ELECTRICAL ENGINEERING DEPARTMENT

B.TECH. PROGRAMME

Release Month & Year: March 2022

Heritage Institute of Technology

Electrical Engineering Department

B.Tech. in Electrical Engineering

1st Year 1st Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	MATH1101	Mathematics I	3	1	0	4	4
2.	PHYS1001	Physics	3	1	0	4	4
3.	CSEN1001	Programming for Problem Solving	3	0	0	3	3
Total Theory			**9**	**2**	**0**	**11**	**11**

Practical/Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	PHYS1051	Physics Laboratory	0	0	3	3	1.5
2.	MECH1051	Workshop/Manufacturing Practices	1	0	4	5	3
3.	CSEN1051	Programming for Problem Solving Lab	0	0	4	4	2
Total Laboratory			**1**	**0**	**11**	**12**	**6.5**
TOTAL OF SEMESTER WITHOUT HONOURS COURSE						**23**	**17.5**

Honours (Applicable to 2019, 2020, 2021,2022 admitted batches):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ECEN1011	Basic Electronics	3	0	0	3	3
2.	ECEN1061	Basic Electronics Lab	0	0	2	2	1
Total Honours			**3**	**0**	**2**	**5**	**4**
TOTAL OF SEMESTER WITH HONOURS COURSE						**28**	**21.5**

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1st Year 2nd Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	HMTS1202	Business English	2	0	0	2	2
2.	CHEM1001	Chemistry	3	1	0	4	4
3.	MATH1201	Mathematics II	3	1	0	4	4
4.	ELEC1001	Basic Electrical Engineering	3	1	0	4	4
		Total Theory	**11**	**3**	**0**	**14**	**14**

Practical/Sessional

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	HMTS1252	Language Lab	0	0	2	2	1
2.	CHEM1051	Chemistry Lab	0	0	3	3	1.5
3.	ELEC1051	Basic Electrical Engineering Lab	0	0	2	2	1
4.	MECH1052	Engineering Graphics	1	0	4	5	3
		Total Laboratory	**1**	**0**	**11**	**12**	**6.5**
		TOTAL OF SEMESTER WITHOUT HONOURS COURSE				**26**	**20.5**

Honours (Applicable to 2019, 2020, 2021 admitted batches):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	HMTS1011	Communication for Professionals	3	0	0	3	3
2.	HMTS1061	Professional Communication Lab	0	0	2	2	1
		Total Honours	**3**	**0**	**2**	**5**	**4**
		TOTAL OF SEMESTER WITH HONOURS COURSE				**31**	**24.5**

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2nd Year 1st Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC2101	Circuit Theory	3	1	0	4	4
2.	ELEC2102	Analog & Digital Electronics	4	0	0	4	4
3.	ELEC2103	Electrical & Electronic Measurement	3	0	0	3	3
4.	MECH2106	Mechanics for Engineers	3	0	0	3	3
5.	HMTS2001	Human Values and Professional Ethics	3	0	0	3	3
6.	BIOT2105	Biology	2	0	0	2	2
Total Theory			**18**	**1**	**0**	**19**	**19**

Practical/Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC2151	Circuit Theory Lab	0	0	2	2	1
2.	ELEC2152	Analog & Digital Electronics Lab	0	0	2	2	1
3.	ELEC2153	Electrical & Electronic Measurement Lab	0	0	2	2	1
Total Laboratory			**0**	**0**	**6**	**6**	**3**
TOTAL OF SEMESTER						**25**	**22**

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2nd Year 2nd Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	MATH2001	Mathematical Methods	3	1	0	4	4
2.	ELEC2201	Electrical Machines-I	3	1	0	4	4
3.	ELEC2202	Signals & Systems	3	0	0	3	3
4.	ELEC2203	Basic Thermal Power Engineering	4	0	0	4	4
5.	ELEC2204	Field Theory	3	0	0	3	3
Mandatory Course							
6.	EVSC2016	Environmental Science	2	0	0	2	0
		Total Theory	**18**	**2**	**0**	**20**	**18**

Practical/Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC2251	Electrical Machines-I Lab	0	0	2	2	1
2.	ELEC2252	Signals & Systems Lab	0	0	2	2	1
3.	ELEC2253	Basic Thermal Power Engineering Lab	0	0	2	2	1
		Total Laboratory	**0**	**0**	**6**	**6**	**3**
		TOTAL OF SEMESTER WITHOUT HONOURS COURSE				**26**	**21**

Honours(Applicable to 2019, 2020 admitted batches):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	PHYS2211	Physics (EE)-II	4	0	0	4	4
		Total Honours	**4**	**0**	**0**	**4**	**4**
		TOTAL OF SEMESTER WITH HONOURS COURSE				**30**	**25**

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3rd Year 1st Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC3101	Electrical Machines-II	3	1	0	4	4
2.	ELEC3102	Power System-I	3	1	0	4	4
3.	ELEC3103	Control System	3	1	0	4	4
4.	ELEC3104	Power Electronics	3	0	0	3	3
5.	Professional Elective-I		3	0	0	3	3
Mandatory Course							
6.	INCO3016	Indian Constitution and Civil Society	2	0	0	2	0
		Total Theory	**17**	**3**	**0**	**20**	**18**

Practical/Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC3151	Electrical Machines-II Lab	0	0	2	2	1
2.	ELEC3152	Power System-I Lab	0	0	2	2	1
3.	ELEC3153	Control System Lab	0	0	2	2	1
4.	ELEC3154	Power Electronics Lab	0	0	2	2	1
		Total Laboratory	**0**	**0**	**8**	**8**	**4**
		TOTAL OF SEMESTER				**28**	**22**

Professional Elective-I Paper (any one)

5(a). ELEC3141 Digital Signal Processing

5(b). ELEC3142 Computational Electromagnetics

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3rd Year 2nd Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC3201	Power System-II	3	1	0	4	4
2.	ELEC3202	Microprocessor & Microcontroller	3	0	0	3	3
3.	HMTS3201	Economics for Engineers	3	0	0	3	3
4.	Professional Elective-II		3	0	0	3	3
5.	Open Elective-I		3	0	0	3	3
		Total Theory	**15**	**1**	**0**	**16**	**16**

Practical/Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC3251	Power System-II Lab	0	0	2	2	1
2.	ELEC3252	Microprocessor & Microcontroller Lab	0	0	2	2	1
3.	ELEC3260	Electrical Machine Design	0	0	2	2	1
4.	ELEC3293	Term Paper and Seminar	0	0	4	4	2
		Total Laboratory/Sessional	**0**	**0**	**10**	**10**	**5**
		TOTAL OF SEMESTER WITHOUT HONOURS COURSE				**26**	**21**

Honours (Applicable to 2019 admitted batch):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC3211	Electric Drives	3	0	0	3	3
2.	ELEC3261	Electric Drives Lab.	0	0	2	2	1
		Total Honours	**3**	**0**	**2**	**5**	**4**
		TOTAL OF SEMESTER WITH HONOURS COURSE				**31**	**25**

Professional Elective-II Paper (any one)(Applicable to 2019 admitted batch)

4(a). ELEC3241 Illumination Engineering
4(b). ELEC3242 Electrical Machine Dynamics

Professional Elective-II Paper (any one)(Applicable to 2020,2021 &2022 admitted batch)

4(a). ELEC3241 Illumination Engineering
4(b). ELEC3242 Electrical Machine Dynamics
4(c). ELEC3243 Electric Drives

Open Electives-I Paper (any one)

5(a).CSEN3221 Fundamentals of RDBMS
5(b).ECEN3223 Analog and Digital Communication
5(c).AEIE3222 Fundamentals of Electronic Measurements

Open Elective-I Paper to be offered by Dept. of EE

ELEC3221 Fundamentals of Circuit Theory

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4th Year 1st Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	HMTS4101	Principles of Management	3	0	0	3	3
2.	Professional Elective-III		3	0	0	3	3
3.	Open Elective-II		3	0	0	3	3
4.	Open Elective-III		3	0	0	3	3
		Total Theory	**12**	**0**	**0**	**12**	**12**

Practical/ Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC4191	Industrial Training Evaluation	0	0	0	0	2
2.	ELEC4195	Project Stage-I	0	0	8	8	4
		Total Practical	**0**	**0**	**8**	**8**	**6**
TOTAL OF SEMESTER WITHOUT HONOURS COURSE						**20**	**18**

Honours (Applicable to 2018 admitted batch only):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC4111	Transducers & Sensors	4	0	0	4	4
		Total Honours	**4**	**0**	**4**	**4**	**4**
TOTAL OF SEMESTER WITH HONOURS COURSE						**24**	**22**

Professional Elective-III Paper (any one)
(Applicable to 2018 admitted batch only)

2(a). ELEC4131 Advanced Power System
2(b). ELEC4132 Advanced Control System

Professional Elective-III Paper (any one)
(Applicable to 2019, 2020, 2021 and 2022 Admitted batches)

2(a). ELEC4131 Advanced Power System
2(b). ELEC4132 Advanced Control System
2(c). ELEC4133 Transducers & Sensors

Open Elective-II Paper (any one)

3(a). AEIE4121 Instrumentation and Telemetry
3(b). INFO4121 Fundamentals of Cloud Computing
3(c). INFO 4122 Machine Learning

Open Elective-III Paper (any one)

4(a). AEIE4126 Optical Instrumentation
4(b). CHEN4126 Industrial Total Quality Management
4(c). CSEN4126 Intelligent Web and Big Data

Open Elective-II Paper to be offered by Dept. of EE

ELEC4121 Automatic Control System

Open Elective-III Paper to be offered by Dept. of EE

ELEC4126 Principles of Electrical Machines

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4th Year 2nd Semester Course Structure

Theory:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	Professional Elective-IV		3	0	0	3	3
2.	Professional Elective-V		3	0	0	3	3
3.	Open Elective-IV		3	0	0	3	3
		Total Theory	**9**	**0**	**0**	**9**	**9**

Practical/ Sessional:

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	ELEC4295	Project Stage-II	0	0	16	16	8
2.	ELEC4297	Comprehensive Viva Voce	0	0	0	0	1
		Total Sessional	**0**	**0**	**16**	**16**	**9**
		TOTAL OF SEMESTER:				**25**	**18**

Honours Paper for Lateral Entry Students (Applicable to 2018 admitted batch only):

Sl. No.	Code	Paper	Contact periods per week			Total Contact Hrs	Credits
			L	T	P		
1.	HMTS 4011	Disaster Response Services And Technologies	4	0	0	4	4
		Total Honours	**4**	**0**	**0**	**4**	**4**

Professional Elective-IV Paper (any one)

1(a). ELEC4231 High Voltage Engineering
1(b). ELEC4232 Process Control

Professional Elective-V Paper (any one)

2(a). ELEC4241 Electronic Instrumentation
2(b). ELEC4242 Control System Design

Open Elective-IV Paper (any one)

3(a). CHEN 4222 Introduction to Solar and Wind Technology
3(b). ECEN4221 Cellular and Mobile communication
3(c). ECEN4222 Optical Fiber Communication
3(d). BIOT4222 Non-conventional Energy
3(e). AEIE4221 Process Instrumentation
3(f). AEIE4222 Medical Instrumentation
3(g). CSEN4221 Basics of Mobile Computing
3(h). CIVL 4222 Introduction to Finite Element Methods

Open Elective-IV Paper to be offered by Dept. of EE

ELEC4221 Applied Illumination Engineering

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Breakup of Credits

Sl. No.	Category	AICTE Suggested	EE Department HITK
1	Humanities and Social Sciences including Management courses	**12**	**12**
2.	Basic Science courses	**25**	**25**
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	**24**	**29**
4.	Professional core courses	**48**	**50**
5.	Professional Elective courses relevant to chosen specialization/branch	**18**	**15**
6.	Open subjects – Electives from other technical and /or emerging subjects	**18**	**12**
7.	Project work, seminar and internship in industry or elsewhere	**15**	**17**
8.	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	**0**	**0**
	Total	**160**	**160**

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Honours Credit Chart

Sl No.	Semester	Paper Code	Paper Name	Contact hrs/wk				Credit Points
				L	T	P	Total	
01.	1st	ECEN1011	Basic Electronics	3	0	0	3	3
		ECEN 1061	Basic Electronics Lab	0	0	2	2	1
02.	2nd	HMTS 1011	Communication for Professionals	3	0	0	3	3
		HMTS1061	Professional Communication Lab	0	0	2	2	1
03.	4th	PHYS2211	Physics (EE)-II	4	0	0	4	4
04.	6th	ELEC3211	Electric Drives	3	0	0	3	3
		ELEC3261	Electric Drives Lab.	0	0	2	2	1
05.	7th	ELEC4111	Transducers & Sensors	4	0	0	4	4
							Total	**20**

Honours Paper Exclusively for the Lateral Entry Students

Sl No.	Semester	Paper Code	Paper Name	Contact hrs/wk				Credit Points
				L	T	P	Total	
01.	8th	HMTS 4011	Disaster Response Services And Technologies	4	0	0	4	4

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per Week = 1 Credit
- 1 Hour Tutorial (T) per Week = 1 Credit
- 1 Hour Practical (P) per Week = 0.5 Credits
- 2 Hours Practical (Lab) per Week = 1 Credit

Range of Credits (as per AICTE):

✓ A total of 160 credits will be necessary for a student to be eligible to get B Tech degree.

✓ A student will be eligible to get B Tech degree with Honours if he/she completes an additional 20 credits. These could be acquired through various Honours Courses offered by the respective departments.

✓ A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOCs will have to submit an appropriate certificate to earn the corresponding credit.

✓ For any additional information, the student may contact the concerned HODs.

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Swayam/MOOCs courses recommended to the students of EE Dept.

Code	Name	Credit Points	Corresponding Online Course	Offered by	PLATFORM
ECEN1011	Basic Electronics	3	Fundamentals of Semiconductor Devices	IISc, Bangalore	NPTEL
ECEN1061	Basic Electronics Lab	1			
HMTS1011	Communication for Professionals	3	Effective Business Communication **AND**	IIM Bangalore	Swayam
HMTS1061	Professional Communication Lab	1	Developing Soft Skills and Personality	IIT, Kanpur	Swayam
ELEC3211	Electric Drives	3	Fundamental of Electric Drives	IIT, Kanpur	NPTEL
ELEC3261	Electric Drives Lab.	1			
ELEC4111	Transducers & Sensors	4	Sensors And Actuators	IISC, Bangalore	NPTEL

B.Tech in Electrical Engineering

1st Year, 1st Semester

Syllabus

Paper Name: **MATHEMATICS-I**					
Paper Code: **MATH 1101**					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

After successfully completing this course the students will be able to:

MATH1101.1 Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.
MATH1101.2 Develop the concept of eigen values and eigen vectors.
MATH1101.3 Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.
MATH1101.4 Analyze the nature of sequence and infinite series
MATH1101.5 Choose proper method for finding solution of a specific differential equation.
MATH1101.6 Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus.

Detailed Syllabus:

Module I: [10L]

Matrix: Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II: [10L]

Vector Calculus: Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics.

Infinite Series: Convergence of sequence and series; Tests for conver gence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III: [10L]

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV: **[10L]**

Calculus of functions of several variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables.

Multiple Integration: Concept of line integrals, Double and triple integrals. Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis (Schaum's outline series): M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
9. Engineering Mathematics: S. S. Sastry (PHI)
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

Course Name: Physics I					
Course Code: PHYS1001					
Contact hours per week	**L**	**T**	**P**	**TOTAL**	**CREDIT POINT**
	3	**1**	**0**	**4**	**4**

Module 1: Mechanics (7+5) = 12L

Elementary concepts of grad, divergence and curl. Potential energy function F= - grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field.

Central forces: conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Statellite manoeuvres.

Non-intertial frames of reference: rotating coordinate system; five term acceleration formula-centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

Module 2: Optics (4 +3+ 5) = 12 L

Oscillatory Motion:

Damped harmonic motion – Overdamped , crtically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics:

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, polaroids and application of polarizations.: Polarimeter

Laser & Fibre Optics:

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fibre optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fibre.

Module 3: **Electrostatics (8+4) = 12 L**

Electrostatics in free space

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplaces and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images , energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium
Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge infront of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

Module 4: **Magnetostatics and Electromagnetic Induction: (6+3+3) = 12L**

Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stoke's theorem; the equation for the vector potential and it's solutions for given current densities .

Magnetostatics in a linear magnetic medium:
Magnetization and associated bound currents; Auxiliary magnetic field $\vec{H}$; boundary condition on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law:
Differential form of Faraday's law expressing curl of electric field in terms of time derivative magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

Books of reference:

1. Optics – **Eugene Hecht** Pearson Education India Private Limited
2. Introduction to Electrodynamics, **David J. Griffiths**, Pearson Education India Learning Private Limited
3. Waves and Oscillations by **N.K. Bajaj**
4. Principles of Physics, 10ed, **David Halliday, Robert Resnick Jearl Walker** , Wiley
5. Electricity, Magnetism, and Light, **Wayne M. Saslow**, Academic Press
6. Classical mechanics, **Narayan Rana, Pramod Joag**, McGraw Hill Education
7. Introduction to Classical Mechanics, **R Takwale, P Puranik**, McGraw Hill Education
8. Optics, **Ghatak**, McGraw Hill Education India Private Limited
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – **C.L.Arora**

Course Outcome: PHYS 1001 [2018 – 2020]

After successfully completing this course the students will be able to:

1. To develop basic understanding of the modern science to the technology related domain.
2. Analytical & logical skill development through solving problems.
3. To impart idea of concise notation for presenting equations arising from mathematical formulation of physical as well as geometrical problems percolating ability of forming mental pictures of them.
4. Imparting the essence and developing the knowledge of controlling distant object like satellite, data transfer through optical fiber, implication of laser technology, handling materials in terms of their electrical and magnetic properties etc.

Revised Course Outcome: PHYS 1001 [2021 - Onwards]

After successfully completing this course the students will be able to:

1. Understand and apply Vector Calculus as tool for solving different physical problems.
2. Analyze the nature of central forces and rotating frame phenomenon to understand basic space science and real world applications.
3. Interpret the different types of oscillatory motion and resonance.
4. Apply fundamental theories and technical aspect in the field of electricity and magnetism in solving real world problems in that domain.
5. Understand the Electrical and Magnetic properties of different types of materials for scientific and technological use.
6. Develop Analytical & Logical skill in handling problems in technology related domain.

Course Name: Programming for Problem Solving					
Course Code: CSEN1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

CO 1: Understand and remember functions of the different parts of a computer.

CO 2: Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.

