), single-phase to single-phase cycloconverters, three-phase to single-phase cycloconverters, Output equation and control circuit.

Unit 5- Inverters: (8 Hours)

Principle of operation of Single-phase bridge inverters, Three phase bridge Inverters: 180 degree and 120 degree mode Voltage Source Inverters (VSI). Voltage control of Single-phase and Three-phase inverters. Pulse width modulation techniques, Harmonic analysis, harmonic reduction techniques.

Text Books:

1. M.H. Rashid, Power Electronics: Circuits, Devices and Applications, Pearson.
2. P.S. Bimbhra, Power Electronics, Khanna Publishers.

Reference Books:

1. Ned Mohan, Power Electronics, John Wiley.
2. V.R.Moorthi, Power Electronics- Devices, Circuits and Industrial Applications, Oxford
3. M.D. Singh and K.B. Khanchandani, Power Electronics, MGH.
4. NPTEL- Power Electronics, IIT Bombay, Prof. B.G. Fernandes, Prof. Kishore Chatterjee, https://nptel.ac.in/courses/108101038

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PCC 5EE4-03	**Electrical Power Transmission & Distribution**	**3L:0T:0P = 3 Cr.**

Unit 1 - Introduction to Power Transmission & Distribution (8 Hours)

Single line diagram of Power system, Effect of High voltage transmission in power system, Various DC and AC (1 and 3 phase) transmission systems. AC & DC distribution, Primary & Secondary AC distribution, Radial, Ring main & Interconnected systems, conductor's size determination by Kelvin's law.

Unit 2 - Mechanical Characteristics of Power Transmission Lines (8 Hours)

Mechanical Features of Overhead Lines: Conductor material and types of conductor. Conductor arrangements and spacing. Classification of pole and transmission tower structures, Calculation of sag and tension, supports at different levels, effect of wind and ice loading, stringing chart and sag template. Conductor vibrations and vibration dampers.

Unit 3 - Parameters of Transmission Lines (10 Hours)

Resistance inductance and capacitance of overhead lines, effect of earth, line transposition. Geometric mean radius and distance. Inductance and capacitance of line with symmetrical and unsymmetrical spacing. Inductance and capacitance of double circuit lines. Skin and proximity effects. Equivalent circuits and performance of short, medium and long transmission line. Ferranti effect. Interference with communication circuits.

Unit 4 - Corona Calculations and Transmission line Insulators (8 Hours)

Introduction to Corona formation in a power transmission line and its effects on transmission efficiency, Advantages and disadvantages of corona, factors affecting corona, critical disruptive voltage, visual critical voltage and power loss due to corona, Methods for corona neutralization.

Introduction to transmission line insulators and their usage according to voltage levels, Materials used for manufacturing of insulators, Classification of transmission line insulators (Pin, Suspension, Shackle, Post, Strain and Stay), Calculation of potential distribution and string efficiency of an insulator, methods for string efficiency improvement.

Unit 5 - Underground Cables (6 Hours)

Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses. Causes of breakdown. Thermal rating of cable. Introduction to oil filled and gas filled cables.

Text Books:

1. A Course in Electrical Power by Soni, Gupta and Bhatnagar (Dhanpat Rai Publication)
2. Principles of Power System by V.K. Mehta, Rohit Mehta (S. Chand Publication)

Reference Books:

1. Electrical Power by S.L.Uppal (Khanna Publication)
2. Electrical Power systems by Ashfaq Hussain (CBS Publication)
3. Electric Power Distribution by A.S. Pabla (Tata McGraw-Hill Publication)
4. Electrical Power systems by C. L. Wadhwa (New Age International Publication)
5. NPTEL- **Power System Generation, Transmission and Distribution (Encapsulated from earlier Video), IIT Delhi,** Prof. D.P. Kothari, https://nptel.ac.in/courses/108102047

PCC 5EE4-04	Control System	3L:0T:0P= 3 Cr.

Unit 1 - Introduction to Classical Control System (6 Hours)

Elements of control systems, concept of open loop and closed loop systems. Examples and application of open loop and closed loop systems, brief idea of multivariable control systems.

Unit 2 - Mathematical Modeling of Physical Systems (8 Hours)

Representation of physical system (Electro Mechanical) by differential equations, Determination of transfer function by block diagram reduction techniques and signal flow method, Laplace transformation function, inverse Laplace transformation.

Unit 3 - Time Response Analysis of First Order and Second Order System (8 Hours)

Characteristic equations, response to step, ramp and parabolic inputs, transient response analysis, steady state errors and error constants, Transient & steady state analysis of LTI systems.

Unit 4 - Stability of the System (10 Hours)

Absolute stability and relative stability, Routh's stability criterion, root locus method of stabilty analysis, polar plots, Nyquist stability criterion and M and N Loci, Bode Plot.

Unit 5 - Elementary Ideas of Compensation, Networks (8 Hours)

Lag, lead and lag-lead networks, brief idea of proportional, derivative, integral and PID controllers.

Text Books:

1. I. J. Nagrath and M. Gopal —Control Systems Engineering, New Age International, 2009.

Reference Books:

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. NPTEL- Control Engineering, IIT Delhi, Prof. M. Gopal, https://nptel.ac.in/courses/108102043

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PCC 5EE4-05	Microcontroller	2L:0T:0P= 2 Cr.

Unit 1 - Fundamentals of Microprocessors and Microcontrollers (5 Hours)

Fundamentals of Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

Unit 2 - The 8051 Architecture (8 Hours)

Internal Block Diagram, CPU, ALU, address, data and control bus, Pin Diagram, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory.

Unit 3 - Instruction Set and Programming (5 Hours)

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs.

Unit 4 - External Communication Interface (5 Hours)

Synchronous and Asynchronous Communication. RS-232, SPI, I2C protocols. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.

Unit 5 - Applications (5 Hours)

LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing

Text Books:

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, The8051Microcontroller and Embedded Systems: Using Assembly and C, Pearson.
2. K. J. Ayala, 8051 Microcontroller, Delmar Cengage Learning,2004

Reference Books:

1. R. Kamal, Embedded System, McGraw Hill Education,2009
2. D.A. Patterson and J.H. Hennessy, Computer Organization and Design: The Hardware/Software interface, Morgan Kaufman Publishers, 2013
3. D. V. Hall, Microprocessors & Interfacing, McGraw-Hill
4. NOC:Microprocessors And Microcontrollers, IIT Kharagpur, Prof. Santanu Chattopadhyay, https://nptel.ac.in/courses/108105102

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PEC 5EE5-11	Renewable Energy Sources	3L:0T:0P= 3 Cr.

Unit 1 – Introduction (8 Hours)

World energy situation, conventional and non-conventional energy sources, Indian energy scenario.

Tidal Energy: Introduction to tidal power. components of tidal power plants and double basin arrangement. power generation by tidal energy, advantages and limitations of tidal energy and prospects of tidal energy in India.

Unit 2 - Solar Energy (8 Hours)

Solar radiation, solar radiation geometry, solar radiation on tilted surface.

Solar energy collector: - Flat- plate collector, concentrating collector – parabolidal and heliostat.

Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system.

Unit 3 - Wind Energy (8 Hours)

Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy.

Unit 4 – Geothermal and Nuclear Energy (8 Hours)

Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant.

Advantages and disadvantages of geothermal energy, Applications of geothermal energy. Geothermal energy in India.

Nuclear Fusion Energy: Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybrid and cold fusion.

Unit 5 - Biomass Energy (8 Hours)

Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production.

Text Books:

1. D. Rao: Renewable Energy
2. H. Khan: Non-Conventional Energy Resources II Edition, MGH.

Reference Books:

1. N. Mathur: Non-Conventional Resources of Energy.
2. Boyle: Renewable Energy, 3rded Oxford.
3. Bent Sorensen, 4th ed.: Renewable Energy, Elsevier.
4. V. N. Kishore: Renewable Energy Engineering and Technology, TERI.
5. Garg & Prakash: Solar Energy : Fundamentals and Applications, MGH
6. David Boyles: Bio Energy, Elis Horwood Ltd..
7. NPTEL- Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems, IIT Guwahati, Prof. Vaibhav Vasant Goud, Prof. R. Anandalakshmi, https://nptel.ac.in/courses/103103206

PEC 5EE5-12	Industrial Electrical Systems	3L:0T:0P= 3 Cr.