CO 3: Understand and remember syntax and semantics of a high-level language (C programming language, in this course).

CO 4: Understand how code can be optimized in high-level languages.

CO 5: Apply high-level language to automate the solution to a problem.

CO 6: Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

Learning Objectives: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Total load – 40 hours

Module I: [10L]

Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX

How to write algorithms & draw flow charts.

Module II: [10L]

Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [10L]
Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.

C preprocessor (macro, header files), command line arguments.

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

Module IV: [10L]
Data Handling in C
User defined data types and files:
Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell().

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

PHYSICS Lab **Code: PHYS1051**

Course Outcome:

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. Apply the analytical techniques and graphical analysis to the experimental data.
4. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
5. To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

Minimum of six experiments taking at least one from each of the following four groups :

Group 1 : Experiments in General Properties of matter

1. Determination of **Young's modulus** by **Flexure Method**
2. Determination of **bending moment** and **shear force** of a rectangular beam of uniform cross- section.
3. Determination of **modulus of rigidity** of the material of a rod by **static method**
4. Determination of **rigidity modulus** of the material of a **wire by dynamic method.**
5. Determination of **coefficient of viscosity** by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of **dispersive power** of the material of a prism
2. Determination of wavelength of light by **Newton's ring** method.
3. Determination of wavelength of light by **Fresnel's biprism method.**
4. Determination of the **wavelength of a given laser** source by diffraction method

Group 3: Electricity & Magnetism experiments

1. Determination of **dielectric constant** of a given dielectric material.
2. Determination of resistance of **ballistic galvanometer by half deflection** method and study of variation of **logarithmic decrement** with series resistance.
3. Determination of the **thermo-electric power** at a certain temperature of the given thermocouple.
4. Determination of **specific charge (e/m)** of electron.

Group 4: Quantum Physics Experiments

1. Determination of **Planck's constant**.
2. Determination of **Stefan's radiation** constant.
3. Verification of **Bohr's atomic orbital** theory through **Frank-Hertz experiment**.
4. Determination of **Rydberg constant** by studying **Hydrogen/ Helium** spectrum.
5. Determination of **Hall co-efficient of semiconductors.**
6. Determination of **band gap** of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Course Name: WORKSHOP /MANUFACTURING PRACTICES					
Course Code: MECH 1051					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	**0**	**4**	**5**	**3**

Course Outcomes:

Upon completion of this course

1. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

2. The students will be able to fabricate components with their own hands.

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

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

5. The students will be able to describe different components and processes of machine tools.

6. The students will be able to apply the knowledge of welding technology and they can perform arc and gas welding to join the material.

(i) Lectures & videos: (13 hours)

Detailed contents

1. Introduction on Workshop and Safety Precautions. **(1 lecture)**

2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**

3. CNC machining, Additive manufacturing **(1 lecture)**

4. Fitting operations & power tools **(1 lecture)**

5. Electrical & Electronics **(1 lecture)**

6. Carpentry **(1 lecture)**

7. Plastic moulding, glass cutting **(1 lecture)**

8. Metal casting **(1 lecture)**

9. Welding (arc welding & gas welding), brazing **(2 lecture)**

10. Viva-voce **(1 lecture)**

(ii) Workshop Practice :(52 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop	**(12 hours)**
2. Fitting shop	**(8 hours)**
3. Carpentry	**(4 hours)**
4. Electrical & Electronics	**(4 hours)**
5. Welding shop **(Arc welding 4 hrs + gas welding 4 hrs)**	**(8 hours)**
6. Casting	**(4 hours)**
7. Smithy	**(4 hours)**
8. Plastic moulding& Glass Cutting	**(4 hours)**
9. Sheet metal Shop	**(4 hours)**

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

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

(iii)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Name: Programming for Problem Solving Lab					
Course Code: CSEN1051					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**4**	**4**	**2**

Software to be used: GNU C Compiler (GCC) with LINUX
NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors
Topic 2: Basic Problem Solving
Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Topic 4: Loops - Part I (for, while, do-while)
Topic 5: Loops - Part II
Topic 6: One Dimensional Array
Topic 7: Array of Arrays
Topic 8: Character Arrays/ Strings
Topic 9: Basics of C Functions
Topic 10: Recursive Functions
Topic 11: Pointers
Topic 12: Structures
Topic 13: File Handling

Text Books
1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Course outcome:
After completion of this course the students should be able:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

B.Tech in Electrical Engineering

1st Year, 2nd Semester

Syllabus

BUSINESS ENGLISH (Theory)– [2L/2C] (Total 26hrs.)
Paper Code: HMTS 1202

Course Objectives:

The learner will

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.
5. Write reports according to various specifications.
6. Acquire the skill to express with brevity andclarity

Module- I (6hrs.)
Grammar (Identifying Common Errors in Writing)

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced Modifiers
- Articles
- Prepositions
- Redundancies

Module- II (6hrs.)

Basic Writing Strategies

Sentence Structures

- Use of phrases and clauses in sentences
- Creating coherence
- Organizing principles –accuracy, clarity, brevity
- Techniques for writing precisely
- Different styles of writing: descriptive,narrative, expository
- Importance of proper punctuation

Module- III (8hrs)

Business Communication- Scope & Importance

Writing Formal Business Letters:Form and Structure-Parts ofa Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular

Organizing e-mail messages, E-mail etiquette

Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of well-written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

Module- IV (6hrs)

Writing skills

- Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice
- Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/developing a paragraph.
- Précis: The Art of Condensation-some working principles and strategies. Practice sessions of writing précis of given passages.
- Essay Writing:Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

References:

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. &Agarwal,S. Business Communication,Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., , Oxford University Press.2nd Edition.2015
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

CHEMISTRY-1
Code: CHEM 1001
Contacts: 3L + 1T = 4
Credits: 4

MODULE 1
Atomic structure and Wave Mechanics:

Brief outline of the atomic structure, Duel character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ, concept of atomic orbital.

3**L**

Thermodynamics:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation.

4**L**

Spectroscopic Techniques & Application
Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation.
Principle and application of UV- visible and IR spectroscopy
Principles of NMR Spectroscopy and X-ray diffraction technique **3L**

MODULE 2
Chemical Bonding

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. Theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi-molecular orbitals of ethylene and butadiene.

5**L**

Periodicity

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect.

3L

Ionic Equilibria

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation .

2L

MODULE 3

Conductance

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration.

3L

Electrochemical Cell

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.

Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells.

4L

Reaction dynamics

Rate Laws, Order & Molecularity; zero, first and second order kinetics.

Pseudo-unimolecular reaction, Arrhenius equation.
Mechanism and theories of reaction rates (Transition state theory, Collison theory).
Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

3L

MODULE 4

Stereochemistry

Representations of 3- dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

4L

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity.

3L

Organic reactions and synthesis of drug molecule (4 lectures)

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation-reduction reactions. Synthesis of commonly used drug molecules.

3L

TEXT BOOKS

1. Atkins' Physical Chemistry, P.W. Atkins (10^{th} Edition)
2. Organic Chemistry, I. L. Finar, Vol-1 (6^{th} Edition)
3. Engineering Chemistry, Jain & Jain,(16^{th} Edition)
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2^{nd} Edition)
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3^{rd} Edition)

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7^{th} Edition)
3. Organic Chemistry, Morrison & Boyd , (7^{th} Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4^{th} Edition)
5. Physical Chemistry, G. W. Castellan, (3^{rd} Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1^{st} Edition)

Course outcome for the subject code CHEM1001

The subject code CHEM1001 corresponds to chemistry theory classes for the first year B. Tech students, which is offered as Engineering Chemistry and is common for all branches of engineering subjects. The course provides basic knowledge of theory based subjects like quantum mechanics, thermodynamics, reaction dynamics, electrochemistry, structure and reactivity of molecules. The course outcomes of the subject are

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.

2. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.for engineering applications.

3. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.

4. Understanding of bulk properties and processes using thermodynamic considerations.

5 Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.

6. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

Paper Name: **MATHEMATICS-II**					
Paper Code: **MATH 1201**					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

After successfully completing this course the students will be able to:

MATH1201. 1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.

MATH1201. 2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.

MATH1201. 3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.

MATH1201. 4. Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.

MATH1201. 5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.

MATH1201. 6. Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

Detailed Syllabus:

Module I: [10L]

Basic Probability: Random experiment, Sample space and events, Classical and Axiomatic definition of probability, Addition and Multiplication law of probability, Conditional probability, Bayes' Theorem, Random variables, General discussion on discrete and continuous distributions, Expectation and Variance, Examples of special distribution: Binomial and Normal Distribution.

Module II: [10L]

Basic Numerical Methods: Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method. Solution of linear system of equations: Gauss Elimination Method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method. Solution of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta Method of 4th order.

Module III: [10L]

Basic Graph Theory: Graph, Digraph, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walk, Path, Circuit, Euler

Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Dijkstra's Algorithm for shortest path problem. Definition and properties of a Tree, Binary tree and its properties, Spanning tree of a graph, Minimal spanning tree, Determination of spanning trees using BFS and DFS algorithms, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

Module IV: [10L]

Laplace Transformation: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. Introduction to integral transformation, Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions, Definition and properties of inverse LT, Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT

References:

1. Advanced Engineering Mathematics, E.Kreyszig, Wiley Publications
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Course Name: BASIC ELECTRICAL ENGINEERING					
Course Code: ELEC1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes

After attending the course, the students will be able to

- Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.
- Analyse DC Machines; Starters and speed control of DC motors.
- Analyse magnetic circuits.
- Analyse single and three phase AC circuits.
- Analyse the operation of single phase transformers.
- Analyse the operation of three phase induction motors.

Module-I:

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet. [5L]

Module-II

AC single phase system: Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit. [10L]

Module-III

Three phase system: Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method. [4L]

DC Machines: Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor. [7L]

Module-IV

Transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to three phase transformer. [6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics. [4L]

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Language Lab (Practical) – [2P/1C] 26 hrs.

Paper Code: HMTS-1252

Course Objectives:

The learner will

i) Acquire the techniques to become an effective listener.
ii) Acquire the skill to become an effortless speaker.
iii) Organize and present information for specific audience.
iv) Communicate to make a positive impact in professional and personal environment.
v) Engage in research and prepare authentic, formal, official documents.
vi) Acquire reading skills for specific purpose.

Module- I (4hrs)

Listening Skills

- Principles of Listening: Characteristics, Stages.
- Types of Listening: Passive listening, Marginal or superficiallistening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
- Guidelines for Effective Listening
- Barriers to Effective Listening
- Listening Comprehension

Module- II (8hrs)

- Interviewing
  Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews,Interview through video conferencing.
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module- III (6hrs)

- Public Speaking:TheSpeech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
- Characteristics of a good speech : content and delivery, structure of a speech
- Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.
- Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
- Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.

- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module- IV (8hrs)

Presentation Skills

- Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
- Project Team/Group Presentations

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. Sen, S.,Mahendra,A. &Patnaik,P.,Communication and Language Skills, Cambridge University Press, 2015
5. Locker,Kitty O. Business and Administrative Communication McGraw-Hill/ Irwin.
6. Chaney,L.andMartin,J., Intercultural Business Communication. Prentice Hall

Chemistry Lab
Code: CHEM 1051
Credit: 1.5

1. Estimation of iron using $KMnO_4$ self indicator.
2. Iodometric estimation of Cu^{2+}.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n-butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis-G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry- S. C. Das
3. Practicals in Physical Chemistry- P. S. Sindhu

Course outcome for the subject code CHEM1051

The subject code CHEM1051 corresponds to chemistry laboratory classes for the first year B. Tech students. This course enhances the students' experience regarding handling of various chemicals along with various laboratory equipments. Hands on experiments increase the depth of knowledge that is taught in the theory classes as well as it increases research aptitude in students because they can see the direct application of theoretical knowledge in practical field. The course outcomes of the subject are

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.
2. Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^{-} present in water sample to know the composition of industrial water.
3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.
4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.
5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.
6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

Course Name: BASIC ELECTRICAL ENGINEERING LABORATORY					
Course Code: ELEC1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes: The students are expected to

- Get an exposure to common electrical apparatus and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Apply various network theorems in Electrical Circuits.
- Understand the application of common electrical measuring instruments.
- Understand the basic characteristics of different electrical machines.
- Know the measurement technique various electrical parameters.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

Course Name: ENGINEERING GRAPHICS & DESIGN					
Course Code: MECH 1052					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit Points**
	1	**0**	**4**	**5**	**3**

Course Outcomes:

After going through the course, the students will be able

1. To understand the meaning of engineering drawing.
2. To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
3. To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
4. To read and understand projection drawings.
5. To draw the section view and true shape of a surface when a regular object is cut by a section plane.
6. To use engineering drawing software (CAD).

Lecture Plan (13 L)

1. Importance and principles of engineering drawing	(1 L)
2. Concepts of Conic sections and Scale	(1 L)
3. Introduction to concept of projection (Projections of points, lines and surfaces)	(4 L)
4. Definitions of different solids and their projections	(1 L)
5. Section of solids and sectional view	(1 L)
6. Isometric projection	(2 L)
7. Introduction to CAD	(2 L)
8. Viva Voce	(1 L)

Detailed contents of Lab hours (52 hrs)

Module 1: Introduction to Engineering Drawing covering**,**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal.

(4 hrs + 4 hrs)

Module 2: Orthographic Projections covering**,**
Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina.

(4 hrs+4 hrs + 4 hrs)

Module 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views.

(4 hrs + 4 hrs)

Module 4: Sections and Sectional Views of Right Angular Solids covering**,**
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids.

(4 hrs)

Module 5: Isometric Projections covering**,**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

(4 hrs + 4 hrs)

Module 6: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids.

(4 hrs)

Module 7: Customisation & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

(2 hrs)

Annotations, layering & other functions covering
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation.

(2 hrs)

Module 6: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame.

(4 hrs)

References:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) "Elementary Engineering Drawing" ; Charotan Publishing House

2. Narayana, K.L. and Kannaaiah P "Engineering Graphics"; TMH

3. Lakshminarayanan, V. and Vaish Wanar, R.S "Engineering Graphics" Jain Brothers.

4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Edication.

5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

B.Tech in Electrical Engineering

2nd Year, 1st Semester

Syllabus

CIRCUIT THEORY

CODE: ELEC2101 **Contact: 3L+1T**

Credit: 4

COURSE OUTCOMES:

The students will be able to

- apply network theorems to solve electrical circuits having both dependent and independent sources.
- analyze magnetically coupled circuits.
- apply Laplace transform technique in solving transient problems of electrical circuits.
- apply the concept of graph theory to electrical circuits.
- obtain the equivalent representation of electrical circuits using two- port parameter representation.
- analyze and synthesize filters.

Module-I

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis of transformed circuits. Network Theorems: Superposition, Thevenin, Norton and maximum power transfer theorem applied to circuits containing dependent sources. [7L]

Coupled Circuits: Coefficient of coupling, Dot convention, Analysis of coupled circuits. [3L]

Module-II

Laplace Transform: Concept of complex frequency. Properties of Laplace transform linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents, independent and dependent sources, Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Treatment of mutual couplings in t & s domain. Concept of natural frequency and damping. Sketching of transient response. [10L]

Module-III

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, Tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory. [6L]

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [6L]

Module-IV

Filter Circuits: Concept of filters, Classification of filters. Analysis and synthesis of Low pass, High pass, Band pass and Band reject filters using operational amplifier. Filter approximations: Butterworth and Chebyshev filters. [8L]

Total: 40L

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis, M.E. Valkenburg, Pearson Education
3. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.
4. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand.

Reference Books:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin,The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza & S.Seely, McGraw Hill.

ANALOG & DIGITAL ELECTRONICS

CODE: ELEC2102 **CONTACT: 4L**
Credit: 4

COURSE OUTCOME

After successful completion of the course the students will be able to do the following:

- Recall basic principles of diodes, transistors and OPAMPs.
- Understand basic principles of OPAMP based circuits for linear and nonlinear operations and analyze their implications.
- Acquire knowledge about different waveform generators, 555 timers, ADCs and DACs and their applications.
- Recall number systems and Boolean algebra.
- Understand Boolean algebra based realisation of logic gates and design of various arithmetic and combinational circuits.
- Design and analyze various sequential circuits like synchronous and asynchronous counters, shift registers using flip flops.

Module-I

Semiconductor devices:

Review of diodes, transistors.

Recall Transistor amplifiers: Biasing and Equivalent circuit.

Review of Operational amplifiers (OPAMP). Basic building blocks of OPAMP, Ideal OPAMP characteristics, Specifications of OPAMP.

Concept of feedback. Analysis of practical feedback amplifiers.

Realization of different OPAMP based practical circuits: integrators, differentiators etc. Use of OPAMP to realise linear differential equations.

Non-linear applications of operational amplifiers:

Comparators, zero crossing detectors, Schmitt triggers, precision rectifiers, peak detectors, clippers and clampers. **[12L]**

Module-II

Waveform generators using operational amplifiers:

Oscillators: Barkhausen criteria; Phase shift oscillator, Wien Bridge oscillator, Colpitts oscillator, Hartley oscillator**,** crystal oscillator.

Multivibrators: Astable, monostable and bistable multivibrators.

Triangular and saw-tooth wave generator, voltage controlled oscillator (VCO).

555 timer:

Functional diagram of 555 timer, design of astable and monostable multivibrators using 555 timer. **[8L]**

Module-III

Data, Number Systems: Concept of digital data, Review of number systems and codes.

Boolean Algebra: Elementary logic gates (NOT, AND, OR, NOR, NAND, XOR and XNOR), their truth tables and circuits, Universality of NOR and NAND gates, Boolean algebra, De-Morgan's Theorem and applications, Representation of logical statement into Boolean expression and realization using logic gates, Representation of logical expression in SOP and POS forms, Minimization of logic expressions by algebraic method, K-map method.

Combinational Circuits: Adder, Subtractor, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer, Parity Generator and Code Converters. **[10L]**

Module-IV

Sequential Circuits: Basic memory elements, Latch and Flip Flop, S-R, J-K, D, and T Flip flop, Conversion of one flip flop into other flip flops.

Counters & Their Design: Asynchronous and Synchronous counters and their realization using flip flops, Ring Counters.

Registers: Shift registers, parallel load and serial load.

Converters: Different types of A/D and D/A conversion techniques.

Logic families: TTL, ECL, MOS & CMOS, their operation and specification. **[10L]**

Text Books:

1. Adel S. Sedra & Kenneth Carless Smith, Microelectronic Circuits, Oxford University Press
2. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall of India Private Limited
3. H. Taub, D. Schilling, "Digital Integrated Electronics", McGraw-Hill Kogakusha Ltd.
4. Fundamental of Digital Circuits, A. Anand Kumar, PHI.
5. Digital Circuits and Design, 4th Edition, S. Salivahanan & S. Arivazhagan, Vikas Publishing House Pvt Ltd.

References:

1. Robert L. Boylestad, Electronic Devices and Circuit Theory, Prentice Hall
2. Millman & Halkias: Integrated Electronics.
3. Modern Digital Electronics, 2nd Edition, R.P. Jain. Tata McGraw Hill Company Limited
4. S. Salivahanan and V.S. Kanchana Bhaaskaran. Linear Integrated Circuits, Tata McGraw Hill Company Limited

ELECTRICAL & ELECTRONIC MEASUREMENT

CODE: ELEC2103 **CONTACT: 3L**
Credit: 3

The students will be able to

- understand the mechanism and operating principles of various deflecting type measuring instruments and extension of their ranges.
- define and classify various errors in measurement.
- acquire knowledge of various power and energy measuring devices
- understand the operating principles and applications of instrument transformers and potentiometers
- acquire knowledge about and analyze various ac and dc bridges for measuring different electrical parameters and their applications.
- acquire knowledge about various electronic and digital instruments like average reading AC voltmeters, peak reading AC voltmeters, true RMS voltmeter, electronic multi-meter, digital voltmeters.

Module-I

Electrical Instruments:

Introduction, Classification of electrical measuring instruments. Construction, Principle of operation, torque equation, advantage and disadvantage of Moving coil, Moving iron, Electrodynamometer type and Induction type instruments. Extension of instrument ranges and multipliers, Principle of operation of the Electrostatic Instruments. [8L]

Errors in Measurement:

Definition of accuracy, precision, speed of response, Instruments' hysteresis, classification of errors, Absolute Error and Limiting Error. [2L]

Module-II

Measurement of Power:

Power measurement by Electrodynamometer type wattmeter, construction, principle of operation, shape of scale, wattmeter connections and errors. [3L]

Measurement of Energy:

Induction type energy meter: Principle of operation, errors and their compensation. [3L]

Instrument transformer:

Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Construction, Principle of operation, Equivalent circuit and Vector diagram of Current & Potential transformer, Errors in Current Transformer and Potential Transformer. [4L]

Module-III

Measurement of Resistance:

Wheatstone Bridge, Low resistance measurement by Kelvin double Bridge, High resistance measurement, Megger. [2L]

Measurement of Inductance, Capacitance and Frequency:

Maxwell's Bridge, Anderson Bridge, Owen's Bridge, De Sauty's Bridge, Schering Bridge and Wien Bridge. [2L]

Potentiometer:

Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer & Application. [4L]

Module-IV

Localization of cable fault: Murray loop test, Varley loop test. [2L]

Electronic Instruments:

Average reading AC voltmeters, peak reading AC voltmeters, true RMS voltmeter, Electronic multi-meter. [3L]

Digital Voltmeter: Integrating type using voltage to time and voltage to frequency conversion techniques and Successive approximation type. [3L]

TOTAL-36L

Text Books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
4. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
5. Electrical and Electronic Measurement, N.K.Dutta

MECH 2106: Mechanics for Engineers

Contacts: 3 L **Credits: 3**

Course Outcome:

After going through the course, the students will be able

- Understand basic concepts of vector algebra as applied to engineering mechanics.
- Draw free body diagram of a system under equilibrium.
- Understand friction phenomenon and calculate friction loss.
- Understand and quantify elastic behavior of deformable bodies.
- Know how to calculate the CG location required for design of structures.
- Apply the principles of work-energy for analysis of dynamic systems.

SL. No	Syllabus	Contacts Hrs.
Module 1	Importance of Mechanics in Engineering ; Definition of Mechanics; Concepts of particles & rigid bodies;	1
	Vector and scalar quantities; Vector algebra –definition and notation; Types of vectors – equal , equivalent , free , bound , sliding ; Addition , subtraction of vectors ; Parallelogram law , triangle law , vector polygon ; Scalar multiplication of vectors ; Resolution of vectors in Cartesian co–ordinate system ; Unit vector, unit co–ordinate vectors (i^, j^, $\hat{k}$) ; Direction cosines ; Addition/ subtraction of vectors in components form.	3
	Dot product , cross product and the application ; Important vector quantities (position vector , displacement vector, velocity vector, acceleration vector, force vector);	1
	Force, Moment of a force about a point and about an axis , moment of a couple ; Representation of force and moments in items of i^, j^, $\hat{k}$. Principle of transmissibility of force (sliding vector); Varignon's theorem for a system of concurrent forces with proof; Resolution of a force by its equivalent force-couple system; Resultant of forces.	5
Module 2	Type of forces – collinear, concurrent, parallel, concentrated, distributed; Active and reactive forces, different types of reaction forces; Free body concept and diagram; Concept and equilibrium of forces in two dimensions; Equations of equilibrium; Equilibrium of three concurrent forces -- Lami's theorem.	7
	Concept of friction: Laws of Coulomb's friction; Angle of friction, angle of repose, coefficient of friction -- static and kinetic.	3

Module 3	Distributed force system; Centre of gravity; Centre of mass & centroid; Centroid of an arc; Centroid of plane areas – triangle, circular sector, quadrilateral and composite area consisting of above figures. Concept of simple stress and strain ; normal stress , shear stress , normal strain, shear strain; hooke's law; poisson's ratio; stress- strain diagram of ductile and brittle material; proportional limit, elastics limit, yield point , ultimate stress, breaking point,; modulus of elasticity. Factor of safety for design calculations.	4 6
Module 4	Introduction to dynamics: Kinematics & kinetics; Newton's laws of motion; Law of gravitation and acceleration due to gravity; Rectilinear motion of particles with uniform & non – uniform acceleration. Plane curvilinear motion of particles: Rectangular components (projectile motion). Principle of work & energy; Principle of conservation of energy.	4 3 2
	Total	**39**

Recommended books:-

1. Engineering Mechanics:- Statics and Dynamics by Meriam & Kreige , Wiley india
2. Engineering Mechanics:- Statics and Dynamics by I.H. Shames, P H I
3. Engineering Mechanics by Timoshenko , Young and Rao , TMH
4. Fundamentals of Engineering Mechanics by Nag & Chanda – Chhaya Prakashani.

Syllabus

Human Values and Professional Ethics(HMTS-2001)

3L/3credit Max Marks: 100

COURSE OUTCOME:

The student will

i) be aware of the value system and the importance of following such values at workplace
ii) learn to apply ethical theories in the decision making process
iii) follow the ethical code of conduct as formulated by institutions and organizations
iv) Implement the principles governing work ethics
v) Develop strategies to implement the principles of sustainable model of development
vi) Implement ecological ethics wherever relevant and also develop eco-friendly technology

Module I (10 L)

Human society and the Value System

Values: Definition, Importance and application.
Formation of Values: The process of Socialization
Self and the integrated personality
Morality, courage, integrity

Types of Values:

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----
Individual Level
Societal Level
Cultural Level
Value Crisis management----Strategies and Case Studies

Module II (10L)

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism,Utilitarianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties

Ethics-- Standardization
Codification
Acceptance
Application

Types of Ethics--- Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work

Professional Ethics

Ethics in Engineering Profession;
moral issues and dilemmas, moral autonomy(types of inquiry)
Kohlberg's theory, Gilligan'stheory (consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEEInstitute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals
social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies
Ethics and Industrial Law
Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III (10L)

Science, Technology and Engineering

Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk

Technology Transfer: Definition and Types
The Indian Context

Module IV (6L)

Environment and Eco- friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment

Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends

Appropriate technology movement by Schumacher and later development
Reports of Club of Rome.

Suggested Readings:

1)Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2)Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996.
3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008.
4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008.
5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
6)Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
7) Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

BIOT2105 BIOLOGY (2-0-0) 2 CREDITS

Course Outcomes:

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

i) Understand the basic structure and function of cells and cellular organelles.
ii) Understand the fundamental concepts of DNA, RNA and central dogma of cells.
iii) Characterize the different types of proteins, lipids and carbohydrates.
iv) Analyze the mechanism of inheritance of characters through generations.
v) Understand and implement the working principles of enzymes and their applications in biological systems and industry.
vi) Design and evaluate different environmental engineering projects with respect to background knowledge about bioresources, biosafety and bioremediation.

MODULE-I: BASIC CELL BIOLOGY

Prokaryotic and Eukaryotic cells, Cell theory; Cell structure and function, Cell organelles, Structure and function of DNA and RNA, Central Dogma; Genetic code and protein synthesis.

MODULE-II: BIOCHEMISTRY AND CELLULAR ASPECTS OF LIFE

Biochemistry of carbohydrates, proteins and lipids; Fermentation; Cell cycle; Basics of Mendelian Genetics.

MODULE-III: ENZYMES AND INDUSTRIAL APPLICATIONS

Enzymes – significance, co-factors and co-enzymes, classification of enzymes; models for enzyme action; Restriction enzymes; industrial applications of enzymes.

MODULE-IV: BIODIVERSITY AND BIOENGINEERING INNOVATIONS

Basic concepts of environmental biosafety, bioresources, biodiversity, bioprospecting, bioremediation, biosensors; recent advances in engineering designs inspired by examples in biology.

TEXT BOOKS:

1. Wiley Editorial, "*Biology for Engineers: As per Latest AICTE Curriculum*," Wiley-India, 2018.
2. S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "*Biology for Engineers*," Tata McGraw-Hill, New Delhi, 2012.

BIOT2105 BIOLOGY (2-0-0) 2 CREDITS

REFERENCE BOOKS:

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "*Biochemistry*," W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "*Molecular Biology*," MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "*Biosensors A Practical Approach*" Bellwether Books**,** 2004.
4. Martin Alexander, "*Biodegradation and Bioremediation,"* Academic Press, 1994.
5. Kenneth Murphy, "*Janeway's Immunobiology*," Garland Science; 8th edition, 2011.

CIRCUIT THEORY LABORATORY

CODE: ELEC2151 **Contact: 2P**

Credit: 2

COURSE OUTCOMES:

The students are expected to

- Learn simulation of electrical circuits.
- gain knowledge of transient and frequency response of electrical circuit.
- find out open circuit impedance parameter and short circuit admittance parameter of two port network experimentally.
- design and synthesize filters.

List of Experiments:

1. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
2. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB/OCTAVE in analog form.
3. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion from cascade form and vice versa in s-domain using MATLAB/OCTAVE.
4. Transient response of R-L and R-C network.
5. Transient response of R-L-C series and parallel circuit.
6. Verification of Network theorems.
7. Determination of Impedance (Z) and Admittance (Y) parameter of a two port network.
8. Design of Butterworth Low Pass and High Pass filters: Simulation and Hardware implementation
9. Design of Band Pass and Band Reject filters using Butterworth Low Pass and High Pass filters: Simulation and Hardware implementation.

ANALOG & DIGITAL ELECTRONICS LABORATORY

CODE: ELEC2152 **Contact: 2P**

Credit: 1

Course Outcomes:

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

- Realize OPAMP as inverting and non-inverting amplifier, adder, subtractor, integrator, differentiator.
- Realize OPAMP as comparator, zero crossing detector, Schmitt trigger.
- Realize astable and monostable multivibrator using OPAMP.
- Realize astable, monostable and bistable multivibrator and VCO using 555 timer.
- Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
- Apply the design procedure to design and implement various combinational and basic sequential circuits.

Experiments on Analog Electronic Circuit:

1. Transfer characteristics of an inverting and non-inverting amplifier using operational amplifier.
2. Realization of adder and subtractor using operational amplifier.
3. Realization of integrator and differentiator using operational amplifier.
4. Transfer characteristics of zero crossing detector, comparator with hysteresis using operational amplifier.
5. Realization of astable and monostable multivibrator using operational amplifier.
6. Realization of astable and monostable multivibrator using 555.
7. Design of bistable multivibrator and VCO using 555.

Experiments on Digital Electronic Circuit:

8. Realization of logic statement using universal logic gates.
9. Construction of decoder and encoder using logic gates.
10. Realization of MUX and DMUX using logic gates.
11. Realization of SR, D, JK and T Flip Flop.
12. Realization of binary, BCD counters (synchronous and asynchronous).
13. Construction of shift registers using Flip Flops.
14. Familiarization experiments on DAC0808 & ADC0808.

ELECTRICAL AND ELECTRONIC MEASUREMENT LABORATORY

CODE: ELEC2153 **CONTACT: 2P**

Credit: 1

Course Outcome:

Students will be able to

- calibrate analog ammeter, voltmeter and wattmeter using dc potentiometer.
- measure unknown resistance, inductance, capacitance and frequency using different dc and ac bridges.
- use instrument transformer for measuring power consumption of connected load using standard available measuring meters.
- calculate energy consumption of single phase system and power measurement of three phase system.

List of Experiments:

1. Familiarization of instruments: Identification of the different parts of PMMC, Dynamometer, Electro-thermal and Rectifier type of instruments. Oscilloscope and Digital multi-meter.
2. Calibration of moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibration of dynamometer type wattmeter by potentiometer.
4. Calibration of AC energy meter.
5. Measurement of resistance by Kelvin double bridge.
6. Measurement of Power and use of Instrument transformer to extend the range of power measuring instruments.
7. Measurement of power in Three-phase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson Bridge.
10. Measurement of capacitance by De-Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.

B.Tech in Electrical Engineering

2nd Year, 2nd Semester

Syllabus

Subject Code: MATH 2001
Subject Name: MATHEMATICAL METHODS
(Course: B Tech Stream: EE/CE)

Contacts: 3L+1T
Credits: 4

Course Outcome:- After completing the course the student will be able to:

MATH2001.1 Construct appropriate mathematical models of physical systems.

MATH2001.2 Recognize the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.

MATH2001.3 Generate the complex exponential Fourier series of a function and make out how the complex Fourier coefficients are related to the Fourier cosine and sine coefficients.

MATH2001.4 Interpret the nature of a physical phenomena when the domain is shifted by Fourier Transform e.g. continuous time signals and systems.

MATH2001.5 Develop computational understanding of second order differential equations with analytic coefficients along with Bessel and Legendre differential equations with their corresponding recurrence relations.

MATH2001.6 Master how partial differentials equations can serve as models for physical processes such as vibrations, heat transfer etc.

MODULE I : [12L]

Functions of Complex Variables:

Complex numbers and its geometrical representation.

Functions of a complex variable – Limits, Continuity, and Differentiability.

Analytic Functions, Cauchy- Riemann equations, Necessary and sufficient conditions for analyticity of complex functions (Statement only), Harmonic functions.

Line Integral on complex plane, Cauchy-Goursat theorem, Cauchy's Integral Formula.

Taylor's and Laurent's series expansion.

Zeros, Different types of Singularities. Definitions of poles and residues, Residue Theorem, Evaluation of real integrals using residue theorem.

MODULE II : [12L]

Fourier Series , Integrals and Transforms:

Definite Integral , Orthogonality of Trigonometric Functions , Power Series and its convergence .
Periodic Functions , Even and Odd Functions , Dirichlet's Conditions , Euler Formulas for Fourier coefficients , Fourier series representation of a function, e.g. Periodic square wave, Half wave rectifier, Unit step function.
Half Range series , Parseval's Identity.

Fourier Integral theorem , Fourier transform , Fourier sine and cosine transform, Linearity, Scaling , Frequency Shifting and Time shifting properties, Convolution Theorem.
Discussion of some physical problems : e.g Forced oscillations.

MODULE III : [12L]

Series Solutions to Ordinary Differential Equations and Special Functions:

Series solution of ODE: Ordinary point , Singular point and Regular Singular point, series solution when $x = a$ is an ordinary point, Frobenius method.

Legendre's Equation , Legendre's polynomials and its graphical representation.

Bessel's equation , Bessel's function of first kind and its graphical representation.

Finite Difference Method and its application to Boundary Value Problem.

MODULE IV : [12L]

Partial Differential Equations:

Introduction to partial differential equations, Formation of partial differential equations, Linear and Nonlinear pde of first order, Lagrange's and Charpit's method of solution.

Second order partial differential equations with constant coefficients , Illustration of wave equation, one dimensional heat equation, Laplace's equation, Boundary value problems and their solution by the method of separation of variables.

Solution of Boundary value problems by Laplace and Fourier transforms.

Suggested Books:

1. Complex Variables and Applications
   Brown Churchill
   MC Graw Hill

2. Complex Variable
   Murrey R. Spiegel
   Schaum's Outline Series

3. Theory of Functions of a Complex Variable
   Shanti Narayan, P. K. Mittal
   S. Chand

4. Larry C. Andrew, B. K. Shivamoggi
   Integral Transforms for Engineers and Applied Mathematicians
   Macmillan

5. Fourier Analysis with Boundary Value Problem
   Murrey R. Spiegel
   Schaum's Outline Series

6. Mathematical Methods
   Potter, Merle C., Goldberg, Jack.
   PHI Learning

7. Ordinary and Partial Differential Equations
   M. D. Raisinghania
   S. Chand

8. Elements of Partial Differential Equation
   Ian Naismith Sneddon
   Dover Publications

9. Advanced Engineering Mathematics
   Kreyszig
   Willey

10. Higher Engineering Mathematics
    B. V. Ramana
    Tata McGraw-Hill

ELECTRICAL MACHINE-I

CODE: ELEC2201 **CONTACT: 3L+1T**
Credit: 4

Course Outcome:

The students will be able to:

1. Understand the fundamental principle of electromechanical energy conversion.
2. Acquire knowledge about the constructional details, principle of operation, excitation types in dc machines.
3. Understand the working of dc machines and acquire knowledge about testing on dc machines.
4. Acquire knowledge about the constructional details, principle of operation, performance analysis and testing of single phase transformers.
5. Understand different types of connections of three phase transformers.
6. Understand and analyze the performance of three phase transformers.

Module-I [9L]

Principles of Electromechanical Energy Conversions:

Conversion of Energy: Introduction, Production of EMF, Production of Force, Flow of Energy in Electromechanical devices, Energy stored in Magnetic Systems.
Singly Excited Machine: Determination of Mechanical Force, Mechanical Energy, Torque Equation.
Doubly Excited Machine: Determination of Mechanical Force, Mechanical Energy, Torque Equation.