Unit 1 - Illumination (8 Hours)
Introduction, terms used in illumination, laws of illumination, polar curves, photometry. Sources of light Discharge lamps: Mercury Vapor and Sodium Vapor lamps – comparison between tungsten filament lamps and fluorescent lamps. Basic principles of light control, Types and design of lighting and flood lighting.

Unit 2 - Residential and Commercial Electrical Systems (8 Hours)
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 for commercial installations. Selection and sizing of components.

Unit 3 - Electric Heating and Welding (8 Hours)
Electric Heating: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

Unit 4 - Industrial Electrical Devices (8 Hours)
Industrial loads, motors, starting of motors, Lightning Protection, methods of earthing, UPS System, Electrical Systems for the elevators, Battery banks, Selection of UPS and Battery Banks.

Unit 5 - Electric Traction (8 Hours)
Traction Systems: types, overview of existing electric traction systems in India. Special features of traction motor. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

Text Books:

1. J.B. Gupta, "Utilization of Electric Power and Electric Traction", Kataria & Sons publishers, Delhi, IX Edtion, 2004.

2. C.L. Wadhwa, "Generation, Distribution and Utilization of electrical Energy", New Age International (P) Limited Publishers, 3rd Edition, 2010
3. S. L.Uppal and G.C.Garg," Electrical wiring Estimating & costing" Khanna publishers,2008
4. Utilization of electric Energy by E. Openshaw Taylor, Orient Longman Private Limited,1971.

Reference Books:

1. N.V. Suryanarayana, "Utilization of Electrical Power including Electric drives and Electric traction", New Age International (P) Limited Publishers, 1st Edition, 1994.
2. E. Open Shaw Taylor, "Utilization of Electric Energy", Orient Longman,1st Edition,1937

PEC 5EE5-13	Power System Instrumentation	3L:0T:0P= 3 Cr.

Unit 1 - Theory of Errors (8 Hours)
Accuracy and precision, systematic and random errors, limits of error, probable error and standard deviation. Gaussian error curves, combination of errors.

Unit 2 – Transducers (8 Hours)
Construction & Operating Characteristics of active and digital transducers, Measurement of temperature, pressure, displacement, acceleration, noise level. Instrumentation for strain, displacement, velocity, acceleration, force, torque and temperature.

Unit 3 - Signal Conditioning (8 Hours)
Instrumentation amplifiers, isolation amplifiers, analog multipliers, analog dividers, function generators, timers, sample and hold, optical and magnetic isolators. Frequency to voltage converters, temperature to current converters. Shielding and grounding.

Unit 4 – Measurement of Electrical Quantities (8 Hours)
Measurement of voltage, current, phase angle, frequency, active power and reactive power in power plants. Energy meters and multipart tariff meters. Basic idea of LT & HT panel's.

Unit 5 – Instrument Transformers (8 Hours)
Capacitive voltage transformers and their transient behavior, Current Transformers for measurement and protection, composite errors and transient response.

Text Books:

1. R. H. Cerni and L. E. Foster: Instrumentation for Engineering Measurements, John Wiley and Sons, 1962.
2. Curtis and D. Hohnson: Process Control Instrumentation Technology, John Wiley and sons, 2013.

Reference Books:

1. R. Morrison: Instrumentation Fundamentals and Applications, John Wiley and Sons, 1984.
2. A. K. Sawhney: Advanced Measurements & Instrumentation, Dhanpat Rai & Sons, 1994.
3. E.O. Decblin: Measurement System– Application & design, MGH, 1975.
4. A. S. Moris: Principles of Measurement & Instrumentation, Prentice Hall, 1993.
5. NPTEL- Industrial Instrumentation, IIT Kharagpur, Prof. Alok Barua, https://nptel.ac.in/courses/108105064

PCC 5EE4-21	MATLAB Programming and Simulation Lab	0L:0T:3P= 1.5 Cr.

1) **Programming**

Introduction to MATLAB, Constants, Variables and Expressions, Vectors and Matrices, Polynomials, Input- Output Statements, MATLAB Graphics, Control Structures, Writing programs and functions, Ordinary Differential Equation and Symbolic Mathematics.

2) **Simulink**

a. Modeling and Simulation of first and second order differential equation.
b. Modeling and Simulation of higher order differential equation.
c. Modeling of electrical circuits for Nodal and Mesh analysis.
d. Modeling & Simulation of a single-phase half wave & full wave-controlled rectifiers.
e. Modeling and Simulation of Armature controlled DC motor.
f. Modeling and Simulation of Field controlled DC motor.
g. Modeling and Simulation of 1-phase transformer to perform OC and SC test.
h. Modeling and Simulation of 3- phase induction motor to obtain its Torque- Speed characteristics.

Reference/Suggested Books

1. R K Bansal et. al., MATLAB and its Applications in Engineering, Pearson Education. Second Impression, 2010
2. Almos Gilat: MATLAB: An Introduction with Applications, Wiley India Ltd., 2004.
3. Ram N. Patel et. al.: Programming in MATLAB, Pearson.

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PCC 5EE4-22	Power Electronics Lab	0L:0T:2P= 1 Cr.

1) To plot the I-V characteristics of SCR and measure forward breakdown voltage, latching and holding currents.
2) To plot the I-V characteristics of TRIAC and DIAC.
3) To plot the output and transfer characteristics of MOSFET and IGBT.
4) To study and test the firing circuits for SCR-R, RC and UJT firing circuits.
5) To study and obtain the output waveforms of single-phase half controlled rectifier with R and RL loads. Study the variation of output voltage with respect to firing angle.
6) To study and obtain the output waveforms of single-phase full controlled bridge converter with R and RL loads. Study and show rectification and inversion operations with and without freewheeling diode.
7) Perform an experiment to observe the effect of buck, boost and buck- boost regulators
8) To study and test SCR DC circuit breaker.
9) To study and test AC voltage regulators using TRIAC, antiparallel thyristors and TRIAC & DIAC.
10) To study and test single-phase PWM inverter.

Reference Books:

1. O. P. Arora: Power Electronics Laboratory-Experiments and Organization, Narosa Pub.
2. P. B. Zbar: Industrial Electronics- A Text-Lab Manual, MGH.

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PCC 5EE4-23	Power System Lab	0L:0T:2P= 1 Cr.

1) Generating station design: Design considerations, basic schemes and single line diagram of hydro, thermal, nuclear and gas power plants.
2) Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law.
3) Study of short term, medium term and long term load forecasting.
4) To draw the sending end and receiving end power circle diagrams.
5) Substations: Types of substations, various bus–bar arrangements. Electrical equipment for substations.
6) Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer.
7) To determine the ABCD constants, characteristic impedance and propagation constant of a transmission line.
8) To determine the voltage profile along the transmission line with and without shunt compensation
9) To determine the shunt compensation to counteract the Ferranti effect in transmission line.
10) To determine the reactive power required for Zero voltage regulation at different loads.

Reference Books:

1. Principles of Power System by V.K. Mehta, Rohit Mehta (S. Chand Publication)
2. Electric Power Distribution by A.S. Pabla (Tata McGraw-Hill Publication)

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PCC **5EE4-24**	**Microcontroller Lab**	**0L:0T:2P= 1 Cr.**

1) Write an assembly language program to perform addition of two 8-bit numbers and store the result.
2) Write an assembly language program to transfer block of data in forward and reverse bias.
3) Write an assembly language program to sort an array in both ascending and descending order.
4) Write an assembly language program to find the largest and smallest number in an array.
5) Write an assembly language program to find a given number in an array and count it occurrence in the array.
6) Write an assembly language program to multiply and divide two 8-bit numbers and store the result.
7) Write an assembly language program to design a counter to count up and countdown using subroutine.
8) Write an assembly language program to convert a number from BCD to ASCII, ASCII to Decimal, Decimal to Hexadecimal and Hexadecimal to decimal.
9) Write an assembly language program to generate delay using serial port and on-chip timer/counter.
10) Write an assembly language program to find square and square root of an 8-bit number.