Fundamentals of DC Machine:

Working Principle: Introduction, Production of EMF in Elementary DC Generator, Production of Torque in Elementary DC Motor.
Construction of DC Machine: Basic idea of Yoke, Poles, Armature, Commutator and brush, Armature Windings, Materials used.
EMF and Torque in DC machine: Generation of EMF in DC machine, Torque developed in DC Machine, Counter torque and Counter EMF.
Methods of Excitations: Shunt, Series and Compound excitation.

Module-II [11L]

DC Machine:

Flux density waveform in DC machine: Armature reaction & its effects, Methods of limiting the Armature reaction, Commutation Process, Methods of commutation.
DC Generator: Voltage build up of dc shunt generator, Characteristics with different excitation systems, Voltage regulation, Parallel Operation.
DC Motor: Characteristics and applications of Separate, Shunt, Series and Compound motors, Methods of starting, speed control, equivalent circuit. Series-parallel operation of motors, Braking in DC Motor.
Testing of DC Machine: Brake test, Swinburne test, Hopkinson's test.

Module-III **[11L]**

1-ph Transformer:

Basic Principle of Transformer: Faraday's law of electromagnet induction, Basics idea of magnetic circuits, Mutual and Leakage Flux, Concept of ideal Transformer and its assumptions.

Construction of Transformer: Magnetic Circuit, Windings, Insulation, Different types of cooling, Tank and radiator construction, Transformer oil, Transformer accessories, eg., conservator, breather, Bucholtz relay, bushing, etc. Tap changer.

Performance of Transformer: Operation of real Transformer under load, Equivalent circuit and phasor diagram, per unit system of representation, Voltage regulation, Efficiency, Effects of changes of frequency and voltage on transformer performance, Rating of Transformer.

Testing of Transformer: OC and SC test, separation of losses, determination of equivalent circuit parameters.

Parallel Operation of Transformers: Conditions, Load sharing.

Single phase Auto Transformer: Principle of operation, phasor diagram. Comparison of weight, Copper loss equivalent reactance with 2-winding transformer.

Module-IV **[9L]**

3-ph Transformer:

Different Connections: Introduction, Different Vector groups, 3-phase to 6-phase conversion, 3-phase to 2-phase conversion, Open delta, Grounding Transformer.

Performance of 3-phase Transformer: Production of Harmonics in Transformer and its suppression, Effect of harmonics on different types of 3-phase Transformer, Unbalanced loading on 3-phase transformer.

Text Books:

1. Electrical Machinery by Dr. P.S. Bimbhra.
2. Generalized Theory of Electrical Machines by Dr. P.S. Bimbra.
3. Electrical Machines by P. K. Mukherjee & S. Chakravorty.
4. Electrical Machinery by S.K.Sen.
5. Theory of Alternating Current Machinery by Alexander S Langsdorf.

Reference Books:

1. The Performance and Design of Direct Current Machines by Clayton & Hancock.
2. The Performance and Design of Alternating Current Machines by M.G.Say.
3. A Textbook of Electrical Machines by K. R. Siddhapura &D. B. Raval.
4. Electrical Machines by Prithwiraj Purkait & Indrayudh Bandyopadhyay.

SIGNALS AND SYSTEMS

CODE: ELEC2202 **CONTACT: 3L**
Credit: 3

COURSE OUTCOMES:
Students will be able to

- Understand the concept of signals and analyze the spectral content in periodic and aperiodic signals.
- Understand the impulse response of a system, convolution of two signals and its application to dynamic systems.
- Understand the concept of sampling of a signal; obtain the output of a system using z – transform.
- Describe the mathematical model of physical systems and understand the concept of BIBO stability.
- Possess a basic understanding of the concept of frequency response and time response of dynamic systems and analyze their implications.
- Describe the mathematical model of dynamical systems in state-space form and its time domain solution using the concept of "state transition matrix".

Module-I
Signals: Concept of Signals, Continuous and discrete time signals, Classification of Signals:Periodic and aperiodic, even and odd, energy and power signals, Deterministic and randomsignals, Exponential, sinusoidal signals. Decomposition of signals into odd and even components. Singularity functions- step, ramp, impulse and doublet signals. Properties of Impulse Function. Decomposition of simple aperiodic waveforms in terms of singularity functions. Transformation of signals: time scaling; time shifting. Convolution Theorem. **[5L]**

Fourier Series & Transform: Dirichlet's conditions, Fourier series-trigonometric and exponential.Gibbs Phenomenon, Fourier transform of aperiodic functions. Generalized Fourier transform. Properties of Fourier transform. **[5L]**

Module-II
Sampling: Representation of continuous time signals by its samples- Types of sampling, Sampling theorem. Reconstruction of a signal from its samples, aliasing. **[3L]**

Z-Transforms: z-transform definition, mapping between s-plane and z-plane, unit circle in z plane, region of convergence (ROC), Properties of z-transform, Poles and Zeros, inverse z-transform using Residue Theorem, Power Series expansion and Partial fraction expansion. **[5L]**

Module-III
Systems: Concept of Systems, Classification, Differential equation representation of systems, Definition of Linear Time invariant (LTI) systems. Concept of transfer function, Poles and zeros. Concept of BIBO stability of a system. Time and frequency response of first and second order systems. **[5L]**

Modeling of Dynamic Systems: Mechanical systems (translational systems and rotary systems) electromechanical systems (DC Servo motor and PMMC). Electrical analogous systems. **[5L]**

Module-IV

State space analysis: State variable representation of systems, Normalization of linear equations. Converting higher order linear differential equations into State Variable (SV) form. Obtaining SV model from Transfer Function. Obtaining characteristic equations and transfer functions from SV model. State variable representations of electrical and mechanical systems. Solutions of state equations. State transition matrix. Properties of state transition matrix. **[8L]**

Total: 36L

Text Books:

1. Signal Processing & Linear Systems, B.P.Lathi, Oxford
2. Signals and Systems, A.NagoorKani, McGraw Hill
3. Signals and Systems, S.Haykin&B.V.Veen, John Wiley
4. Signals and Systems, T.K.Rawat, Oxford

Reference books

1. Kuo, B. C; "Automatic Control System" Prentice Hall of India
2. Lindner D. K; "Introduction to signals and systems", McGraw Hill
3. C-T Chen- Signals and Systems- Oxford
4. Network Analysis & Synthesis, F.F Kuo., John Wiley & Sons

BASIC THERMAL POWER ENGINEERING

Code: ELEC2203 **Contacts: 4L**

Credits: 4

Course Outcome:

After going through the course, the students will be able to

- Analyze a thermodynamic system and calculate work transfer in various quasi-static processes , Understand the difference and correlation between heat transfer and work transfer
- Read and interpret the values of properties of water/steam from steam table and Mollier chart for evaluation of heat transfer and work transfer in processes involving steam
- Understand the basics of thermal power generation and calculate the efficiencies of Rankine cycles with reheat and regeneration
- Understand various types of boilers used in thermal power plants and draw up a heat balance sheet and design the chimney height based on various conditions.
- Calculate power output , blading efficiency , staging efficiency from Impulse and Reaction turbines and appreciate the importance of compounding and governing of turbines.
- Calculate the water requirement for power plant, power required to drive fans, condenser efficiency.

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Sl. No.	Syllabus	Contact Hrs
Module 1	**Basic concepts of Thermodynamics:** Introduction; Definition of Thermodynamic systems; System boundary, universe; Open, closed and isolated systems; Control mass and control volume; State; Definition of properties: intensive, extensive & specific properties.	1
	Thermodynamic equilibrium : Change of state; Thermodynamic processes; Quasi-static processes; Thermodynamic cycles; Zeroth law of Thermodynamics -concept of temperature.	1
	Heat & Work: Definition and units of Thermodynamic work; Work transfer-displacement work for a simple compressible system, path function, Pdv work in various quasi-static processes(isothermal, isobaric, adiabatic, polytropic, isochoric); Free expansion; Net work done by a system in a cycle.	2
	Definition and unit of heat; Heat transfer-a path function; Similarities and dissimilarities between heat and work.	
	First law of Thermodynamics: For a closed system executing a cycle; Concept of stored energy; Energy as a property, different forms of stored energy, internal energy, first law for a non-flow process; Definition of enthalpy, C_p, C_v; Energy of an isolated system.	2
	Flow energy: First law for an open system-steady flow energy equation; Examples of steady flow devices (nozzle and diffuser, turbine, pump, compressor, heat exchanger, throttling device); PMM-I.	2

	Second law of Thermodynamics: Qualitative difference between heat and work; Definition of source & sink: cyclic heat engine, heat pump and refrigerator, thermal efficiency of heat engine, C.O.P of heat pump and refrigerator; Kelvin-Plank and Clausius statements of second law; Equivalence of the two statements. PMM-II Reversible process; Irreversible process; Factors for irreversibility; Carnot cycle and Carnot efficiency; Carnot theorem, corollaries; Reversible heat engine and heat pump.	2 2
Module 2	**Entropy:** Clausius Inequality: Entropy as a property; T-s plot for reversible isothermal, adiabatic, isochoric & isobaric processes. Tds equation and calculation of entropy change of ideal gases for various processes; entropy change of solids; Concept and uses of entropy, Entropy principle. **Pure substance**: Definition, properties of pure substance; Phases of pure substance; Phase change processes of pure substances — critical point, triple point; Property (phase) diagrams — P- v, P- T, T- s, h-s diagrams; P v T surface for water; Property tables of pure substances — compressed liquid, saturated, wet and superheated vapour, use of saturated and superheated steam table and Mollier diagram **Vapour power Cycle:** Carnot cycle and its practical difficulties; Basic Rankine cycle with steam; Mean temperature of heat addition, steam rate, heat rate; Reheat cycle; Regenerative cycle , Binary vapour cycle.	2 3 7
Module 3	**Nozzles** ; Types of nozzles:Flow throigh nozzles under dry saturated and superheated condition; exit velocity calculation , condition for maximum mass flow rate through ; relationship between area, velocity ,pressure . **Turbines:** Steam turbine classification, Impulse Turbine velocity diagram, Blading efficiency, staging efficiency ,condition for maximum blading efficiency, Reaction turbine , degree of reaction , Parson's reaction Turbine, Condition for maximum blading efficiency of Parson's reaction turbine , Reheat factor, carry over efficiency,blade height calculation. **Governing** : Governing of steam turbine and Losses	3 7 2
Module 4	**Boilers:** Types of boilers ; fire tube boilers , water tube boilers, economiser, evaporator and superheater efficiency, overall efficiency of boiler , natural circulation , forced circulation , Boiler draught, Induced draught , Forced draught , Calculation of chimney height, Efficiency of chimney , Power required to drive fan , Boiler performance and testing . **Bolier: Boiler** operation and safety practices. **Condenser** : Types of condensers,vacuum efficiency , condenser efficiency, Cooling water and Cooling ponds, **Material Handling**: Coal handling and Ash handing system in thermal power plants.	7 1 2 2
		48

Text Books:

1. Engineering Thermodynamics- 5e, Nag, P.K. – TMH.
2. Power Plant Engineering – P.K.Nag – McGraw Hill Education (India) Pvt. Ltd.
3. Thermal Engineering – R.K.Rajput – Laxmi Publication Pvt. Ltd.

Reference Books:

1. Thermal Engineering – Domkundwar – Dhanpat Rai & Co.

FIELD THEORY

Code: ELEC2204
Credit: 3 **Contact: 3L**

Course Outcome: After completion of the course students will be able to
CO1: Apply knowledge of different co-ordinate systems for field analysis problems.
CO2: Apply different techniques of vector calculus to analyze electromagnetic fields to reach substantiated conclusions.
CO 3: Solve static electric field problems for different engineering applications by using vector calculus.
CO4: Solve static magnetic field problems for different engineering applications by using vector calculus.
CO5: Apply the knowledge of Maxwell's equation in solving wave propagation problems.
CO6: Understand and analyze the concepts of electromagnetic waves.

Module 1: **7L**
Introduction: Curvilinear coordinate system, Cartesian coordinates, Cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems.
Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Stoke's theorem, Laplacian operator on scalar and vector, Classification of vector fields, Statement of Helmholtz's theorem, Uniqueness theorem.

Module 2: **10L**
Coulomb's law and Electric field intensity: Coulomb's law, Electric field intensity E & Potential Φ, field due to line charge, field due to sheet charge, field due to continuous volume charge distribution.
Electric flux density and Gauss's Law: Electric flux density, Gauss's law, Maxwell's first equation, Application of Gauss's law.
Energy and potential: Relationship between E and V, Polarization and Dipole moment, Energy density in electrostatic field.
Dielectrics and Capacitance: Electric boundary conditions between dielectrics and conductor–dielectric, capacitance.
Poisson's and Laplace's equation: Poisson's and Laplace's equation, Application of Poisson's and Laplace's equation for solving Electrostatic problems.
Current and conductors: Ohm's law and law of conservation of charge and continuity equation.

Module 3: **11L**
The Steady Magnetic Field : Biot-Savart's law, Ampere's circuital law both differential and Integral form, Magnetic flux density, Magnetic field intensity, Magnetic Vector and Scalar Potential.
Magnetic materials and boundary condition: Magnetization in material and permeability, Boundary conditions between two magnetic media, Magnetic circuits.
Inductance and Energy: Self and Mutual inductance, Inductance of solenoid, Inductance of coaxial cable, Inductance of two wire transmission lines, Energy stored in magnetic field.
Magnetic Forces: Force on a moving charge and current carrying conductor due to magnetic field, Torque developed in current carrying coil in a magnetic field, magnetic moments, forces on magnetic materials.

Module 4: **8L**
Time-Varying Electromagnetic Fields and Maxwell's equation: Faraday's law, Transformer and motional emf, Displacement current, Loss tangent, Maxwell's equations for time varying fields, Time varying Potential, Time harmonic fields.
Electromagnetic wave propagation: Electromagnetic wave equation in loss-less dielectric medium and conducting medium, Plane and polarized waves and their propagation, Intrinsic Impedance, solution of wave equation, Skin effect, Skin depth, Poynting's Theorem and Poynting vector, and it's application.

Text Books:

1. Engineering Electromagnetics by W.H.Hayt
2. Electromagnetics by Kraus & Carver
3. Electromagnetic Theory and application by P.Mukhopadhyay
4. Electromagnetics by A.Pramanik
5. Electromagnetics by Joseph Edminister
6. Electromagnetic fields by Griffiths.

Environmental Sciences **Code: EVSC2016**
Contacts: 2L, Credits: 0

Module 1

Socio Environmental Impact **6L**

Basic ideas of environment and its component
Population growth: exponential and logistic; resources; sustainable development. 3L
Concept of green chemistry, green catalyst, green solvents
Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. 3L

Module 2 **6L**
Air Pollution
Structures of the atmosphere, global temperature models
Green house effect, global warming; acid rain: causes, effects and control. 3L
Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. 3L

Module 3 **6L**
Water Pollution
Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.
Biochemical effects of heavy metals; eutrophication: source, effect and control. 2L
Water quality parameters: DO, BOD, COD.
Water treatment: surface water and waste water. 4L

Module 4 **6L**
Land Pollution
Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. 3L
Noise Pollution
Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. 3L

Text/Books
1. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
2. A. K. De, “Environmental Chemistry”, New Age International.
3. A. K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd

References/Books

1. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
2. D. De, D. De, Fundamentals of Environment & Ecology, S. Chand & Company Ltd.

Course outcome for the subject code EVSC2016

The subject code EVS2016 corresponds to basic environmental chemistry for the 2nd year B.Tech students, which is offered as Environmental Sciences and is mandatory for all branches of engineering. The course provides basic knowledge of various environmental pollutions as well as its impact and ways to curb it. The course outcomes of the subject are

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
5. Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
6. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Electrical Machine Laboratory-I

Code: ELEC 2251 **Contact Hour: 2P**
Credit: 1

Course Outcome:
Students will be able to
1. Understand the operation of DC machines by studying its characteristics.
2. Evaluate the performance of a DC machine by calculating its efficiency.
3. Apply the knowledge to correlate theory with experimental efficiency and regulation calculation in single phase transformer and learn about parallel operation in single phase transformers.
4. Learn to make several connections in a three phase transformer.

List of Experiments:

1. Study of the characteristics of a DC shunt generator.
2. Study of the characteristics of a DC compound motor.
3. Study of methods of speed control of DC shunt motor.
4. Study of the characteristics of a compound DC generator.
5. Study of the characteristics of a DC series motor.
6. Determination of efficiency of a DC machine by
   (a) Swinburne's test.
   (b) Hopkinson's test
7. Determination of efficiency and regulation of a single phase transformer by:
   (a) Open circuit and Short circuit test.
   (b) Load test.
8. Study of different connections of 3-phase transformer
9. Parallel operation of single phase transformers.

SIGNALS & SYSTEMS LAB.

CODE: ELEC2252 **CONTACT: 2P**
Credit: 1

COURSE OUTCOMES

Students will be able to:

- Understand the elementary concept of various types of signal.
- Study and analyze the time domain response of various system.
- Analyze a system from its frequency response.
- Model a system in state variable approach and study the response of it.

List of Experiments:

1. The generation of different type of continuous and discrete signals using MATLAB.
2. Spectrum analysis of different signals.
3. Study of aliasing phenomenon and convolution.
4. Time response of first and second order systems for step, ramp and impulse input.
5. Study of performance indices of second order system excited by step input.
6. Frequency response of first and second order systems.
7. Determination of z- transform and inverse z transform using MATLAB.
8. Obtain Transfer Function of a given system from State Variable model and vice versa using MATLAB.
9. Obtain the step response and initial condition response of SISO and MIMO systems in SV form by simulation.

BASIC THERMAL POWER ENGINEERING LAB

Code: ELEC2253 **Contacts: 2P**

Credits: 1

Expt No.	Title of the Experiment	Periods
1	Study of Two stroke petrol and Four Stroke Diesel and Petrol engines through cut models	2
2	Study of various types of water tube and Fire tube boilers through cut models	2
3	To find the calorific value od diesel fuel using Bomb Calorimeter	2
4	To find the Flash Point and Fire Point of Diesel Fuel using Pensky Marten's Apparatus.	2
5	To find the dryness fraction of steam by Separating and Throttling Calorimeter	2
6	To find the valve timing diagram of a 4 stroke petrol engine	2
7	To carry out volumetric efficiency test on 4 stroke single cylinder diesel engine.	2
8	To carry out the fuel consumption test on 4 stroke single diesel engine.	2
9	Exhaust gas emission test	2

B.Tech in Electrical Engineering
3rd Year, 1st Semester
Syllabus

ELECTRICAL MACHINES-II

CODE: ELEC3101
CONTACT: 3L+1T
Credits: 4

COURSE OUTCOME

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

1. Have an idea about the general terms of rotating machines.
2. Accrue the knowledge about the construction, operating principle, characteristic and commissioning of Alternators.
3. Accrue the knowledge about the construction, operating principle and characteristic of Synchronous Motor.
4. Understand operating principle and analyze the performance of Three Phase Induction Motors.
5. Able to analyze the performance and starting of Single Phase Induction Motor with their uses depending on their torque speedcharacteristics.
6. Apply the knowledge of special motors for solving engineering problems related to various applications.

MODULE I

Basic concept of rotating machine: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil.Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding,Rotating magnetic field**.[3L]**

Synchronous Generator: Construction and operating principle. Different excitation systems. Armature reaction. Theory for salient and non-salient pole machine.Two reaction theory.Transient and Subtransientreactances during short circuit condition. Determination of synchronous machines parameters under steady state and transient condition. Phasor diagram of alternator under different types of loads.Operating characteristic of alternator.Determination of voltage regulation by Synchronous impedance method, M.M.F. method.Potier triangle method. Synchronous machine connected to infinite bus. Effect of change of excitation and speed of prime mover. Synchronization of alternator. Power flow and power angle characteristic.Synchronizingpower.**[9L]**

MODULE II

Synchronous Motor: Construction and operating principle of synchronous motor. Damper winding. Method of starting. Phasor diagram. V curve under lagging and leading p.f, Under excitation and Over excitation. Synchronous Condenser. Power factor control,Hunting.Applications.**[8L]**

MODULE III

Three Phase Induction Motor (IM): Construction. Type and operating principle. Flux and MMF phasor in Induction motors. E.M.F. equation. Determination of equivalent circuit parameters by No load & Block rotor test. Efficiency of 3-ph IM. Torque-slip characteristics. Conditions for maximum torque at start and run. Deep bar and double cage rotor. Methods of starting and speed control. Crawling & Cogging phenomena.ApplicationofPolyphaseInductionmotor.Inductiongenerator. **[10L]**

MODULE IV

Single Phase Induction Motor: Construction. Double revolving field theory. Cross field theory. Starting methods. Speed-Torque characteristics. Phasor diagram. Determination of equivalent circuit parameters by No load and Block rotor test. Condition of Maximumtorque.Applications. **[6L]**

Special Electromechanical Devices: Switched Reluctance motor. Stepper motor. Brush less DC machines. Application of A.Cseriesmotor. **[4L]**

Text Books:	**Reference Books:**
1. Electrical Machinery by Dr. P.S.Bimbhra. 2. Generalized Theory of Electrical Machines byDr.P.S. Bimbhra. 3. Electrical Machines by P. K. Mukherjee & S. Chakravorty. 4. Electrical Machinery byS.K.Sen. 5. Theory of Alternating Current Machinery by Alexander S Langsdorf.	1. The Performance And Design Of Direct Current Machines by Clayton & Hancock. 2. The Performance And Design Of Alternating Current Machines byM.G.Say.

POWER SYSTEM - I

Code: ELEC3102
Contact: 3L+1T
Credits:4

COURSE OUTCOME

Students will be able

1. To demonstrate the basic structure of power system, various methods of conventional power generation and tariff.
2. To explain the mechanical design and the electrical design of power transmission system.
3. To analyze the performance of different type of transmission lines.
4. To learn about the underground cables, different type of distribution systems and power factor correction techniques.

MODULE – I

Introduction: Structure of a power system-Generation, transmission and distribution configuration. Choice of voltage and frequency.

Generation of Electric Power: General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation.

Load Characteristics & Tariff

Indian Electricity Rules-1956: General introduction. (9L)

MODULE – II

Mechanical design of transmission line: Line supports, Towers, Poles, Calculation of sag of Transmission lines, Variation of sag with wind and ice load, stringing chart.

Insulators: Types of Insulators, Potential distribution over a string of Suspension Insulators, String efficiency, Methods of Equalizing the Potential.

Overhead transmission line: Types of conductors, Skin effect and Proximity effect. Inductance and Capacitance of single phase and three phase (symmetrical and unsymmetrical) line, Charging current, Transposition, Bundle and composite conductors, GMD and GMR. Influence of earth on conductor capacitance. (12 L)

MODULE – III

Transmission System: Short, Medium (nominal T and π) and Long transmission lines (equivalent T and π) and their representation. ABCD constants, Ferranti effect, Surge Impedance Loading, Active and reactive power flow through transmission lines, Power Circle diagram.

Corona: Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona, methods of reduction of Corona. (10 L)

MODULE – IV

Power Cables : Types of cables, insulation Resistance, stress and capacitance of single and multicore cables, grading of cables, sheath effects, dielectric loss. Comparison of cables and overhead lines.

Distribution Systems: Feeders, distributors, and service mains; Types of distribution systems- Radial, Ring-Main; Interconnector; Kelvin's law for design of feeders.

Power factor correction (9L)

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Elements of power system analysis, C.L. Wadhwa, New Age International.
3. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors

Reference Books:

1. Power System Analysis by Grainger & Stevenson, Tata McGraw Hill
2. Power System analysis by H.Cotton

CONTROL SYSTEM

CODE: ELEC3103
CONTACT: 3L+1T
Credits: 4

COURSE OUTCOME

Students will be able to

1. Know the fundamental concepts of Control systems and mathematical modeling of the system
2. Analyze time response of a system and understand the concept of stability
3. Investigate frequency response of the system and examine the relative stability by various approach
4. Design and realize control systems using classical methods and state variable modeling technique

Module -I

Introduction to control systems: Introduction of automatic control, Classification of control systems, open loop and closed loop systems. Examples of control systems. Properties of Control Systems, Elementary concepts of sensitivity and robustness, concepts of non minimum phase systems and time delay systems. [2L]

Representation of systems: Block diagram representation of control systems. Block diagram algebra. Block diagram reduction and signal flow graph. Mason's gain formula. [4L]

Control system components: Potentiometer, Tacho-generator, Synchro and resolver, DC and AC servomotor, Actuators, Gyroscope. [4L]

Module -II

Time domain analysis: Review of transient & steady state response of first and second order systems. Concept of undamped natural frequency, damping, overshoot, rise time, peak time and settling time. Effects of Poles and Zeros on transient response. Steady-state and transient errors, concept of system types and error constants. [5L]

Stability Analysis: BIBO stability**,** stability by pole location, Routh-Hurwitz criteria and applications, Root locus techniques, construction of Root Loci. [7L]

Module -III

Frequency domain analysis: Review of frequency response of first and second order systems. Frequency Domain Specifications. Bode plot and Nichols chart. Polar plots. Nyquist criterion, Stability margins. Comparison of absolute and relative stability. [10L]

Module -IV

Design of Control System: Control actions: Proportional, integral, derivative actions and their combinations. Design of compensators. Lead, Lag, Lead- Lag and Lag-Lead compensators. [4L]

State Variable Analysis: State variable formulation of control systems, Canonical forms of SV equations, diagonalization. Introduction to Controllability and Observability. Linear state variable feedback controllers, the pole placement problem. Linear system design by state variable feedback. [6L]

Total: 42L

Text Books:

1. Control system Engineering: I.J. Nagrath & M. Gopal, New Age International.
2. Digital Control & State Variable Methods: M. Gopal, 2nd Edition, TMH
3. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI
4. Control System Engineering: D. Roy Chowdhuri, PHI

Reference books:

1. Control Systems: Principles and Design, M Gopal, TMH
2. Control system Engineering, Ananda Natarajan , P. Ramesh Babu, Scitech
3. Modern Control Engineering, Ogata;Katsuhiko, PHI

POWER ELECTRONICS

Paper Code: ELEC3104
Contact: 3L
Credits: 3

COURSE OUTCOME

Students will be able to:

1. Understand the basic theory and characteristics of power semiconductor devices.
2. Acquire knowledgeabout the operation of single-phase and three-phase thyristorized rectifiers and learn to design them.
3. Analyze basic DC-DC, DC-AC converter topologies.
4. Learn the operation of various AC-AC converters and understand the role of Power Electronics in utility-related applications.

Module 1 [9L]

Introduction:
Need for power conversion; Power electronic converters: classifications and scope.

Power Semiconductor Devices:
Power diode: Structure, V-I characteristics, switching characteristics, types, ratings and applications.
SCR: Basic structure, two transistor model, V-I characteristics, switching characteristics, gate characteristics, protection, ratings and applications. Gate triggering methods – R, RC and UJT firing circuits. Series and parallel operation of SCR. Different commutation techniques.
DIAC: Structure, V-I characteristics.
TRIAC: Structure, V-I characteristics.
GTO: Structure, V-I characteristics, switching characteristics.
BJT: Structure, characteristics, ratings.
Power MOSFET: Structure, characteristics, ratings.
IGBT:Structure, characteristics, ratings.

Module 2[10L]

Phase controlled converters:
Input and output characteristics of common rectifier topologies: Single-phase half-wave and full-wavecontrolled rectifiers with R, RL and RLE load. Effect of Free-wheelingdiode. Semiconverters.Performance parameters of two-pulse converters. Three-phase half-wave and full-wave controlledrectifiers with R, RL load (effects of continuous and discontinuous current on converters). Effectof Free-wheeling diode. Power quality aspects in converters. Effect of source inductance incontrolled rectifier and loss of voltage due to commutation.Dual Converters. Selection of devices and its specifications.

Module 3[10L]

DC Choppers: Classification & operation of choppers (A, B, C, D, E). Control strategies. Buck, Boost andBuck-Boost converters: Circuit configuration and analysis.Multiphase chopper.

Inverters:
Definition and classification of inverters: VSI and CSI, SPWM.Brief idea of Resonant Pulse Converter.

Principle of operation of 1-phase VSI and 3-phase VSI (180°, 120°) modes.
PWM inverters.
Power quality aspects of inverters, Improvement of power quality.

Module 4[7L]

AC-AC direct converter:
Principle of on-off voltage regulator and phase controlled voltage regulator. Operation of 1-phase controlled voltage regulator with R, RL loads.

Principle of operation of cycloconverters. Circulating and non-circulating mode of operation single phase to single phase cycloconverters, three phase to three phase cycloconverters.

Applications:
HVDC transmission, SMPS, UPS,Static Circuit Breakers.

Text Books:
1. Power Electronics, Mohan, Undeland& Robbins, Wiley India.
2. Power Electronics, M.H. Rashid, PHI.
3. Power Electronics, M.D Singh and K.B. Khanchandani, Tata McGraw Hill.
4. Power Electronics, P.S. Bimbhra, Khanna Publishers.
5. Power Electronics, Dr. P.C Sen, McGraw Hill Education.

Reference Text Books:
1. Modern Power Electronics and AC Drives, B.K Bose, Prentice Hall.
2. Element of Power Electronics, Phillip T Krien, Oxford.
3. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
4. Power Electronics: Principles and applications, J.M. Jacob, Thomson.

DIGITAL SIGNAL PROCESSING

CODE: ELEC3141
CONTACT: 3L
Credits: 3

COURSE OUTCOME

Students will be able to

1. Understand, interpret, represent, manipulate, process, and analyze of discrete time signals and systems in the context of digital signal processing.
2. Understand a new representation of signal sequences with the z-transform, concept of transfer-function, and an application of z-transform properties for modeling of discrete time signals and stability analysis of systems.
3. Understand the frequency domain analysis of discrete time signals, spectral analysis and existence of efficient and fast algorithms for DSP systems.
4. Understand the design and analyze for digital filters, concept of linear-phase filters, realization of filter structures, mapping from analog filter to digital filter, and implementation of digital filters in real time (with Digital signal processor).

Module-I

Discrete-time signals: Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences,-periodic, energy, power, unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences. [4]

LTI systems: Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems. [6]

Module-II

z-transform: Review of z-transform and its properties, Application of z-transform. [4]

Transformation techniques: Mapping using differentials, impulse invariant transformation, Bilinear transformation, Matched z-transformation. [4]

Module-III

Discrete Fourier Transform: Concept and relations for DFT/IDFT, computational burden of DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods. [6]

Fast Fourier Transform: Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computation load. [4]

Module-IV

Filter Design: Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman window. [8]

Digital Signal Processor: Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language. [2]

Total= 38L

TEXT BOOKS:

1. Digital Signal Processing,Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.

REFERENCE BOOKS:

1. Digital Signal Processing, Chen, OUP
2. Digital Signal Processing, Johnson, PHI
3. Digital Signal Processing using MATLAB, Ingle, Vikas.
4. Digital Signal Processing, Ifeachor, Pearson Education.

COMPUTATIONAL ELECTROMAGNETICS

CODE: ELEC 3142
CONTACT: 3L
Credits: 3

COURSE OUTCOME

At the end of this course students will be able

1. To understand the basic concepts of electromagnetic.
2. To provide comprehensive knowledge on Finite Difference Method (FDM)
3. To provide comprehensive knowledge on Finite Element Method (FEM)
4. To apply the techniques to simple real-life problems.

Module 1:

Introduction:
Review of basic fundamentals of Electrostatics and Electromagnetics. Development of Helmhotz equation, energy transformer vectors, time-harmonic. [4L]

Analytical Methods:
Analytical methods of solving field equations, method of separation of variables, integral methods- Green's function, method of images. [4L]

Module 2:

Finite Difference Method (FDM)
Finite Difference schemes, treatment of irregular boundaries, accuracy and stability of FD solutions, Finite-Difference Time-Domain (FDTD) method- Uniqueness and convergence. [10L]

Module 3:

Finite Element Method (FEM):
Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, efficient finite element computations. [10L]

Module 4:

Applications
Low frequency electrical devices, static / time-harmonic / transient problems in transformers, rotating machines, actuators. [6L]

Text/Reference Books

1. P. P. Silvester and R. L. Ferrari "Finite Element for Electrical Engineers", Cambridge University press, 1996.
2. M. N. O. Sadiku, "Numerical Techniques in Electromagnetics", CRC press, 2001.
3. Analytical and Computational Methods in Electromagnetics, By R.Garg, Artech House Publication
4. Computational Methods for Electromagnetics and Microwaves,By R.C Booton, Jr, , John Wiley & Sons
5. Computational Methods for Electromagnetics, By A. F. Peterson, S. L. Ray, and R. Mittra, IEEE Press
6. The Finite Element Method in Electromagnetics,By J. M. Jin, John Wiley & Sons
7. The finite difference time domain method for electromagnetis,By K. S. Kunz & R. J. Luebbers, CRC Press

Syllabus

Indian Constitution and Civil Society

Paper Code: INCO 3016

Contact Hours-2 hrs/week, 24hrs/semester

Credit-0

Course Outcomes

The learner will be able to-

- Analyse the historical, political and philosophical context behind the Indian Constitution-making process
- Appreciate the important principles characterizing the Indian Constitution and institute comparisons with other constitutions
- Understand the contemporaneity and application of the Indian Constitution in present times
- Critique the contexts for constitutional amendments in consonance with changing times and society
- Establish the relationship between the Indian Constitution and civil society at the collective as well as the individual levels
- Consciously exercise the rights and the duties emanating from the Indian Constitution to one's own life and work

Module 1- 6L

Introduction to the Constitution of India-Historical Background

Making of Indian Constitution -the process of framing the constitution, the constituent assembly

Module II-6L

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

Module III-6L

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

Module IV-6L

Constitution and Society- democracy, secularism, justice

Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental Duties

Reference Books

C.M.Elliot, (ed.), Civil Society and Democracy, OUP, Oxford, 20012..

David Held et.al (ed),The Idea of the Modern State, Open Univ. Press, Bristol, 1993

Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

ELECTRICAL MACHINES-II LAB

CODE: ELEC 3151
CONTACT Hr: 2P
Credit: 1

COURSE OUTCOME

Students will be able to

- acquire knowledge of parallel operation of alternators.
- have an idea about testing of synchronous machines.
- Acquire knowledge about the induction motor working as generators.
- learn the starting and speed control of induction motors
- have an idea about about testing of induction motors.
- Acquire the knowledge of winding connection.

List of Experiments:

1. Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta].
2. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
3. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4. Determination of regulation of Synchronous machine by
    a. Potier reactance method.
    b. Synchronous Impedance method.
5. Determination of equivalent circuit parameters of a single phase Induction motor.
6. Load test on single phase Induction motor to obtain the performance characteristics.
7. Load test on wound rotor Induction motor to obtain the performance characteristics.
8. To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6 poles & 4 pole operation.
9. To study the performance of Induction generator.
10. Parallel operation of 3 phase Synchronous generators.
11. V-curve of Synchronous motor.
12. Determination of equivalent circuit parameters of 3 ph induction machine
13. Performance of 3 ph squirrel cage induction motor.

POWER SYSTEM – I LAB

Code: ELEC3152
Contact: 2P
Credit: 1

COURSE OUTCOME

Students will be able

1. To estimate generalized ABCD parameters of a transmission line.
2. To determine the breakdown strength of solid and liquid insulating material.
3. To analyze dc distribution system by network analyzer.
4. To measure earth resistance by megger.

List of Experiments

1. Determination of the generalized ABCD Constant of a long transmission line
2. Dielectric strength test of insulating oil
3. Determination of break down strength of solid insulating material
4. Measurement of earth resistance by Earth-Tester
5. Determination of Phase Sequence Test of a given Three Phase Supply
6. Simulation of DC distribution by network analyzer for Single-end fed system
7. Simulation of DC distribution by network analyzer for Double-end fed system
8. Study and analysis of an electrical transmission line circuit with the help of PSPICE
9. Study of different types of insulators

CONTROL SYSTEM LABORATORY

CODE: ELEC3153
CONTACT: 2P
Credit: 1

COURSE OUTCOME

Students will be able to

1. familiarize with Control system and Simulink toolbox in MATLAB
2. design controller to improve time response of a system
3. realize and design compensator to enhance system performance
4. design linear state feedback controller

1. Familiarization with MATLAB control system tool box, MATLAB Simulink tool box
2. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB**.**
3. Study of Step response for first order & Second order system & determination of control system specification like Time constant, rise time, % peak overshoot, settling time etc. from the response.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box & different control system specification from the plot.
5. Determination of approximate transfer functions from the Bode plot.
6. Study of P, PI, PD and PID control action.
7. Tuning of P, PD, PI and PID controller for first order plant with dead time using Z-N method.
8. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin with the addition of Lead & Lag compensator.
9. Design of Lead and Lag compensation circuit for the given plant transfer function. Analyze step response of the system by simulation.
10. Design of linear state feedback controller of a system using MATLAB

POWER ELECTRONICS LAB

ELEC3154
Contact: 2P
Credit: 1

COURSE OUTCOME

Students will be able to

1. Set up testing strategies and select proper instruments to evaluate performance characteristics of Power devices and Power Electronics circuits and analyze their operation.