Reference Books:

1. Mazidi and Mazidi, 8051 Microcontroller and Embedded system, Pearson, 2000.

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MC 5EE9-MC1	Mandatory Non-Credit Course (Digital Marketing)	2L:0T:0P = 0 Cr.

Unit 1 - Introduction to Digital Marketing (5 Hours)

Definition and significance of digital marketing, comparison between traditional and digital marketing, process and channels of digital marketing, Impact of digital marketing on sales and performance of an industry.

Unit 2 - Website Planning and Development (5 Hours)

Types of websites, Essential steps involved in website creation and planning, continuous website development and its importance, introduction to optimization of web sites, MS Expression Web, Understanding Domain and Webhosting.

Unit 3 - Search Engine Optimization (5 Hours)

Introduction to Search Engine Optimization, Keyword Planner Tools, On Page SEO Techniques-Indexing and Key Word Placement, Content Optimization, On Page SEO, Off Page SEO Techniques and their importance, Introduction to CRM.

Unit 4 - Email Marketing (6 Hours)

Introduction to Email Marketing and its Significance, designing e-mail marketing campaigns using Mail Chimp, Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring, Email –Atomization, E-mail marketing campaign analysis, Introduction to Pay Per Click Advertising and its terms.

Unit 5 – Social Media Marketing (6 Hours)

Introduction to Social Media Marketing, Facebook Marketing, Types of Various Ad Formats, Setting up Facebook Advertising Account, Designing Facebook Advertising Campaigns, Twitter Marketing Basics, Introduction to LinkedIn Marketing, Developing digital marketing strategy in Integration form.

Text Books:

1. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan and Calvin Jones Publisher- Kogan
2. Google Seo Marketing Book - Offpage SEO For Business, by Sanjana Koul

Reference Books:

1. Search Engine Optimization: An Hour a Day, by Jennifer Grappone, Gradiva Couzin
2. SEO 2017: Learn search engine optimization with smart internet marketing strategies by by Adam Clarke
3. The Art of Social Media: Power Tips for Power Users by Guy Kawasaki & Peg Fitzpatrick.
4. Google Analytics, by Justin Cutroni, Orielly

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Technical Classes (Placement Specific) (L-1) (V Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Basics of mesh analysis and nodal analysis.
2	Thevenin, Norton, superposition and maximum power transfer theorem.
3	Basic idea of single- phase and three- phase A.C. circuits.
4	Basic construction and operation of diode.
5	Basic construction and operation of BJT and FET.
6	Basic construction and operation of Thyrister.
7	Basics of electrical, electrostatic and magnetic circuits.
8	Basics of DC Machines, Characteristics, Starting, Speed Control Methods
9	Basics of Tansformers, Efficiency, Voltage Regulation
10	Single line diagram of Power System (Generation, Transmission and distribution)
11	Basic idea of all the equipment/ Machines used in power system.
12	Overview of grid connected substation

Quantitative & Qualitative Aptitude (V Semester)

Total: 28 hours (Lecture: 2hrs per Week)

S.No	Topics for 5th Semester	Hours
1	Percentage Questions Set with Solutions	2
2	Number Systems Basics	1
3	Reminder Theorem Questions with Solutions	1
4	Time Distance & Speed Questions	2
5	Profit and Loss with Question Set	2
6	Ratio & Proportions Question Set with Solutions	2
7	Average Questions with Solutions	2
8	Mixture & Allegation Questions with Solutions	2

9	Time and Work (Types Discussion)	1
10	Time and Work Questions with Solutions	1
11	Interest (SI + CI)	2
12	Counting of Figures	1
13	Series of Figures (Reasoning) Questions with Solutions	1
14	Number Series Questions with Solutions	1
15	Clocks	1
16	Calendar Questions with Solutions	2
17	Permutation & Combination Questions with Solutions	2
18	Paper Folding Questions (Reasoning) with Solutions	1
19	Paper Cutting And Folding Questions (Reasoning) with Solutions	
20	Series of Figures (Reasoning) Questions with Solutions	1
	Total	**28 Hrs**

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III Year: Electrical Engineering
VI Semester

HSMC 6EE1-01	Technical Communication	3L:0T:0P= 3 Cr.

Unit 1 – Introduction to Technical Communication (8 Hours)

Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.

Unit 2 - Comprehension of Technical Materials/Texts (8 Hours)

Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents.

Unit 3 - Information Design & development (8 Hours)

Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.

Unit 4 - Technical Writing, Grammar and Editing (8 Hours)

Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.

Unit 5 - Advanced Technical Writing (8 Hours)

Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics, formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.

Text Books:

1) Technical Communication, Meenakshi Raman & Sangeeta Sharma, Oxford University Press

Reference Books:

1) Effective Communication Skills, Kulbushan Kumar, Khanna Publishing House, Delhi
2) Communication Skills, Pushplata, Sanjay Kumar, Oxford University Press

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PCC 6EE4-02	Power System Analysis	3L:0T:0P= 3 Cr.

Unit 1 – Admittance and Impedance Model (8 Hours)

Per unit quantities, Single line diagram for a balanced 3-phase system. Admittance Model: Formation of bus admittance matrix. Modification of an existing Y bus. Impedance Model: Formation of bus Impedance matrix. Modification of an existing Z bus.

Unit 2 - Symmetrical Fault Analysis (8 Hours)

Transient on a Transmission line, short circuit model of a synchronous machine in no load, short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions. Selection of circuit breakers, Algorithm for short circuit studies. Analysis of three-phase fault.

Unit 3 - Symmetrical Components (8 Hours)

Fortescue theorem, symmetrical component transformation. Phase shift in star-delta transformers. Sequence Impedances of transmission lines, Synchronous Machine and Transformers, zero sequence network of transformers and transmission lines. Construction of sequence networks of power system.

Unit 4 - Unsymmetrical Fault Analysis (10 Hours)

Analysis of single line to ground faults using symmetrical components, connection of sequence networks under the fault condition. Analysis of line-to-line and double line to ground faults using symmetrical components, connection of sequence networks under fault conditions. Analysis of unsymmetrical shunt faults using bus impedance matrix method.

Unit 5 - Load Flow Analysis (8 Hours)

Load flow problem, development of load flow equations, bus classification. Gauss Seidel, Newton Raphson, decoupled and fast decoupled methods for load flow analysis. Comparison of load flow methods.

Text Books:

1. Kothari & Nagrath: Modern Power System Analysis, MGH 3rd Edition, 2011.
2. Haadi Saadat: Power System Analysis MGH 3rd Edition, 2002.

Reference Books:

1. J. D. Glover, M. S. Sharma & T. J. Overbye: Power System Analysis and Design, Cengage Learning., 2003
2. J. J. Grainger, William, D. Stevenson Jr.: Power System Analysis, MGH, 2007
3. T. K. Nagsarkar & M. S. Sukhija: Power System Analysis, Oxford University Press, 2003
4. Nasser Tleis: Power System Modelling and Fault Analysis, Elsevier, 2007
5. NPTEL:- Power System Analysis https://nptel.ac.in/courses/117105140
6. NPTEL:- Computer Aided Power System Analysis https://nptel.ac.in/courses/108107127

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PCC 6EE4-03	Modern Control System	3L:0T:0P= 3 Cr.

Unit 1 – Introduction to State Space Approach of Control System Analysis (6 Hours)

Modern v/s conventional control theory, concept of state, state variable, state vector, state space, state space equations, writing state space equations of mechanical, electrical systems, analogous systems.

Unit 2 - State Space Representation (9 Hours)

State Space Representation using physical and phase variables, canonical forms of system representation. Block diagram representation of state model. Signal flow graph representation. State space representation using canonical variables. Diagonal matrix. Jordan canonical form, Derivation of transfer function from state-model.

Unit 3 - Solution of State Equations (9 Hours)

Diagonalization, Eigen values and Eigen vectors. State transition matrix, Properties of state transition matrix. Computation of State transition matrix concepts of controllability & observability. Pole placement using state feedback, Ackerman's formula.