2. Use the knowledge of making electrical and device connections by wires keeping in mind the technical, economical, safety issues.

3. Learn to do computer simulations for verification of circuit behavior of different Power Electronics circuits and compare it to theory.

4. Engaging students into team based laboratory activities will enhance their ability to interact effectively on a social and interpersonal level with fellow students, and also demonstrate the ability to divide up and share task responsibilities to complete assignments.

List of Experiments:

1. Study of the characteristics of SCR.
2. Study of the characteristics of DIAC & TRIAC.
3. Study of different triggering circuits of SCR.
4. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
5. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
6. Study of the operation of a single phase AC Voltage controller.
7. Study of performance of step down chopper.
8. Study of MOSFET bridge inverter with R and R-L load.
9. Study of single phase half wave and full wave controlled converters (Simulation).
10. Study of single phase controlled converter with and without source inductance (Simulation).
11. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter (Simulation).
12. Study of step down, step up, step up-down dc-dc converter (Simulation).
13. Study of three phase full controlled converter with R & R-L load (Simulation).
14. Study of AC voltage controller (Simulation).

B.Tech in Electrical Engineering
3rd Year, 2nd Semester
Syllabus

POWER SYSTEM-II

Code: ELEC3201
Contact: 3L+1T
Credits: 4

COURSE OUTCOME

Student will be able

1. To analyze different types of power system faults.
2. To analyze the load flow problems and stability in power system.
3. To discuss the basic principles of Power System relaying and the different protection schemes for various power system components.
4. To discuss the basic principle of Circuit Breaking and grounding.

MODULE – I

Representation of Power system components: Single-line diagram of balanced three phase system, Impedance & Reactance diagram, Per unit system representation, Base values-phase and line quantities.

Symmetrical & Unsymmetrical Fault Analysis: Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system.

Symmetrical fault analysis.

Symmetrical component analysis of unsymmetrical faults, single line-to-ground fault, line-to-line fault, double line-to-ground fault. [11L]

MODULE – II

Power system stability: Classification of power system stability – voltage stability, Rotor angle stability- steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept.

Load flow Analysis: Load flow problem, Y-bus Formulation of problem, Solution technique using Gauss-Seidal method, Newton-Raphson method [10L]

MODULE – III

Basic principles of power system protection, block diagrams of protective scheme and fundamental principles of Induction relay. Single input relays, Principle and application of non-directional & directional over current and earth fault relays. Distance relays, Differential relays. Basic aspects of static relay.

Protection schemes for transformer, generators and motors. [10L]

MODULE – IV

Circuit Breaker : General requirements of circuit breakers. Formation of electric arc, quenching theories, recovery voltage and RRRV, Arc re-striking phenomena. Problems in capacitive and low inductive current interruptions. Rating of circuit breakers.

Different types of circuit breakers - their operating mechanisms & applications. Testing of circuit breakers. D.C circuit breaking.

Substation grounding [9L]

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Power System Analysis by Grainger & Stevenson, Tata McGraw Hill
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. Elements of power system analysis, C.L. Wadhwa, New Age International
5. Power System Protection and Switchgear, B. Ravindranath, M. Chander

Reference Books:

1. Protection & Switchgear, B. Bhalja, R.P. Maheshwari, N.G.Chothani, Oxford.
2. Power system protection & switchgear, B.Ram & D.N. Vishwakarma, Tata McGraw Hill.
3. Power System Stability & Control - Prabha Kundur
4. Power Systems Stability, Vol. I,II& II, E.W. Kimbark, Wiley.
5. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education.
6. Power System Operation by James Malinowski , Robert Miller
7. The Art and Science of Protective Relaying by C. R. Mason, John wiley & Sons

MICROPROCESSOR & MICROCONTROLLER

CODE: ELEC3202
CONTACT: 3L
CREDIT: 3

COURSE OUTCOME

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

CO1: Explain the architecture of 8085 microprocessor and apply the concept of instruction sets to write assembly language program.
CO2: Acquire knowledge of 8085 interrupt structure and interface read/write and read-only memories, input & output devices with microprocessor.
CO3: Analyze the internal architecture of 8051 microcontroller and apply the concept of instruction sets to write assembly language program.
CO4: Understand the interfacing of internal and external program and data memory, different peripheral devices with 8051 microcontroller.

MODULE-I: 8085 MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING

8085 architecture-CPU, ALU, Registers organization, bus structure, pin details.

Programming model, instruction cycle, machine cycle and T states, timing diagram, instruction set and addressing modes, stack and subroutine, programming examples. [12]

MODULE-II: INTERRUPTS AND HARDWARE INTERFACING

Interrupts mechanism (Hardware and Software), DMA mechanism.

Memory interfacing, I/O interfacing, memory mapped I/O and I/O mapped I/O, programmable peripheral interface(8255A) and concept of serial communication. [8]

MODULE-III: MICROCONTROLLER AND ASSEMBLY LANGUAGE PROGRAMMING

Microprocessor vs. Microcontroller, MCS-51 family, Features and architecture, Memory organization, internal RAM structures, Special Function Registers and their orientation within the SFR space, Bit address and bit addressable memory space organization.

Pin details, I/O ports and their functions.

Instruction set, concept of assembly language programming and simple programs.

Timers and Counters-different modes of operation.

Interrupts and its Priority. [10]

MODULE-IV: HARDWARE INTERFACING

Interfacing of external program and data memory with 8051μC.

Interfacing of 7 segment, LCD, ADC, DAC and Stepper motor.

Concept of serial communication. [6]

Text Books:

1. Microprocessor Architecture, Programming and Applications with 8085 by R. S. Gaonkar, Penram Pub.
2. The 8051 Microcontroller Based Embedded Systems by Manish K Patel, McGrawHill Pub.
3. 8051Microcontroller and Embedded Systems by Muhammad Ali Mazidi, Janice Mazidi, Janice Gillispie Mazidi
4. Microprocessors and Microcontrollers by N. Senthil Kumar, M. Saravanan, S. Jeevananthan, Oxford University Press

ECONOMICS FOR ENGINEERS (HMTS-3201)

3L/week **Credit-3**

The student will be able to-

- Evaluate a project and estimate the total cost of the project
- Apply financial analytical methodologies to prepare a report regarding the financial performance of an organization
- Participate actively in an organization's capital budgeting process
- Provide vital inputs regarding the pricing of a product
- Apply the knowledge of the interplay of various economic variables and indicators in workplace
- Provide insight about different accounting concepts and apply broader concepts like costs, revenues, assets, liabilities, capital, profit, investment and interest

Module 1:

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.
The basic concept of economics – needs, wants, utility.
National Income- GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity.
Inflation: meaning, reasons, etc. **(6L)**

Module 2:

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.
Banking: role of commercial banks; credit and its importance in industrial functioning.
Role of central bank: Reserve Bank of India.
International Business or Trade Environment. **(4L)**

Module 3:

Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.
Financial Statement Analysis (Ratio and Cash Flow analysis). **(8L)**

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.
Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.
Marginal Cost based decisions. **(6L)**

Module 4:

Time Value of Money: Present and Future Value, Annuity, Perpetuity.
Equity and Debt, Cost of Capital. **(4L)**

Capital Budgeting: Methods of project appraisal - average rate of return - payback

period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return. Depreciation and its types, Replacement Analysis, Sensitivity Analysis. **(8L)**

Evaluation: Max marks-100
Internal Test-30
Semester Test-70

Suggested Readings:

1. R**.** Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall of India Private Limited. New Delhi
2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of India Private Limited, New Delhi
3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *EngineeringEconomic Analysis.* New York: Oxford University Press. 2012.

ILLUMINATION ENGINEERING

CODE: ELEC 3241
CONTACT: 3L
CREDITS: 3

COURSE OUTCOME

Students will be able to

1. understand the principles of operation of different photometers and apply the laws of photometry for calculation of photometric quantities for different lighting applications
2. understand the principles of operation of different lamps and their accessories
3. analyse indoor lighting schemes and design energy efficient installations complying with lighting codes
4. understand the parameters of energy efficient road lighting and floodlighting installations in conformity with lighting codes

Module – I [9L]

Illumination Engineering Basics and Photometers

Light and Electromagnetic Radiation, Visible spectrum of radiation. Radiometric and photometric quantities, visual response curve of standard observer, relation between Lumen and Watt. Laws of Illumination, perfect diffuser, Lambert's law.Bench photometer, luxmeter, distribution photometer, integrating sphere.

Module – II [9L]

Lamps and Accessories:

Incandescent lamps, tungsten halogen lamps, fluorescent tubes, compact fluorescent lamps (CFL), low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, metal halide lamps, Light Emitting Diode (LED) lamps, LASER. Ballast- function, electromagnetic and electronic types, principles of operation.

Module – III [9L]

Interior Lighting Design

Objectives, quantity and quality of light, selection of lamps and luminaires. Design considerations for lighting of offices, conference rooms, hospitals. Design calculations by lumen

method and zonal cavity method in accordance with lighting code. Emergency lighting concept.

Module – IV [9L]

Outdoor Lighting: Road and Flood Lighting Design

Basic concepts of outdoor lighting design- objectives, design parameters, qualitative & quantitative evaluation of outdoor lighting systems. High mast lighting design. Basic concepts of sports lighting.

References / Books

1. Lighting Engineering Applied Calculations – R. H. Simons & A.R. Bean, Architectural Press
2. Applied Illumination Engineering, Second Edition, Jack L Lindsey, Prentice Hall.
3. Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition Arnold
4. IES Lighting Handbook – IES North America.
5. National Lighting Code- Published by Govt of India,2011
6. Lighting- What everyone should know - M.S.N. Swamy, MSN Marketing
7. Applications of light and energy management - O.N.Awasthi, Narosa Publishing House

ELECTRICAL MACHINE DYNAMICS

CODE: ELEC3242
CONTACT: 3L
Credits: 3

COURSE OUTCOME

Students will be able to

1. develop a clear concept about the generalized theory of electrical machine.
2. understand transient and dynamic analysis of d.c. machine.
3. understand transient and dynamic analysis polyphase synchronous machine.
4. understand transient and dynamic analysis polyphase induction machine.

MODULE-I

Generalized theory of electric machines:

The Primitive machine, Voltage equations of the Primitive machine. Invariance of power. Transformation from a displaced brush axis, Transformation from three phases to two phases, Transformation from rotating axes to stationary axes. Physical concepts of Park's transformations. Transformed impedance matrix. Electrical torque. Restriction of the generalized theory of electrical machines. [12]

MODULE-II

Direct Current machine dynamics:

Steady state analysis, and transient analysis of D.C machines. Transfer functions of D.C machines. Electrical braking of D.C motors. Parallel operation of D.C generators. [8]

MODULE-III

Synchronous Machine Dynamics:

Basic synchronous machine parameters. Behavior of the machine under certain short circuit condition, short circuit oscillogram. Transient analysis of synchronous machine. Transient torque. Sudden reactive loading and unloading. Steady state and transient Power angle Characteristic. Large angular oscillation. Synchronous machine Dynamics. Electrical braking of synchronous motor.

. [12]

MODULE-IV

Induction Machine Dynamics:

Induction machine dynamics during starting and braking. Acceleration time, Induction machine dynamics during normal operation, Operation on unbalanced supply voltage. Slot harmonics. Harmonic effects on Induction motor, Harmonic equivalent circuit and harmonic torque. [8]

Text Books :	Reference Books :
1. Generalized Theory of Electrical Machines by Dr. P.S. Bimbhra 2. Electrical Machinery by S.K.Sen 3. Electric motor drives, modeling, analysis and control, R. Krishnan 4 Dynamic Simulation of Electric Machinery using MATLAB by C. Ong, 5 Analysis of Electric Machinery and Drive Systems by P.C. Krause, Oleg Wasynczuk, Scott D. Sudhoff 6. Electromechanical Motion Device by P.C. krause, O.Wasynczuk	1. Modern power electronics and AC drives, B.K. Bose 2. Electrical Machinery, A.E. Fitzgereld, C. Kingslay and S.D. Uman

Course Name: FUNDAMENTALS OF CIRCUIT THEORY					
Course Code:ELEC3221					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

COURSE OUTCOMES:

The students will be able to

- develop basic concepts of circuit analysis using different mathematical approaches
- make use of network theorems to solve electrical circuits having both dependent and independent sources.
- understand different electrical waveforms, signals and their applications to analyze electrical circuits
- apply Laplace Transform technique for solving transient problems of electrical circuits.
- analyze electrical circuits using the concept of graph theory.
- obtain the equivalent representation of electrical circuits using two-port network parameter representation.

Module-I

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis of electrical circuits.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer theorem applied to circuits containing dependent sources. [8L]

Module-II

Laplace Transform: Concept of complex frequency. Properties of Laplace transform: linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents. Transient and steady state response of switching circuit containing RL, RC, LC and RLC with or without stored energy. [8L]

Module-III

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, Tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium
equations in view of graph theory. [8L]

Module-IV

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [8L]

Total: 32L

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis, M.E. Valkenburg, Pearson Education
3. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference Books:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin,The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza & S.Seely, McGraw Hill.

POWER SYSTEM-II LAB

Code: ELEC3251
Contact: 2P
Credit: 1

COURSE OUTCOME

Students will be able

1. To test CT and PT for power system protection.
2. To experiment with different types of relay.
3. To test different types of protection schemes using ETAP software.
4. To analyze load problems using ETAP software.

List of Experiments

1. Polarity, ratio and magnetization characteristics test on CT and PT
2. To Study & Testing of ON-delay relay and OFF-delay relay
3. To Study the Inverse characteristics of a Under-Voltage relay
4. To Study the Inverse characteristics of Earth Fault relay
5. To Study the Inverse characteristics of Over-Current relay
6. To Study the Inverse characteristics of Directional Over-Current relay
7. To Study Transformer Protection using Electro-mechanical Type Differential relay
8. To study Short Circuit Analysis using Network Analyzer
9. To Study the Performance of Over-Current Relay using ETAP software simulation.
10. To Study the Performance of Under-Voltage Relay using ETAP software simulation.
11. To Study the Performance of Differential Relay for Transformer Protection using ETAP software simulation.
12. To Study the Load Flow analysis by Gauss-Seidel & Newton-Raphson method using ETAP or MATLAB software simulation

MICROPROCESSOR & MICROCONTROLLER LAB

CODE: ELEC3252
CONTACT: 2P
CREDIT: 1

COURSE OUTCOME

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

CO1: Write 8085 based assembly language programs to perform various data transfer, arithmetic and logical operations, stack and subroutine operations.

CO2: Interface various peripheral devices with 8085 microprocessor.

CO3: Write 8051 based assembly language programs to perform various data transfer, arithmetic and logical operations.

CO4: Interface various peripheral devices with 8051 microcontroller.

List of Experiments:

1. Familiarization with Microprocessor trainer kit, assembly language programming of data transfer and arithmetic operation.

2. Assembly language programming of 8 bit and 16 bit addition and subtraction, multiplication, division and BCD subtraction.

3. Assembly language programming of odd and even number determination, shifting a block of data, smallest and largest number, ascending and descending order.

4. Assembly language programming of up and down counters, packing and unpacking of BCD numbers.

5. Assembly language programming of reading data through key board, character display/blink, digital clock.

6. Assembly language programming of waveform generation using interfacing circuit.

7. Interfacing and programming of Stepper Motor and 7 Segment Display.

8. Assembly language programming of 8 bit addition, subtraction, multiplication and division using 8051 microcontroller.

9. Assembly language programming on 8051 timer/counter, I/O port.

10. Interfacing of ADC 0808/0804 with 8051 microcontroller.

ELECTRICAL MACHINE DESIGN

Code: ELEC3260
Contact: 2P
Credit: 1

COURSE OUTCOME

Students will be able to:

1. design heating element and reactor.
2. acquire knowledge related to transformer designing
3. gather information related to induction motor design
4. acquire knowledge related to designing of electronic ballast and servo motor

COURSE CONTENT

- Designing a heating element with specified wattage, voltage and ambient temperature.
- Designing an air core grounding reactor with specified operating voltage, nominal current and fault current.
- Designing of a transformer.
- Designing a three phase squirrel cage induction motor.
- Designing a three phase wound rotor induction motor.
- Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump.
- Designing a permanent magnet fractional hp servo motor.
- Designing of an electronic ballast.

B.Tech in Electrical Engineering

4^{th} Year, 1^{st} Semester

Syllabus

Course Name : Principles of Management					
Course Code: HMTS4101					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcome:

Upon completion of the course, students will be able

1. To study the evolution of Management.

2. To understand various management functions and have some basic knowledge on different aspects of management.

3. To understand the planning process in an organization.

4. To understand the concept of organizational structure.

5. To demonstrate the ability to direct, lead and communicate effectively.

6. To analyse and isolate issues and formulate best control methods.

Module I:

Introduction (8L)

Management: Definition, nature, purpose and scope of management

Skills and roles of a Manager, functions, principles;

Evolution of Management Thought: Taylor Scientific Management, Behavioural Management, Administrative Management, Fayol's Principles of Management, Hawthorne Studies.

Types of Business organization -Sole proprietorship, partnership, company-public and private sector enterprises -Organization culture and Environment –Current trends and issues in Management.

Module II (8L)

Planning: Types of plans, planning process, Characteristics of planning, Traditional objective setting, Strategic Management, premising and forecasting.

Organizing: Nature and Purpose-Formal and informal, organizational chart, organization structure-types-line and staff authority, departmentalization, delegation of authority, centralization and decentralization.

Controlling: Concept, planning-control relationship, process of control, Types of Control, Control Techniques

Human Resource Management-HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

Module III (8L)

Directing: Foundations of individual and group behaviour –motivation –motivation theories –motivational-Techniques –job satisfaction –job enrichment –leadership –types and theories of leadership –Communication –process of communication –barrier in communication –effective communication –communication and IT

Decision-Making: Process, Simon's model of decision making, creative problem solving, group decision-making.

Coordinating: Concepts, issues and techniques.

Module IV (8L)

Leading: Managing Communication: Nature & function of communication, methods of interpersonal communication, barriers of effective communication, direction of communication flow, role of technology in managerial communication

Motivating Employees: Define motivation, compare and contrast early theories of motivation, compare and contrast contemporary theories of motivation & current issues.