Unit 4 - Digital Control Systems (10 Hours)

Introduction, sampled data control systems, signal reconstruction, difference equations. The z-transform, z-transfer function. Block diagram analysis of sampled data systems, z and s domain relationship.

Unit 5 - Stability of the Digital Control Systems (8 Hours)

Modeling of sample-hold circuit, steady state accuracy, stability in z-plane and Jury stability criterion, bilinear transformation, Routh-Hurwitz criterion on z-plane, digital PID controllers.

Text Books:

1. B. C. Kuo ―Digital Control System, Oxford University Press, 2012.

Reference Books:

1. K. Ogata ―Modern Control Engineering, Prentice Hall, 1991.
2. NPTEL- Advanced Control Systems, IIT Guwahati, Prof. S. Majhi, ,https://nptel.ac.in/courses/108103007

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PCC 6EE4-04	Electric Drives	3L:0T:0P = 3 Cr.

Unit 1 – Introduction & Dynamics of Electric Drives (8 Hours)

Electric drive system: Definition, advantages & disadvantages, Block diagram representation, Types of an electric drive, Factors affecting selection of an electric drive, Fundamental Torque equation, Speed-Torque convention and multi-quadrant operation explanation, Equivalent values of drive parameters, Load torque components and its classification, Calculation of time and energy loss in transient operation, Steady state stability, Load equalization.

Unit 2 - DC Drives & Their Control (8 Hours)

Review of conventional speed control methods of DC machine (Armature resistance, Armature voltage, Field flux controls) and their limitations, Starting of a DC machine, Controlled rectifier fed DC drives (single phase and three phase configurations for half and full controlled rectification), Chopper controlled DC drives, Regenerative Braking, dynamic braking and plugging

Unit 3 - AC Drives (Induction) & Their Control (10 Hours)

Review of conventional speed control methods of AC (Induction) machine and their limitations, Starting methods of an AC (Induction) machine, Role of power electronics based converters for the speed control of AC (Induction) machine, Rotor resistance control method and its limitations, Slip-power recovery scheme and its advantages, static Kramer drive system, static Scherbius drive system, Modification of slip-power recovery schemes by close loop control mechanism, Construction and operation of the variable frequency drives and their industrial applications. Braking methods of an AC (Induction) machine.

Unit 4 - AC Drives (Synchronous) & Their Control (7 Hours)

Review of working and classification of synchronous machine, Starting and pull-in torque, transients due to disturbances in the load, Use of damper winding, Self-controlled synchronous drive system employing a load commutated thyristor inverter, Self-controlled synchronous drive system employing a cycloconverter, Starting of large rated synchronous machines, Variable frequency operation of multiple synchronous machines.

Unit 5 - Industrial Applications of Electric Drives (7 Hours)

Selection criteria of any electric drive for various industrial applications, Application and selection of electric drives in various conventional and non-conventional power plants, Application and selection of electric drives in hybrid electric vehicles, Loss measurement in an

electric drive system, Methods for efficient converter operations, Energy efficient operation and power factor improvement of an electric drive system. Introduction to PLC based controlling of DC and AC drives.

Text Books:

1. VEDAM SUBRAMANIAM "Electric drives (concepts and applications)" (Tata McGraw-Hill Publication)
2. G.K. Dubey, Elements of Electric Drives (Narosa Publication)

Reference Books:

1. PILLAI.S.K "A first course on Electric drives" (Wiley Eastern Limited)
2. NAGARATH.I.J & KOTHARI .D.P, "Electrical machines" (Tata McGraw-Hill Publication)
3. M.D. SINGH, K.B.KHANCHANDANI," Power Electronics" (Tata McGraw-Hill Publication)
4. H.Partab,"Art and science and utilization of electrical energy," (Dhanpat Rai and Sons)
5. NPTEL- Fundamentals of Electric Drives, IIT Kanpur, Prof. Shyama Prasad Das, https://nptel.ac.in/courses/108104140

PCC 6EE4-05	Machine Learning	3L:0T:0P= 3 Cr.

Unit 1 - Supervised learning algorithm-1 (8 Hours)
Introduction, Types of learning, Application of machine learning, Issues in Machine Learning. Linear Regression, Multiple Regression, and polynomial Regression

Unit 5 – Supervised learning algorithm -II (8 Hours)
Naive Bayes classifier, Decision Tree, K nearest neighbor, Logistic Regression, Support Vector Machine & Random Forest classifier.

Unit 3 - Unsupervised learning algorithm (8 Hours)
Grouping unlabeled items using k-means clustering, Hierarchical Clustering, Probabilistic clustering, Association rules mining, Apriori Algorithm, Frequent growth algorithm.

Unit 4 -Introduction to Statistical Learning Theory (8 Hours)
Feature extraction - Principal component analysis, Singular value decomposition. Feature selection – feature ranking and subset selection, filter, wrapper and embedded methods, Evaluating Machine Learning algorithms and Model Selection

Unit 5 - Semi supervised and Reinforcement learning (8 Hours)
Markov decision process (MDP), Bellman equations, policy evaluation using Monte Carlo, Policy iteration and Value iteration, Q-Learning, State- Action-Reward-State-Action (SARSA), Model-based Reinforcement Learning.

Text Books:

1. V. K. Jain, Machine Learning , Khanna Publisher

Reference Books:

1. Tomm Mitchell, Machine Learning, Mc-Graw Hill
2. Andriy Burkov, The Hundred Page Machine Learning Book
3. Shai Shalev Shwartz, Understanding Machine Learning, Cambridge
4. Saikat Dutt, Machine Learning, Pearson Education.

PEC 6EE5-11	Wind and Solar Energy Systems	3L:0T:0P= 3 Cr.

Unit 1 – Physics of Wind Power (8 Hours)

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 2 - Wind Generator Topologies (8 Hours)

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 electronic converters. Generator-Converter configurations, Converter Control.

Unit 3 - The Solar Resource (10 Hours)

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Solar Thermal Power Generation Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis.

Unit 4 – Solar Cells and Panels (8 Hours)

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Unit 5 - Network Integration Issues (8 Hours)

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 behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Text Books:

1. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004
2. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.

Reference Books:

1. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984
2. H. Siegfried and R. Waddington, "Grid integration of wind energy conversionsystems" John Wiley and Sons Ltd., 2006.
3. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991
4. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
5. NPTEL:- Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems https://nptel.ac.in/courses/103103206
6. NPTEL:- Non-Conventional Energy Systems https://nptel.ac.in/courses/108108078

PEC 6EE5-12	Soft Computing Techniques	3L:0T:0P= 3 Cr.

Unit 1: Introduction to Neural Networks (7 hours)
Structure and working of Biological Neural Network, Fundamentals of Artificial Neural Networks & Applications, Characteristics of Artificial Neural Networks, History of neural network research, characteristics of neural networks terminology.

Unit 2: Neural Networks Models and Learning Methods (8 hours)
Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks, Learning Methods, Backpropagation, Counter propagation, ART, BAM, Associative memories.

Unit 3: Introduction of Fuzzy logic and Neuro Fuzzy Systems (7 hours)
Introduction, Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification, Architecture of a Neuro-Fuzzy system and its applications.

Unit 4: Genetic Algorithms (10 hours)
Main Operators- Genetic Algorithm Based Optimization-Principle of Genetic Algorithm-Genetic Algorithm with Directed Mutation- Comparison of Conventional and Genetic Search Algorithms Issues of GA in practical implementation. Introduction to Particle swarm optimization-PSO operators-GA and PSO in engineering applications.

Unit 5: Applications (5 hours)
Applications of soft computing techniques in Electrical engineering for fault analysis, power quality analysis and load forecasting.

Text Books:

1. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996
2. Learning and Soft Computing by Kecman, Pearson Education, 2001

Reference Books:

1. Fuzzy Sets and Fuzzy Logic - Klir and Yuan, PHI, 1995.
2. Neural Network in computer Intelligence by Fu, TMH, 2003.
3. Bio-Inspired Artificial Intelligence – Dario Floreano, PHI, 2008.
4. Soft Computing – Ikvinderpal Singh, Khanna Book Publishing 2015.

NPTEL Course:

1. https://onlinecourses.nptel.ac.in/noc20_cs17

PEC 6EE5-13	High Voltage Engineering	3L:0T:0P= 3 Cr.

Unit 1 - Breakdown in Gases, Liquids & Solids (8 Hours)

Breakdown in Gases: Introduction to mechanism of breakdown in gases, Townsend's breakdown mechanism. Breakdown in electromagnetic gases, Application of gases in power system.

Breakdown in Liquids: Introduction to mechanism of breakdown in liquids, suspended solid particle mechanism and cavity breakdown. Application of oil in power apparatus.

Breakdown in solids: Introduction to mechanism of breakdown in solids, electromechanical breakdown, treeing & tracking breakdown and thermal breakdown

Unit 2 – Generation of High Voltage (8 Hours)

High DC Voltage Generation: Generation of high dc voltage, basic voltage multiplier circuit.

High AC Voltage Generation: Cascaded Transformers.

Impulse Voltage generation: Impulse voltage, basic impulse circuit, Mark's multistage impulse generator.

Measurement of High Voltage: Potential dividers - resistive, capacitive and mixed potential dividers.

Unit 3 - Nondestructive Insulation Tests (8 Hours)

Measurement of resistivity, dielectric constant and loss factor. High Voltage Schering Bridge-measurement of capacitance and dielectric loss.

Partial Discharges: Introduction to partial discharge, partial discharge equivalent circuit. Basic wide-band and narrow band PD detection circuits.

Unit 4 –Effect of Over Voltages (8 Hours)

Over voltages: Causes of over voltages, introduction to lightning phenomena, over voltages due to lighting.

Travelling Waves: Travelling waves on transmission lines-open end line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction and line terminated through a capacitance. Attenuation of traveling waves.

Unit 5 - Over Voltage Protection (8 Hours)

Over Voltage Protection**:** Basic construction and operation of ground wires protection angle and protective zone, ground rods, counterpoise, surge absorber, rod gap and arcing horn, lighting arresters - expulsion type, non -linear gap type and metal oxide gapless type.

Text Books:

1. Naidu: High Voltage Engineering 4/e, MGH.
2. John Kuffel, E. Kuffel and W. S. Zaengl: High Voltage engineering, Elsevier.

Reference Books:

1. C. L.Wadhwa: High Voltage Engineering, Wiley Eastern Ltd.
2. Subir Ray: An Introduction to High Voltage Engineering, Prentice Hall of India.

PCC **6EE4-21**	**PLC & SCADA Lab**	**0L:0T:3P= 1.5 Cr.**

1) To study and perform the basic electrical circuit installation, their wiring and functional debugging both for DC and AC loads.
2) To operate DC and AC load with the help of a push to on switch and a switching relay.
3) To operate a DC motor in forward and reverse direction with the help of two switching relays.
4) To operate a load incorporating the use of proximity sensor and counter circuit.
5) To study and perform the methods for starting and speed control of 3-phase induction motor drive.
6) To study and perform the methods for starting and speed control of DC motor drive.
7) To get acquainted with the programmable logic controller (PLC) used for automation in various industries.
8) To understand the architecture of programmable logic controller with connection in PNP and NPN mode.
9) To implement all the logic gates using programmable logic controller.
10) To use the timers and counter circuits with different type of loads using programmable logic controller.

11) To understand functions of programmable logic controllers.

11) To understand the basics of SCADA systems.

12) To apply the SCADA system in order to implement a given problem.

Reference Books:

1. https://www.fatek.com/en/download.php?act=list&cid=140

PCC 6EE4-22	Computer Based Power System Lab	0L:0T:3P= 1.5 Cr.

1) To determine the positive sequence line parameters L and C per phase per kilo-meter of a three phase single and double circuit transmission lines for different conductor arrangements. Also understand modeling and performance of transmission lines and verify results using MATLAB.

2) To determine the bus admittance and impedance matrices for the given power system network and verify results using MATLAB.

3) To determine Symmetrical component of set of unbalance current and Symmetrical component of set of unbalanced three phase voltages and verify results using MATLAB.

4) To determine the Line current using Symmetrical components and verify results using MATLAB.

5) To determine the Impedance matrix, symmetrical components of voltage, current, & complex power delivered to the load in terms of symmetrical components and verify results using MATLAB.

6) To become familiar with modelling and analysis of power systems under faulted condition and to compute the fault level, post-fault voltages and currents for symmetric faults and verify results using MATLAB.

7) To determine the Fault analysis (for 3 to 6 bus) and verify the results using MATLAB : (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault.

8) The mathematical formulation of power flow model in complex form and solving power flow

problems of small sized system using Gauss-Seidel iterative algorithm and verify results using MATLAB.

9) To determine the power flow analysis using Newton – Raphson method and verify results using MATLAB.

10) To become familiar with various aspects of the transient and small signal stability analysis of Single-Machine-Infinite Bus (SMIB) system and verify results using MATLAB.

11) To understand the fundamentals of economic dispatch and solve the problem using classical method with and without line losses and verify results using MATLAB.

Reference Books:

1. Kothari & Nagrath: Modern Power System Analysis, MGH 3rd Edition, 2011.
2. Haadi Saadat: Power System Analysis MGH 3rd Edition, 2002.

PCC 6EE4-23	Electric Drives Lab	0L:0T:2P= 1 Cr.

1. Study and test the firing circuit of three phase half controlled bridge converter.
2. Perform an experiment to observe the input and output voltage waveforms of a three-phase half wave-controlled converter (common cathode) with R Load.
3. Perform an experiment to observe the input and output voltage waveforms of a three-phase half wave-controlled converter (common anode) with RL Load.
4. Perform an experiment to observe the input and output voltage waveforms of a three-phase semi converter with R and R–L load.
5. Perform an experiment to observe the input and output voltage waveforms of a three-phase full converter with R and R–L load.
6. Perform an experiment to control the speed of dc motor using 3-phase half control bridge converter. Plot armature voltage versus speed characteristic.
7. Perform an experiment to control the speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic.
8. Perform an experiment to control the speed of universal motor using AC voltage regulator.
9. Perform an experiment on 3-phase AC voltage controller for controlling R load and R-L load.
10. Perform an experiment to control the speed of a three phase induction motor using Variable frequency drive.

Reference Books:

1. Fundamentals of Electrical Drives by G. K. Dubey.
2. Power Electronics and Motor Drives by B. K. Bose.
3. Electric Drives- Concepts and Applications by V. Subrahmanyam.
4. Power Electronics by Dr. PS Bimbhra.

PCC 6EE4-24	Machine Learning Lab	0L:0T:2P= 1 Cr.

1) Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV files.
2) Design a simple linear regression model on any sample data that need to be predicted with and without using Python library.
3) Design a multiple linear regression model on any sample data that need to be predicted with and without using Python library.
4) Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
5) Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Calculate the accuracy, precision, and recall for your data set.
6) Assuming a set of documents that need to be classified, use the support vector machine algorithm model to perform this task.
7) Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
8) Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9) Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
10) To design a suitable method for analyzing a solar power plant data for the forecasting of its power output.

Text Books:

2. V. K. Jain, Machine Learning , Khanna Publisher

Reference Books:

5. Tomm Mitchell, Machine Learning, Mc-Graw Hill
6. Andriy Burkov, The Hundred Page Machine Learning Book
7. Shai Shalev Shwartz, Understanding Machine Learning, Cambridge
8. Saikat Dutt, Machine Learning, Pearson Education.

MC 6EE9-MC1	Cyber Laws & Intellectual Property Rights	2L:0T:0P= 0 Cr.

Unit 1 - Introduction to Cyber Crime (5 Hours)

Introduction to cyber-crime and cyber law, cyber space and information technology, Nature and scope of cyber-crime, Jurisdiction of cyber-crime.