Being an Effective Leader Define leader/ leadership, compare and contrast early theories of leadership, understand three contingency theories, understand modern views on leadership. Motivation, Leadership, Communication, Teams and Teamwork.

Management by Objectives (MBO): Management by exception; Styles of management: (American, Japanese and Indian), McKinsey's 7-S Approach, Self-Management

Reference Books:

1.Stephen P. Robbins and Mary Coulter, "Management", Pearson Education, 2017, 13th edition

2.Koontz H. and Weihrich H., "Essentials of Management", Mcgraw Hill Int. Ed., 2015, 10thedition

3.Bhat A and Kumar A. “Management: Principles, Processes & Practices”, Oxford University Press, 2016, 2ndedition

4.Robbins, Coulter, and DeCenzo, “Fundamentals of Management”, Pearson Education, 2016, 9th edition

5.Richard L.Daft, "Management", Cengage Learning, 10thedition

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ADVANCED POWER SYSTEM
CODE: ELEC4131
CONTACT: 3L
CREDIT: 3

COURSE OUTCOME
Students will be able
1. To understand the Economic Operation of Power Generation Systems
2. To learn about the components and operation of HVDC transmission system .
3. To learn about the power system transients and protection against overvoltage.
4. To understand and analyze the frequency Control in Power System.
5. To know about the basic principle of voltage control and operation of FACTS devices.

MODULE-I

Economic Operation of Energy Generation Systems
Generator Cost Curves; Economic Operation of Thermal Power plants ; Transmission Loss and Penalty Factor; Necessity of Hydro-Thermal Scheduling; Unit Commitment problem- various costs and constraints, solution of Unit Commitment problem. [9L]

MODULE-II

Introduction to HVDC: Introduction to DC power transmission technology, comparison of AC and DC transmission, Components of HVDC transmission , Configurations of DC transmission system [4L]

Power System Transients: Types of Power System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Reflection and Refraction coefficient; Bewley's Lattice Diagram, Protection against Over-Voltage Transients in Power System. [6L]

MODULE-III

Automatic Generation Control
Concept of AVR and ALFC Loops, Representation of Speed Governors, Turbines, Generators and loads; Exciter and VAR Control; Single Area Load Frequency Control. [7L]

MODULE-IV

Reactive Power Sensitivity and Voltage Control; Shunt and Series Compensation; Introduction to different FACTS devices, their principle of operation and their role in reactive power and voltage control. [10L]

TOTAL: 36L

TEXT BOOKS:

1. HVDC Power Transmission Systems –Technology & System Interaction by K.R.Padiyar, Willey Eastern.
2. Modern power system analysis, D.P. Kothari & I.J. Nagtrath, Tata McGraw Hill.
3. Power generation operation & control, A.J. Wood & B.F. Wollenberg, Wiley India.
4. Power System Stability and Control by Prabha Kundur, Tata McGraw Hill.
5. Electric Energy Systems Theory by O.I. Elgard, Tata McGraw Hill.

REFERENCE BOOKS:

1. Power system analysis- S.Sivanagaraju
2. Power system Analysis, operation & control, Chakrabarty & Haldar, 2nd edition, PHI.
3. Power System Operation and Control, Umakant Rao,
4. Electrical Power System by C.L Waldha, New age International Publication

ADVANCED CONTROL SYSTEM
CODE: ELEC4132
CONTACT: 3L
CREDIT: 3

COURSE OUTCOMES OF ADVANCED CONTROL SYSTEM

Students will be able to

1. Know the fundamental concepts of Nonlinear Control systems
2. Analyze Nonlinear systems by describing function and phase plane method
3. Acquire knowledge about importance of observers in control systems
4. Analyze the stability of a nonlinear system by Lyapunov theory
5. Know the fundamental concepts of optimal control systems

Module I

Nonlinear systems:

Introduction to Nonlinear Systems, Typical behaviors of Nonlinear Systems (Multiple Isolated Equilibrium Points, Finite Escape time, Limit Cycle Oscillations, Bifurcation, Chaos and Jump Resonance). Common nonlinearities (Saturation, Dead-zone, Relay, Hysteresis, Backlash).

Nonlinear system analysis: concepts of phase plane analysis. Phase plane analysis of linear and nonlinear systems. Construction of phase plane trajectories by analytical method and graphical method namely Isoclines method. Concept of Singular Point and its stability. Phase Plane Analysis of linear second order systems and analysis of the stability of the singular points (Node, Saddle, Focus and Centre). Analysis of simple control systems by phase plane methods. Bang Bang or On-Off control. Stability analysis of Limit cycles. 9L

Module II

Describing Function Techniques:

Introduction to Describing function. Determination of Describing Functions for some common memory less and memory based nonlinearities. Stability analysis by describing function technique. Prediction of limit cycles using describing function technique. 4L

Observers in Control Systems:

Introduction to State observers. Design of full order state observers. Observer based state feedback control systems. Reduced order state observers.

5L

Module III

Concept of stability. Stability Analysis by Lyapunov Theory: Lyapunov's First Method, Lyapunov's Second Method. Definitions of Lyapunov functions. Lyapunov analysis of LTI systems. Concept of Asymptotic stability and Exponential Stability, Global and Local stability. Stability Analysis of Nonlinear Systems in the sense of Lyapunov: The first and second methods of Lyapunov. Concepts of linearization. Design of control systems using Lyapunov Methods.

8L

Module IV

Introduction to Optimal Control Systems:

Introductory concepts of Optimal Control Systems and Performance Indices. Concepts of regulator problem, tracking problem. Hamilton-Jacobi equation. Optimal Control of linear systems with Quadratic Performance Index. Numerical solution of Riccati equation. 8L

TOTAL: 34L

Text Books:

1. Applied Nonlinear Control - Jean-Jacques E. Slotine, Weiping Li, Prentice-Hall
2. Nonlinear Control - H.K. Khalil, Prentice-Hall
3. Nonlinear Systems- H.K. Khalil, Prentice-Hall
4. Control system Engineering- I.J. Nagrath & M. Gopal, New Age International.
5. Control System Engineering- D. Roy Chowdhuri-PHI
6. Control Systems: Principles and Design, M Gopal, TMH
7. Modern Control Engineering, Ogata Katsuhiko, PHI

Reference books:

1. Digital Control & State Variable Methods- M. Gopal, 2nd Edition, TMH
2. Nonlinear Systems Analysis- M. Vidyasagar,
3. Non-linear Systems Analysis Stability and Control- Shankar Sastry, Springer

AUTOMATIC CONTROL SYSTEM
CODE: ELEC4121
CONTACT: 3L
CREDITS: 3

COURSE OUTCOMES OF AUTOMATIC CONTROL SYSTEM

Students will be able to

1. understand fundamental concepts of control system.
2. construct mathematical model of systems.
3. analyze time domain response of system and infer about its stability.
4. examine the relative stability of system in the frequency domain by various approaches.

Module I

Review of Laplace Transform.

Introduction to control system: Concept of feedback and automatic control, Effects of feedback, Objectives of control system, Types of control system, examples of feedback control systems. Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness.
Transfer function concept. Poles and Zeros of a transfer function.
Control system components: Potentiometer, Synchro, Resolver, Tacho-generator, Actuator, Servomotor. **[8]**

Module II

Mathematical modeling of systems: Translational systems, Rotational systems, Mechanical coupling Electrical analogy of Spring-Mass-Dashpot system.
Representation of systems: Block diagram representation of control systems. Block diagram reduction techniques. Signal flow graph. Mason's gain formula. **[8]**

Module III

Time domain analysis: Time domain analysis of first and second order closed loop system. Time domain performance parameters: undamped natural frequency, damping ratio, overshoot, rise time, peak time, settling time and steady state error.

Stability Analysis: Routh-Hurwitz criteria. Root locus techniques, construction of Root Loci. **[8]**

Module IV

Frequency domain analysis of linear system: Polar plot, Nyquist stability criteria. Bode plot, determination of phase and gain margins from Bode plot. **[9]**

Text Books:

1. Control system Engineering: I.J. Nagrath & M. Gopal, New Age International.
2. Digital Control & State Variable Methods: M. Gopal, 2nd Edition, TMH
3. Control System Engineering: D. Roy Chowdhuri, PHI

Reference books:

1. Control Systems: Principles and Design, M Gopal, TMH
2. Control system Engineering, Ananda Natarajan , P. Ramesh Babu, Scitech
3. Modern Control Engineering, Ogata;Katsuhiko, PHI

Principle of Electrical Machine

CODE: ELEC4126
Contacts: 3L
Credits: 3

COURSE OUTCOMES

At the end of this course students will be able to

CO1: Acquire knowledge of the constructional details and operating principle of DC generator and analyze the performance under various operating conditions.
CO2: Understand the operating principle of DC motor and analyze the performance.
CO3: Acquire knowledge about the constructional details, principle of operation, performance analysis and testing of single phase transformers.
CO4: Understand operating principle and analyze the performance of Three Phase Induction Motors.
CO5: Understand working of Alternators and its applications.
CO6: Understand working of synchronous motor and its applications.

Module I:

Construction of DC machine, Different methods of excitation of DC machine.

DC Generators:- EMF equation. Concept of armature reaction, Voltage build-up of shunt Generator, Characteristics of DC Generator.

D.C. Motors:- Principle of operation, Back EMF, Torque equation, Characteristics of DC motors, Speed control of DC motor, Starting of DC shunt motor.

Losses and Efficiency of D.C Machine, Application of D.C Machine [9]

Module II:

Single phase Transformers:- Construction of Transformer. Operating principle of 1-ph transformer, Emf Equation, Equivalent circuit and Phasor diagram of ideal and practical transformer, Losses and efficiency,Open & short circuit tests, Voltage regulation. [8]

Module III :

Three phase Induction Motor:- Construction, Production of rotating magnetic field. Working principle. Slip, frequency of rotor current, Equivalent circuit and phasor diagram. Torque-speed characteristic, Methods of improving the starting torque, Different methods of speed control. [7]

Module IV:

Alternator:- Construction, Excitation Systems, E.M.F equation, Pitch factor and Distribution factor, Armature reaction- Lagging, Leading, Unity p.f load, Phasor diagrams, Open circuit and short circuit test, Use of salient pole and cylindrical rotor alternator.

Synchronous Motor:- Principle of operation, Phasor diagram, Effect of varying field current- v curve, synchronous condenser, Starting of synchronous motor, Hunting. Application of synchronous motor. [9]

Text Books :	Reference Books :
1.Electrical Machinery by Dr. P.S. Bimbhra, Khanna Publisher. 2.Electrical Machines by S. K. Bhattacharya, McGraw-Hill Education. 3. Electrical Machines by Ashfaq Hussain, Dhanpat Rai Publications	1.Theory & Performance of Electrical Machines by J.B.Gupta, S.K. Kataria & Sons. 2.Electrical Machines by Abhijit Chakarabarti and Sudipta Debnath, McGraw-Hill Education.

B.Tech in Electrical Engineering

4th Year, 2nd Semester

Syllabus

HIGH VOLTAGE ENGINEERING

CODE: ELEC4231 **CONTACT: 3L**

Credit: 3

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

- Understand the basic physics related to breakdown processes in solid, liquid and gaseous insulating materials.
- Learn the methods of generation of D. C., A.C., & Impulse voltages.
- Learn the methods of measurements of D. C., A.C., & Impulse voltages & currents.
- Perform tests on H. V. equipments and insulating materials, as per the standards.
- Explain the developments of voltage surges in power system and the operation of the related protective devices.

Module-I

Breakdown in Gases – Ionization processes and de-ionization processes, Townsend Mechanism, Paschen's Law, Streamer Theory of Breakdown in Gases, Breakdown in Electronegative Gases, Time Lags for Breakdown, Corona discharge. [5]

Breakdown in liquid and solid Insulating materials – Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, [4]

Module-II

Generation of High AC Voltage – Testing transformer and its cascade connection, single-phase series resonance circuit**,** [3]

Generation of High DC Voltage – Single-stage and multi-stage symmetric as well as asymmetric voltage multiplier circuits, [3]

Generation of Impulse Voltage – Single-stage and multi-stage impulse generators circuits, Triggering and synchronization with CRO. [3]

Module-III

Measurement of High DC Voltage – Ammeter in series with high resistance [1]

Measurement of RMS value of high AC Voltage – Capacitive Voltage Transformer, Potential Dividers, Electrostatic Voltmeter [2]

Measurement of Peak value of high AC Voltage – Frequency dependent method: Chubb & Fortescue Method, Frequency independent methods: Davis-Bowdler Method & Rabus Method, Sphere-Gap Method [3]

Measurement of High DC, AC and Impulse Currents – Hall generator, Current transformer, Resistive shunts, Rogowski coil, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements [3]

Module-IV

Lightning and Switching Over-voltages – Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers. [5]

High Voltage Testing of Electrical Apparatus – Various standards for HV Testing of electrical apparatus, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of power transformers [4]

TOTAL : 36L

Text Book:

1. High Voltage Engineering Fundamentals – John Kuffel, E.Kuffel , W.S Zaengal.
2. High Voltage Engineering: Theory and Practice - Mazen Abdel-Salam.
3. High Voltage Engineering – M.S Naidu, V. Kamraju.
4. High Voltage Engineering – C. L. Wadhwa.
5. High Voltage Technology –Liviu Leonard Alston.
6. High Voltage Measurement Techniques-A.J.Schwab.
7. High Voltage Engineering -V. Razevig & M.P. Chourasia.
8. High Voltage Insulation engineering – Ravindra Arora, Wolfgang Mosch.

PROCESS CONTROL
CODE: ELEC4232
CONTACT: 3L
CREDIT: 3

COURSE OUTCOMES OF PROCESS CONTROL

Students will be able to

1. Understand the mathematical model of various systems using their knowledge of Mathematics, Science and Engineering.
2. Select the control valve necessary to provide engineering solutions of various societal, professional & environmental responsibilities if imposed.
3. Analyze the close loop response of a process in presence of P, PI, PD & PID controllers.
4. Identify, model and analyze the process and provide solution using knowledge of complex control systems like feed forward, cascade and ratio process control.

Module I

Introduction to process control loop and salient components. Process control terminology. Process instrument diagram. Self-regulating and non self-regulating processes. Degrees of freedom for Process Control. Selection of Controlled, Manipulated, and Measured Variables.

Controller implementation. Electronic analog P, PI, PD, PID controllers. Pneumatic controllers: baffle-nozzle amplifiers, relay valve, pneumatic P, PI, PD, PID controllers. 8L

Module II

Importance of time delay in process control loop. Practical examples. Smith predictors/controllers.

Final control elements in process control loop. Types of Actuators: Pneumatic, Electrical, Hydraulic. Positioners. Pneumo-electric converters. Linear and rotary actuators. Linear pneumatic actuators with and without positioners. Control valves: single stem and double stem sliding valves, butterfly valves, ball valves. Valve sizing. Methods of fluid control: variable delivery, bypass. 9L

Module III

Concept of Processes and Units: Process statics, steady state operating point, mass and enthalpy balance.

Modelling of process dynamics: Modelling of simple Industrial processes. Standard first order process model with delay, time and frequency response of standard first order process model with delay.

Single loop control of standard first order process plants: P, PI, PD and PID control, Controller tuning, Frequency domain design, Ziegler-Nichol's and other empirical tuning methods. 9L

Module IV

Feed forward control: configurations, advantages, limitations, Design based on Steady-State Models and Dynamic Models and industrial applications.
Multi-loop and Cascade control: configurations, interaction and decoupling, industrial applications.
Ratio control: principles, configurations including cascade configuration.
Case study: Boiler Control. 9L

TOTAL : 35L

Text and Reference Books :

1. Principles and Practice of Automatic Process Control - Smith and Corripio
2. Principles of Process Control - Patranabis
3. Automatic Process Control - Eckmann
4. Process Control Systems - Shinskey
5. Process Systems Analysis and Control - Coughanowr & Koppel
6. Chemical Process Control – Stephanopoulos
7. Process Dynamics and Control – Dale E. Seborg, Thomas F. Edgar and Duncan A Mellichamp

ELECTRONIC INSTRUMENTATION
CODE: ELEC4241
CONTACT: 3L
CREDIT: 3

Course Outcomes:

Students will be able to

- infer about low current and voltage measurement using electronic instruments.
- explain the applications of DSO and sensors.
- understand wave analyzing circuits and function generator.
- acquire the concepts of data acquisition and virtual instrumentation.

Module I **8L**

Building blocks of Electronic Instruments: Voltage controlled oscillators, Phase Locked Loop, Digital phase meters, Frequency counters, Charge Amplifier, Programmable Gain Amplifier, Current Mirror, Voltage to frequency and frequency to voltage converters. True R.M.S Voltmeter, Digital voltmeters, Dual slope integrating type DVM.

Module II **10L**

Analogue Electronic Instruments: Current-to-voltage converter type Electronic Ammeters, Chopper stabilized amplifiers for measurement of very low voltages and currents. Power factor meters. Vector impedance meters, Vector voltmeters.

Digital Instruments: Basic Digital Displays – LEDs and LCD panels, Digital Storage Oscilloscope.

Review of sensors: Resistive sensors, inductive sensors, capacitive sensors.

Introduction to MEMS: microelectronics compatible sensors technology.

Module III **8L**

Frequency Domain Instruments: Wave analyzer, Frequency Selective wave analyzers, Heterodyne Wave analyzer, application of Wave analyzer, Basic Spectrum analyzer.

Special Instruments: Q meter, function generators.

Module IV **10L**

Review of digital to analog and analog to digital converters.

Data Acquisition Systems: General Block diagram of Data Acquisition Systems (DAS), Objectives of DAS, Applications of DAS.

Signal Conditioner: Sample and hold circuit, Multiplexing, Analog to Digital Multiplexing, Digital to Analog Multiplexing, Analog Multiplier

Virtual Instrumentation: Virtual Instruments versus Traditional Instruments.

TOTAL : 36L

TEXT BOOKS:

1. Modern Electronic Instrumentation & Measurement Techniques : by Helfrick & Cooper
2. Transducer & Instrumentation, D.V.S Murthy,PHI
3. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
4. Sensors & Transducers : by D. Patranabis
5. Electronic Instrumentation : by Oliver & Cage

REFERENCE BOOKS:

1. Measurement Systems: by Ernest Doebelin
2. Instrument Measurement & Analysis : By Nakra & Chaudhry
3. Principles of Measurement Systems : by John P. Bentley

CONTROL SYSTEMS DESIGN
CODE: ELEC4242
CONTACT: 3L
CREDIT: 3

COURSE OUTCOMES OF CONTROL SYSTEMS DESIGN

Students will be able to

1. Understand various design specifications.
2. Design compensator to satisfy the desired design specifications
3. Design controllers to satisfy the desired design specifications using simple controller structures.
4. Design controllers using the state-space approach.