Unit 2 - Cyber Crime Issues (6 Hours)

Important definitions under IT Act 2000, Cybercrime issues: unauthorized access, White collar crimes, viruses, malwares, worms, Trojans, logic bomb, Cyber stalking, voyeurism, obscenity in internet, Software piracy.

Unit 3 – IT Acts- I (6 Hours)

IT Act 2000, offences under IT Act and IT (amendment) Act, 2008. CRPC overview, Case studies, Role of intermediaries, electronic evidence, Cyber terrorism, espionage, warfare and protected system.

Unit 4 – IT Acts- II (6 Hours)

Overview of amended laws by the IT Act, 2000: The Indian Penal Code, 1860, The Indian Evidence Act, 1872, The Banker's Book Evidence Act, 1891, The Reserve Bank of India Act, 1934, Cyber Theft and the Indian Telegraph Act, 1885. Relevant Case laws. Digital Signatures and certificate - legal issues.

Unit 5 – Copyrights (6 Hours)

Intellectual Property rights: Introduction to IP, Copyright, Related Rights, Trademarks, Geographical Indications, Industrial Design, Patents, Licensing and transfer of technology, WIPO Treaties, Copyrights Act, Patents Act, Trademarks Act.

Text Books/ Reference Books:

1. Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives, Raghu Santanam, M. Sethumadhavan, Information Science Reference.
2. Pfleeger, Charles P. and Shari L. Pfleeger. Security in Computing, 4th Edition. Upper SaddleRiver, NJ: Prentice Hall, 2008.
3. Cybercrime: Security and Surveillance in the Information Age, Douglas Thomas; BrianLoader.
4. Computer Crime: A Crime-Fighters Handbook by David Icove.
5. Crime in the Digital Age: Controlling Telecommunications and Cyberspace Illegalities, Peter N. Grabosky.

6. Cyberlaw – The Indian Perspective By Pavan Duggal, Saakshar Law Publications.
7. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997.
8. Mark F Grady, FransescoParisi, "The Law and Economics of Cyber Security", CambridgeUniversity Press, 2006.

Quantitative & Qualitative Aptitude (VI Semester)

Total: 28 hours (Lecture: 2hrs per Week)

S.No	Topics	Hours
1	Percentage Questions Set with Solutions	2
2	Number Systems Basics	1
3	Reminder Theorem Questions with Solutions	1
4	Time Distance & Speed Questions	2
5	Profit and Loss with Question Set	2
6	Ratio & Proportions Question Set with Solutions	2
7	Average Questions with Solutions	2
8	Mixture & Allegation Questions with Solutions	2
9	Time and Work (Types Discussion)	1
10	Time and Work Questions with Solutions	1
11	Interest (SI + CI)	2
12	Counting of Figures	1
13	Series of Figures (Reasoning) Questions with Solutions	1
14	Number Series Questions with Solutions	1
15	Clocks	1
16	Calendar Questions with Solutions	2
17	Permutation & Combination Questions with Solutions	2
18	Paper Folding Questions (Reasoning) with Solutions	1
19	Paper Cutting And Folding Questions (Reasoning) with Solutions	
20	Series of Figures (Reasoning) Questions with Solutions	1
	Total	**28 Hrs**

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Programming Classes (Placement Specific) (P-2) (VI Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Familiarization with the language covering following points for C/C++/ Python: Variables, assignments, Simple input, Main program, If-statement, Logical operators and Loops
2	Familiarization with the language covering following points for C/C++/ Python: Output formatting, Functions, Parameters, return values, Lists, Strings and Dictionary
3	Familiarization with the language covering following points for C/C++/ Python: Values and references, Basics of program design, Programming style, Exceptions, File handling, Classes and objects
4	To input the values from the user and create an array/list/ dictionary/ matrix and to read/display/ output a specific cell/ address value.
5	To sort an array/list in ascending and descending order and to display/output maximum and minimum values.
6	To create a Fibonacci series taking input the values from the user.
7	Create a function to compute the factorial of a number.
8	Making use of Inbuilt functions find the roots of a quadratic equation.
9	To solve the simultaneous linear equation with three variables using Cramer's Rule.
10	To read and write excel files for any Data Wrangling Process/ Task using python inbuilt libraries. Using inbuilt libraries for plotting, implement/ explore data exploration/ visualization
11	Identify and illustrate the significance of the programming languages (python) over each other (C/C++)
12	What are the applications of programming languages in Electrical Engineering field. (1 hr.)

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IV Year: Electrical Engineering
VII Semester

PCC 7EE4-01	Power System Protection	3L:0T:0P= 3 Cr.

Unit 1 - Introduction (8 Hours)

Introduction to protection, trip circuit of a circuit breaker. Functional characteristics of a relay, zones of protection, primary and backup protection. Current transformer construction, measurement and protective CTs. Potential transformer construction, Steady state ratio and phase angle errors in CTs and PTs. Types of potential transformers. Transient errors in CT and CVT (Capacitive Voltage Transformer).

Unit 2 - Overcurrent Protection (8 Hours)

HRC fuse and thermal relay. Overcurrent relays – instantaneous, definite time, inverse time and inverse definite minimum time overcurrent relays, time and current gradings. Induction disc type relay. Directional overcurrent relay, 30^0, 60^0 and 90^0 connections. Earth fault relay. Brief description of overcurrent protective schemes for a feeder, parallel feeders and ring mains.

Unit 3 - Generator Protection (8 Hours)

Stator protection–differential and percentage differential protection, protection against stator inter-turn faults, stator overheating protection. Rotor protection-protection against excitation and prime mover failure, field earth fault and unbalanced stator currents (negative sequence current protection).

Unit 4 – Transformer and Busbar Protection (8 Hours)

Percentage differential protection, magnetizing inrush current, percentage differential relay with harmonic restraint. Buchholz relay. Differential protection of generator transfer unit.

Busbar Protection: Differential protection of busbars. High impedance relay scheme, frame leakage protection.

Unit 5 - Transmission Line and Induction motor Protection (8 Hours)

Introduction to distance protection. Construction, operating principle and characteristics of an electromagnetic impedance relay. Effect of arc resistance. Induction cup type reactance and mho relays. Comparison between impedance, reactance and mho relays. Three stepped distance protection of transmission line.

Induction Motor Protection: Introduction to various faults and abnormal operating conditions, unbalance supply voltage and single phasing. Introduction to protection of induction motors-HRC fuse and overcurrent, percentage differential, earth fault and negative sequence voltage relays.

Text Books:

1. Badri Ram: Power System Protection and Switchgear, MGH,2011.
2. Ravindra Nath M. Chander: Power System Protection and Switch Gear, John Wiley Eastern, 1977.

Reference Books:

1. Sunil S. Rao.: Power System Protection and Switch Gear, Khanna Publishers,1999.
2. Oza: Power System Protection and Switchgear, MGH, 2010.

PCC 7EE5-11	Electric Vehicle Drives	2L:0T:0P= 2 Cr.

Unit 1 - Introduction **(5 Hours)**
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Unit 2 - Hybrid Electric Vehicles (5 Hours)
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.

Unit 3 - Energy Storage I (6 Hours)
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.

Unit 4 - Energy Storage II (6 Hours)
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 5 - Energy Management Strategies (6 Hours)
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.

Text Books:

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.

Reference Books:

1. 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.
2. T. Denton, ―Electric and Hybrid Vehicles‖, Routledge, 2016.
3. NPTEL- Electric Vehicles - Part 1, IIT Delhi, Prof. Amit Jain, https://nptel.ac.in/courses/108102121

PEC 7EE5-12	Special Electrical Machines	2L:0T:0P= 2 Cr.

Unit 1 - Poly-phase AC Machines (6 Hours)
Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power).

Unit 2 - Induction Generator (6 Hours)
SEIG, DFIG: Operating Principle, Equivalent Circuit, Characteristics, Application
Two Phase AC Servomotors: Construction, characteristics, performance and applications.

Unit 3 - Stepper Motors (6 Hours)
Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications. Switched Reluctance Motors: Construction; principle of operation; torque production, modes of operation, drive circuits.

Unit 4 - Permanent Magnet Machines (6 Hours)
Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM AC motors, brushless dc motors and their important features and applications, PCB motors. Introduction to permanent magnet generators and applications

Unit 5 - Single Phase Commutator Motors (6 Hours)
Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.
2. P.C. Sen "Principles of Electrical Machines and Power Electronics" Johnwilley&Sons, 2001
3. K.R. Varmah, "Fundamentals of Electrical machines & Drives", Cengage.

Reference Books:

1. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987
2. M.G. Say "Alternating current Machines" Pitman & Sons

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PEC 7EE5-13	Power System Dynamics and Control	2L:0T:0P= 2 Cr.

Unit 1: Introduction to Power System Operations (2 hours)

Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control.

Unit 2: Analysis of Linear Dynamical System and Numerical Methods (4 hours)

Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.

Unit 3: Modeling of Synchronous Machines and Associated Controllers (8 hours)

Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

Unit 4: Modeling of other Power System Components (6 hours)

Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads.

Unit 5: Stability Analysis (8 hours)

Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs.

Text Books

1. K.R. Padiyar, ―Power System Dynamics, Stability and Control, B. S. Publications, 2002.

Reference Books

1. P. Kundur, ―Power System Stability and Control‖, McGraw Hill, 1995.
2. P. Sauer and M. A. Pai, ―Power System Dynamics and Stability‖, Prentice Hall, 1997.

NPTEL Course link:

1. https://nptel.ac.in/courses/108101004
2. https://nptel.ac.in/courses/108105133

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PCC 7EE4-21	Embedded Systems Lab	0L:0T:3P= 1.5 Cr.

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or on sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface Ultra Sonic sensor with Arduino/Raspberry Pi and write a program to turn ON LED at sensor detection.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
9. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
10. Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thingspeak cloud.

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, İnternet of Things, "A Hands on Approach", University Press.
2. Introduction to Embedded Systems, K.V. Shibu, McGraw Hill
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

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PCC **7EE4-22**	**Power System Protection Lab**	**0L:0T:2P= 1 Cr.**

1) Perform an experiment to analyze the Line to ground (L-G) fault of a single-phase transmission line at no load and light load conditions.
2) Perform an experiment to analyze the Line to ground (L-G) fault of a three-phase transmission line at no load and light load conditions.
3) Perform an experiment to analyze the Line to line (L-L) fault of a three phase transmission line at no load and light load conditions.
4) Perform an experiment to analyze the double line to ground (L-L-G) fault of a three phase transmission line at no load and light load conditions.
5) Perform an experiment to analyze the three phase (L-L-L) fault of a three phase transmission line at no load and light load conditions.
6) To study over current relay and to draw the current/time characteristics of an over current relay for TMS =1 and PSM =2,5 &10.
7) To study of percentage biased differential relay at different percent biasing.
8) To study under frequency / over frequency relay and draw the characteristics between fault current and operating time.
9) Study of gas actuated Buchholz relay for protection of transformer.

Reference Books:

1. Badri Ram: Power System Protection and Switchgear, MGH,2011.
2 Oza: Power System Protection and Switchgear, MGH, 2010.

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Digital Marketing Classes (VII semester)

Total: 14 hours (Lecture: 1hr per Week)

S. No.	CONTENT	Number of Hours
1	Basics of marketing, product, price, promotion, place	**2**
2	Traditional & digital marketing	**2**
3	Search engine marketing	**1**
4	Search engine optimization	**2**
5	Social media marketing	**1**
6	Business data analytics: (using MS Excel)	**2**
7	Descriptive: - central tendency, standard deviation, variance, skewness	**2**
8	Predictive - forecasting- regression - correlation	**1**
9	Prescriptive: Optimization of product mix	**1**
	Total	**14**

Quantitative & Qualitative Aptitude (VII Semester)

Total: 28 hours (Lecture: 2hrs per Week)

S. No.	Topic	Hours
1	Unit digit and Digit Sum Concept	1
2	Time Distance & Speed Question	1
3	Ratio & Proportions Question Set with Solutions	1
4	Mixture & Allegation Questions with Solutions	1
5	Permutation & Combination Questions with Solutions	1
6	Pipes and Cistern Questions with Solutions	2
7	Calendar Questions with Solutions	1
8	Boat and Stream Questions with Solutions	1
9	Coding & Decoding	1
10	Ranking and Sitting Arrangements, Data Arrangement	2

11	Data Interpretation (Pie, Bar graph)	3
12	Cognitive ability with gaming Aptitude and Logical Thinking (Geo-Sudo,Grid Challenge, Digit Challenge)	3
13	Cognitive ability with gaming Aptitude and Logical Thinking (Switch Challenge, Inductive-logical Reasoning (Spacio Challenge))	3
14	Geometry (Lines and Angles Triangle, Quadrilateral)	1
15	Area of Circles and Mensuration (2D)	1
16	Mensuration Questions Discussion	1
17	Cryparithmetic Questions with Solutions	1
18	Directions and Blood Relations	2
	Total	**27**

Placement Preparation (Fixed) (VII semester)

Total: 14 hours (Lecture: 1hr per Week)

S. No.	CONTENT	Number of Hours
1	Resume Up gradation/ Executive Bag	1
2	Technical Interview Preparation	1
3	HR Interview Preparation	1
4	Technical and HR Interview Rounds	4
5	Group Discussion Rounds	4
6	Alumni Connect	3
	Total	**14**

Technical Classes (Placement Specific) (L-1) (VII Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Basics of mesh analysis and nodal analysis.
2	Thevenin, Norton, superposition and maximum power transfer theorem.

3	Basic idea of single- phase and three- phase A.C. circuits.
4	Basic construction and operation of diode.
5	Basic construction and operation of BJT and FET.
6	Basic construction and operation of Thyrister.
7	Basics of electrical, electrostatic and magnetic circuits.
8	Basics of DC Machines, Characteristics, Starting, Speed Control Methods
9	Basics of Tansformers, Efficiency, Voltage Regulation
10	Single line diagram of Power System (Generation, Transmission and distribution)
11	Basic idea of all the equipment/ Machines used in power system.
12	Overview of grid connected substation

Innovation Lab (Phase II) (VII semester)

Total: 3 hours per Week

1. Interfacing of lamp and button with PLC for ON/OFF operation.
2. Perform Delayed Operation Of Lamp By Using Push Button.
3. Multiple push button operation with delayed lamp for ON/OFF operation.
4. Combination of Counter &Timer for Lamp ON/OFF operation.
5. To study Set and Reset operation of lamp.
6. DOL Starter & Star Delta Starter operation by using PLC.
7. PLC based temperature sensing using RTD.
8. PLC based thermal ON/OFF control.
9. PLC interfaced with SCADA and status read/ command transfer operation.
10. Parameter reading of PLC in SCADA.
11. Alarm annunciation using SCADA.
12. Reporting and Trending in SCADA System.
13. Temperature sensing using SCADA.

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IV Year: Electrical Engineering
VIII Semester

PCC 8EE4-01	HVDC Transmission System	3L:0T:0P= 3 Cr.

Unit 1 – DC Transmission Technology: (8 Hours)

Comparison of AC and DC Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVDC Systems. Components of a HVDC system. Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVDC Technology. Introduction to Modular Multi-level Converters.

Unit 2 - Analysis of Line Commutated and Voltage Source Converters: (10 Hours)

Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters.
Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.

Unit 3 - Control of HVDC Converters (8 Hours)

Principles of Link Control in a LCC HVdc system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation

Unit 4 - Components of HVDC systems (8 Hours)

Smoothing Reactors, Reactive Power Sources and Filters in LCC HVDC systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes

Unit 5 - Stability Enhancement using HVDC Control (8 Hours)

Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/DC systems.

Text Books:

1. K. R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, 2011.

Reference Books:

1. J. Arrillaga, "High Voltage Direct Current Transmission", Peter Peregrinus Ltd., 1983.
2. E. W. Kimbark, "Direct Current Transmission", Vol.1, Wiley-Interscience, 1971.
3. NPTEL:- High Voltage DC Transmission - Web course https://nptel.ac.in/courses/108104013

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PEC 8EE5-11	Electrical Vehicle Charging Systems	3L:0T:0P= 3 Cr.

Unit 1 - Battery **parameters (8 Hours)**

Cell and battery voltages, Charge (or Amphour) capacity, Energy stored, Energy density, Specific power, Amphour (or charge) efficiency, Energy efficiency, Self-discharge rates, Battery geometry, Battery temperature, heating and cooling needs, Battery life and number of deep cycles.

Unit 2 - EV Batteries (8 Hours)

Lead Acid Batteries: Lead acid battery basics, Special characteristics of lead acid batteries, Battery life and maintenance, Battery charging.

Nickel-based Batteries: Introduction, Nickel cadmium, Nickel metal hydride batteries.

Unit 3 - Sodium, Lithium and Metal air batteries (8 Hours)

Sodium-based Batteries: Introduction, Sodium sulphur batteries, Sodium metal chloride (Zebra) batteries.

Lithium Batteries**:** Introduction, The lithium polymer battery, The lithium-ion battery

Metal Air Batteries: Introduction, The aluminium air battery, The zinc air battery.

Unit 4 - Charging Infrastructure (8 Hours)

Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

Unit 5 - EV Charging (8 Hours)

Battery Chargers: Charge equalization, Conductive (Basic charger circuits, Microprocessor based charger circuit). Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods.

Text Books:

1. James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology Explained, 2012.
2. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

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Accredited by NAAC with 'A' Grade

JIET Universe, N.H. - 62, Mogra, Pail Road, Jodhpur – 342802 (Raj.)

Tel: 0291-2868152/53, *E-mail: info@jietjodhpur.ac.in*Web: www.jietjodhpur.ac.in

PEC 8EE5-12	Smart Grid	3L:0T:0P= 3 Cr.

Unit 1 - Introduction to Smart Grid (6 Hours)

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits. Difference between conventional & Smart Grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Unit 2 - Smart Grid Technologies (10 Hours)

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and Control, Distribution Systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, and Plug in Hybrid Electric Vehicles (PHEV).

Unit 3 - Smart Meters and Advanced Metering Infrastructure (8 Hours)

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement, Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.

Unit 4 - Power Quality Management in Smart Grid (7 Hours)

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit 5 - High Performance Computing for Smart Grid Applications (9 Hours)

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL),IP based Protocols, Basics of Web Service and Cloud computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Text Books:

1. Vehbi C. Güngör, Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke: Smart Grid Technologies- Communication Technologies and Standards IEEE Transactions on Industrial Informatics, Vol. 7, No. 4, November 2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang: Smart Grid – The New and Improved Power Grid- A Survey, IEEE Transaction on Smart Grids.2011

Reference Books:

1. Smart Grid-Infrastructure, Technology and Solutions, Stuart Borlase., CRC Press 2012.

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PEC 8EE5-13	Advanced Power System Protection	3L:0T:0P=3 Cr.

Unit 1 - Static Relays (8 Hours)

Static Relays: Introduction, merits and demerits of static relays. Comparators: amplitude and phase comparator, duality between amplitude and phase comparators. Circulating current type phase-splitting type and sampling type amplitude comparators. Vector product type and coincidence type phase Comparators. CTs & PTs: Current transformer (CT) Construction, measurement CT and protective CT. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT.

Unit 2 - Static Over Current and Differential Relays (8 Hours)

Static Over Current and Differential Relays: Instantaneous over current relay, definite time over current relay, inverse-time over current relay, directional over current relay. Static Differential Relays: Differential relay scheme, single-phase static comparator, poly-phase differential protection. Differential protection for generator and transformer.

Unit 3 - Static Distance Relays (8 Hours)

Static Distance Relays: Impedance relay, reactance relay and mho relay using amplitude and phase comparators. Polarized and offset mho relays. Carrier Current Protection: Phase Comparison scheme, carrier aided distance protection. Distance Protection: Effect of resistance, power swings, line length and source impedance on the performance of distance protection. Out of step tripping and blocking relays. Mho relay with blinders. Quadrilateral and elliptical relays. Selection of distance relays.

Unit 4 - Induction Motor Protection (8 Hours)

Induction Motor Protection: Various faults and abnormal operating conditions. Protection against faults, unbalance supply voltage, single phasing, over load and mechanical rotor faults, HRC fuses, over-current relay, percentage differential and earth fault protection. Negative sequence voltage relays and resistance temperature detector relay.

Unit 5 - Digital Protection (8 Hours)

Digital Protection: Introduction to digital protection, block diagram of digital relay, sampling theorem, correlation with a reference wave, Fourier analysis of analog and discrete signals, least error squared technique, digital filtering low pass, high pass, finite impulse response and infinite impulse response fillers. Introduction to digital over-current, transformer differential and transmission line distance protection.

Text Books:

1. Badri Ram: Power System Protection and Switchgear, MGH.
2. Ravindra Nath M. Chander: Power System Protection and Switch Gear, John Wiley Eastern.

Reference Books:

1. Patra Basu & Choudhary : Power System Protection , Oxford & IBH.

PCC 8EE4-21	**Energy Lab**	**0L:0T:3P= 1.5 Cr.**

1.(a) Determination of open circuit voltage (Voc) and short circuit current (Isc) of a solar photovoltaic module.

(b) Determination of open circuit voltage (Voc) and short circuit current (Isc) of solar panels connected in series and parallel configurations.

2 (a) Perform an experiment to plot I-V and P-V characteristics of single module of solar photovoltaic panel.

(b) Perform an experiment to plot I-V and P-V characteristics of series and parallel combination of 2 solar panels.

3.Study the effect of light intensity on I-V characteristics of a solar module.

4.Determine the effect of series blocking diode with PV string.

5.Determine the effect of bypass diode in a solar photovoltaic array.

6.Determine the effect of cloud (using X Ray film) and dust on I-V Characteristics of solar panel.

7.Study Wind turbine, it's various component and various generator topologies used in wind turbine.

8.Study of different components of Micro Grid.

9.(a) Determination of open circuit voltage (Voc) and short circuit current (Isc) of a solar photovoltaic module by MATLAB simulation.

(b) Determination of open circuit voltage (Voc) and short circuit current (Isc) of solar panels connected in series and parallel configurations by MATLAB simulation.

10. Perform an experiment to plot I-V and P-V characteristics of single module of solar photovoltaic panel by MATLAB simulation.

(b) Perform an experiment to plot I-V and P-V characteristics of series and parallel combination of 2 solar panels by MATLAB simulation.

PCC 8EE4-22	High Voltage Lab	0L:0T:3P= 1.5 Cr.

1) To perform an experiment for filtration and treatment of mineral oil used in oil-immersed transformer.
2) To perform an experiment to calculate the dielectric strength of mineral oil used in oil-immersed transformer.
3) To determine the capacitance and dielectric loss of an insulating material using Schering Bridge.
4) To measure the insulation of air with the help of sphere gap.
5) Study applications of insulating materials.
6) Study direct testing and indirect testing of circuit breakers.
7) To determine withstand voltage of cable by cable testing kit.
8) To determine flashover voltage during dry test and wet test.
9) To determine the string efficiency of insulator by dry test & wet test.
10) Design an EHV transmission line

Reference Books:

1) C. L.Wadhwa: High Voltage Engineering, Wiley Eastern Ltd.

Technical Classes (Placement Specific) (L-1) (VIII Semester)

LIST OF EXPERIMENTS

S.No.	CONTENT
1	Basics of mesh analysis and nodal analysis.
2	Thevenin, Norton, superposition and maximum power transfer theorem.
3	Basic idea of single- phase and three- phase A.C. circuits.
4	Basic construction and operation of diode.
5	Basic construction and operation of BJT and FET.

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6	Basic construction and operation of Thyrister.
7	Basics of electrical, electrostatic and magnetic circuits.
8	Basics of DC Machines, Characteristics, Starting, Speed Control Methods
9	Basics of Tansformers, Efficiency, Voltage Regulation
10	Single line diagram of Power System (Generation, Transmission and distribution)
11	Basic idea of all the equipment/ Machines used in power system.
12	Overview of grid connected substation