Module I

Design Specifications

Introduction to design problem and philosophy; Introduction to time domain and frequency domain based design specifications for second order systems and their physical relevances. Effect of gain on transient and steady state responses. Effect of addition of poles and zeros (both in open loop and closed loop) on system responses. Design considerations for Higher order systems. 7L

Module II

Design of Classical Control System

Preliminary considerations of Classical Design; Introduction to compensators. Cascade Compensation: Design of Lag, Lead and Lag-lead compensators in time domain and frequency domain using Root locus and Bode Plots respectively. Hardware realization of cascade compensators. Introduction to Feedback compensation. Introduction to Robust Control System Design. 11L

Module III

Design of PID Controllers

Design of P, I, D, PI, PD and PID controllers in time domain and frequency domain for first, second and higher order systems. Output Derivative Control. Application of Regenerative feedback and control. PID tuning methods. 8L

Module IV

Control System Design in State Space

Review of the Concepts of controllability & observability-Kalman's law and Gilbert's law. Controllable Phase Variable form and Observable Phase Variable form, Effect of pole zero cancellation; Pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Full-order and Reduced order observers. 9L

TOTAL :35L

Text and Reference Books :

1. N. Nise, “Control system Engineering”, John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, “Control system engineering”, Wiley, 2000.
3. D. Roychoudhuri, “Modern Control Engineering”, PHI, 2005
4. K. Ogata, “Modern Control Engineering”, Prentice Hall, 2010.
5. B. C. Kuo, “Automatic Control system”, Prentice Hall, 1995.
6. J. J. D’Azzo and C. H. Houpis, “Linear control system analysis and design (conventional and modern)”, McGraw Hill, 1995.
7. R. T. Stefani and G. H. Hostetter, “Design of feedback Control Systems”, Saunders College Pub, 1994.
8. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988

APPLIED ILLUMINATION ENGINEERING
CODE: ELEC4221
CONTACT: 3L
CREDITS: 3

COURSE OUTCOMES OF APPLIED ILLUMINATION ENGINEERING

Students will be able to

1. apply laws of photometry for calculation of illuminance levels for different lighting applications
2. understand the principles of operation of different photometers
3. compare different types of lamps according to their specifications and uses
4. develop energy efficient indoor lighting installations complying with lighting code
5. correlate parameters of energy efficient outdoor lighting installations

Module I

Illumination Engineering Basics and Photometers **9L**

Visible spectrum of electromagnetic radiation.
Radiometric and photometric quantities, visual response curve of standard observer, relation between Lumen and Watt.
Laws of Illumination, perfect diffuser, Lambert's law.
Bench photometer, luxmeter, integrating sphere.

Module II

Principle of operation of lamps: **8L**

Incandescent lamps, tungsten halogen lamps, fluorescent lamps, low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, metal halide lamps, Light Emitting Diode (LED) lamps.

Module III

Interior Lighting Design **9L**

General requirements and recommendations for working interiors. Recommendations for lighting of industries, offices, hospitals, educational institutes. Design calculations by lumen method in accordance with lighting code.

Module IV

Outdoor Lighting **8L**

Basic concepts of outdoor lighting design- objectives, design parameters, qualitative & quantitative evaluation of outdoor lighting systems. Energy efficient street lighting guidelines. High mast lighting.

Text and Reference Books:

1. Lighting Engineering Applied Calculations – R. H. Simons & A.R. Bean, Architectural Press
2. Applied Illumination Engineering, Second Edition, Jack L Lindsey, Prentice Hall.
3. Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition Arnold
4. IES Lighting Handbook – IES North America.
5. National Lighting Code- Published by Govt of India,2011

Honours Papers

Syllabus

Course Name : Basic Electronics					
Course Code: ECEN1011					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes (CO)

After going through this course, the students will be able to

1) Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.
2) Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.
3) Design different application specific circuits associated with diodes operating both in forward and reverse bias.
4) Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.
5) Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.
6) Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and anlayze their performance depending on the type of required output and subsequently the applied input.

Module I [10 L]

Basic Semiconductor Physics:
Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor

Diodes and Diode Circuits:
Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application.
Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module II [8 L]

Bipolar Junction Transistors (BJT):
PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation, current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module III [9 L]

Field Effect Transistors (FET):
n-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET): enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.

MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.

Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI), Classification of Integrated circuits (IC) and their applications.

Module IV [9 L]

Feedback in amplifiers :
Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:
Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:
Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

References:

1. Boylestad & Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad:Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

Course Name : Basic Electronics Laboratory					
Course Code: ECEN1061					
Contact hrs per week:	**L**	**T**	**P**	**Total**	**Credit points**
	0	**0**	**2**	**2**	**1**

Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPs.

List of Experiments (from)

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

COMMUNICATION for PROFESSIONALS (Theory) – [3L/Week] 39 hrs**.**

Paper code HMTS-1011

Course Objectives:

Students will be able to

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.
5. Learn to articulate opinions and views with clarity.
6. Use various techniques of communication for multiple requirements of globalized workplaces.

Module- I (9hrs.)

Introduction to Linguistics

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Voice Modulation
- Accent Training
- Vocabulary Building
- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in Englishto form derivatives
- Synonyms, Antonyms and standard abbreviations

Module- II (10hrs.)

Communication Skills

- Definition, nature & attributes of Communication
- Process of Communication
- Models or Theories of Communication
- Types of Communication
- Levels or Channels of Communication

- Barriers to Communication

Module- III (10hrs.)

Professional Writing Skills

- Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone
- Proposal Writing: Purpose, Types of Proposals, Structure of Formal Proposals.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

Module- IV (10hrs.)

Communication skills at Work

- Communication and its role in the workplace
- Benefits of effective communication in the workplace
- Common obstacles to effective communication
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections,
- Identify common audiences and design techniques for communicating with each audience

References:

1 Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011
2 Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018
3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

Professional Communication Lab (Practical) –(2P/1C)

Paper code:HMTS 1061

Course Outcome:

Students will be able to

1. Communicate in an official and formal environment.
2. Effectively communicate in a group and engage in relevant discussion.
3. Engage in research and prepare presentations on selected topics.
4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.
5. Organize content in an attempt to prepare official documents .
6. Appreciate the use of language to create beautiful expressions

Module- I (4hrs)

Techniques for Effective Speaking

Voice Modulation: Developing correct tone

Using correct stress patterns: word stress, primary stress, secondary stress

Rhythm in connected speech

Module- II (6hrs.)

Effective Speaking and Social awareness

The Art of Speaking

- Encoding Meaning Using Nonverbal Symbols
- How to Improve Body Language
- Eye Communication, Facial Expression, Dress and Appearance
- Posture and Movement, Gesture, Paralanguage
- Encoding meaning using Verbal symbols: How words work and how to use words
- Volume, Pace, Pitch and Pause
- Cross-Cultural Communication : Multiple aspects/dimensions of culture
- Challenges of cross-cultural communication
- Improving cross-cultural communication skills at workplace.

Module- III (6hrs)

- Group Discussion:Nature and purpose
- Characteristics of a successful Group Discussion
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure.

Module- IV (10hrs.)

Professional Presentation Skills

Nature and Importance of Presentation skills

Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.

Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides

Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, provide closure.

Improving Delivery: Choosing Delivery methods, handling stage fright

Post-Presentation discussion: Handling Questions-opportunities and challenges.

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015
5. Malhotra, A.,Campus Placements, McGraw Hill Education.2015

Physics-II

(Hons paper for Electrical Engineering)

CODE:PHYS2211 **Contact:4L**

Credit: 4

Course Outcome:

1. To understand the concept of mechanics of Quantum Particles and hence their strange behavior imparting the knowledge of nano – science and its applications in nano technology.
2. To understand how thermodynamics gives rise to completely general relationships among various material properties regardless of microscopic structure.
3. To understand the physics behind the superconducting properties of materials and their industrial and medical usefulness
4. To understand the physics behind X-ray diffraction in crystalline structure of a material, and the different imperfection in it.
5. To understand the basic difference between the atomic structure of an isolated atom and atoms in solids differ and accordingly assures the electrical and thermal properties of solids.
   To study the energy band formation in solids and the behavior of electron and hole in the bands.

Module 1:

Thermodynamics :

Zeroth law and First Law of Thermodynamics: Concept of temperature; heat. Energy, enthalpy, specific heats, first law applied to systems and control volumes, steady and unsteady flow analysis. **(1L)**

Second Law of Thermodynamics:

Kelvin-Planck and Clausius statements, reversible and irreversible processes, Carnot theorems, thermodynamic temperature scale, Clausius inequality and concept of entropy, principle of increase of entropy; availability and irreversibility. Application in chemical reaction. **(2L)**

Properties of Pure Substances:

Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T behaviour of simple compressible substances, phase rule, thermodynamic property tables and charts, ideal and real gases, equations of state, compressibility chart. **(3L)**

Thermodynamic Relations:

T-ds relations, Gibbs and Helmholtz free energies; Concept of phase transition, Chemical potential; different forms of criteria of spontaneity and equilibrium; Maxwell relations; Joule Maxwell equations, Joule-Thomson coefficient, coefficient of volume expansion, adiabatic and isothermal compressibilities, Clapeyron equation, vapor pressure vs temperature relations. **(6L)**

Module 2:

Quantum Mechanics:

Group velocity and Phase Velocity, Heisenberg's Uncertainty Relation and its application, Wave function and its physical interpretation, Postulates of Quantum Mechanics, Schrodinger time dependent and time independent equation , Operator formalism, commutation ,expectation value. **(6L)**

Application of Quantum Mechanics:

Concept of free state and bound state, finite and infinite potential , step potential, Rectangular barrier potential, Square well, One dimensional potential well of finite and infinite depth. Quantum confinement **(6L)**

Module 3:

Crystal Physics:

Review of Symmetries in solid, Two dimensional and three dimensional Bravias lattices, Millers indices; X-ray Diffraction: Brags law, Laue's equation. Reciprocal lattice, Concept of Brillion Zone, Ewald construction, Structure factor, Imperfections due to point defects, Energy of formation of vacancy, number of vacancies at any temperature, equilibrium concentration of of Schottky and Frenkel defects in ionic crystal , Colour center, Exciton. **(12L)**

Module 4:

Physics of Solids:

Bonding energy of ionic crystal, Vibrations of monoatomic linear lattice, One dimensional diatomic lattice, Concept of phonons, Inelastic scattering of photons and phonons, Einstein and Debye theory of specific heat. **(6L)**

Band Theory of Solids:

Fermi Dirac distribution and its application in metal and semiconductor. Bloch theorem. Kronig-Penny model (qualitative treatment). Origin of energy band formation in solids. Classification of materials into conductors, Semi conductors & Insulators. Concept of effective mass of an electron and hole. **(6 L)**

Recommended Books:

1. **Atomic Physics Vol 1, S.N.Ghoshal**
2. **Solid State physics by Ashcroft and Mermin.**
3. **Introduction to Solid State Physics by Charles Kittel.**
4. **Heat and Thermodynamics by M.W. Zemansky**
5. **Solid State Physics by A J Dekker**

ELECTRIC DRIVES

Code: ELEC3211
Contact: 3L
Credit: 3

COURSE OUTCOME

Students will be able to:

1. Understand the stable steady state operation and transient dynamics of motor-load system.
2. Learn characteristics, control and operation of solid state DC Motor drives.
3. Appraise various control methods of Induction Motor drives and understand its operation.
4. Analyze various synchronous motor drives and traction drives in detail.

MODULE I [10L]

Electric Drives:
Concept, classification, parts and advantages of electrical drives. Types of Loads, Components of load torques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multiquadrant operation of drives.

Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors. Choice of couplings and bearings.

MODULE II [8L]

DC Motor Drives:
DC Motors and their performance, Types of braking, Single phase and three phase fully controlled and half controlled DC drives, Dual converter fed drives, Armature current control with constant flux and field weakening, Drive schemes with armature voltage feedback, IR-compensation and tacho feedback for both constant flux and field weakening. Chopper controlled DC motor drives.

MODULE III [10L]

Induction Motor Drives:
Induction motor – Equivalent Circuits, Torque-speed characteristics; Operation of Induction Motor with Unbalanced Source Voltages; Analysis of Induction Motor from Non-sinusoidal Voltage Supply; Starting and Braking of Induction Motor; Stator voltage variation by three phase controllers, Speed control using dynamically varying resistance in the

rotor circuit, Slip Power Recovery schemes. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Basics of Vector or Field oriented control.

MODULE IV [8L]

Synchronous Motor Drives:
Variable frequency control, Self Controlled synchronous motor drive, Brushless dc (or Trapezoidal PMAC) Motor Drives

Traction Drives:
Characteristics of Traction Drives; Nature of traction load; Drive Power Requirement; DCand AC Traction.

Text Books:
1.G.K.Dubey, "Fundamentals of Electrical Drives", Narosa Publications.
2. Vedam Subramanyan, "Thyristor control of Electrical Drives", Tata McGraw Hill Publications.
3. Bimal K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall of India.

Reference Books:
1.R. Krishnan, "Electric motor drives Modeling, Analysis and Control", Pearson Publications.
2.S.K. Pillai, "A first course on Electrical Drives", New Age International Publication.
3.W.Shepherd, L.N. Hulley, &D.T.W. Liang, "Power Electronics and Motor Control", Cambridge University Press.

ELECTRIC DRIVES LAB

Code: ELEC3261
Contact: 2P
Credit: 1

COURSE OUTCOME

Students will be able to:

1. Analyze the operation and characteristics of various DC and AC drives.
2. Understand various control strategies that can be applied to DC and AC drives.
3. Learn about how braking is brought about in DC and AC Motors.
4. Enhancing student interaction on a social and interpersonal level with fellow students by engaging them into team based laboratory activities.

List of Experiments:

1. Study of thyristor controlled DC Drive.

2. Study of Chopper fed DC Drive.

3. Study of AC Single phase motor and speed control using TRIAC.

4. PWM Inverter fed 3 Phase Induction Motor control.

5. VSI / CSI fed Induction motor Drive analysis using Software/Hardware.

6. Study of V/f control operation of 3Φ induction motor drive.

7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software/Hardware.

8. Regenerative / Dynamic braking operation for DC Motor - Study using Software/Hardware.

9. Regenerative / Dynamic braking operation of AC motor - Study using Software/Hardware.

10. Dual converter fed DC Motor Drive for realization of four quadrant operation.

Course Name: Transducers & Sensors
Course Code: ELEC 4111
Contact Hrs: 4L
Credits: 4

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

- relate the concepts for converting a physical parameter into an electrical quantity.
- explain the working principles, characteristics of sensors and transducers used for measuring physical quantities.
- understand the operational conditions, range and limitations of sensors and transducers.
- select the best-fit sensors and their use in medical and other applications**.**

Module I **[11L]**

Introduction: Definition, principles of sensing and transduction, classification; concept of signal conditioning.
Mechanical and electromechanical sensors.
Resistive (potentiometric) type: Forms, materials, resolution, accuracy, sensitivity.
Strain Gauges: theory, types, materials, design consideration, sensitivity, gauge factor, temperature dependence, adhesives, rosettes. Applications-force, velocity and torque measurements.
Inductive sensors: common types- reluctance change type, mutual inductance change type,
LVDT: Construction, materials, working principle, output-input relationship.
Capacitive sensors: Variable distance- parallel plate type, Variable area- parallel plate, serrated Plate/teeth type and cylindrical type, variable dielectric constant type.

Module II **[11L]**

Magnetic sensors: Sensors based on Villari effect for assessment of force, torque, rpm meters, proximity measurement.
Hall Effect and Hall drive, Piezoelectric elements: piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, piezoelectric accelerometer.
Tachometers – Stroboscopes, Encoders, seismic accelerometer, Measurement of vibration.

Flow Measurement: Constant-area, Variable-Pressure-drop meters and Constant- Pressure-drop, Variable-area meters. Electromagnetic Flowmeters, Ultrasonic Flowmeters, Hot-wire anemometers.

Module III **[9L]**

Industrial weighing systems: Link–lever mechanism, Load cells – pneumatic, piezo-electric, elastic and magneto-elastic types.

Thermal sensors: RTD – materials, construction, types, working principle.

Thermistor – materials, construction, types, working principle. Thermo-emf sensors: Thermocouple – Thermoelectric Laws, working principle. Thermopile, series and Parallel configuration of thermocouple, Wien's displacement Law, Pyrometer total -radiation and optical types.

Module IV **[10L]**

Optical Sensors: Introduction to optical fibers, LDR, Photodiode, Photovoltaic cell, Photomultiplier Tube. Geiger counters, Scintillation detectors, Ultrasonic sensors: working principle.

Introduction to Smart sensors, Advantages of Smart sensor over conventional sensors. Sensor Applications: Process Engineering, Medical Diagnostic and Patient monitoring, Environmental monitoring etc.

TOTAL : 41L

Text books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. S. Renganathan, *Transducer engineering*, Allied Publishers Limited, 2003.
4. Measurement Systems: Application and Design, E. A. Doebelin, Mc Graw Hill, NewYork

References:

1. Transducer and instrumentation, D. V. S. Murty, PHI, second edition, 2008.

CourseName: DISASTER RESPONSE SERVICES AND TECHNOLOGIES					
CourseCode:HMTS 4011					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	0	0	4	4

Course Outcomes:

After the completion of this course, student will be able to

CO1: Recall the basic concepts and terminologies of disaster and disaster management.
CO2: Understand disaster risk assessment, risk reduction and community preparedness plans.
CO3: Interpret and characterize hazards, vulnerabilities and strategies for disaster mitigation.
CO4: Examine techniques for post disaster situation awareness, damage and need assessment.
CO5:Evaluate post disaster remedial measures and long-term recovery planning.
CO6: Design emergency communication infrastructures, technologies and services.

Module-I [10L]: Introduction

Definition of disaster, types of disasters, phases of disasters, factors contributing to disaster impact and severity, disaster profile of India, definition of disaster management, disaster management cycle, Disaster Management Act 2005, organizations involved in disaster management.

Module -II [10L]: Pre Disaster Services for Risk Reduction

Disaster Preparedness:

Disaster risk assessment, disaster risk reduction, preparedness plans, community preparedness, and emergency resource networks.

Disaster Mitigation:

Concepts of hazard, hazid, hazan and hazop as part of safety and risk management; types of vulnerabilities, vulnerability assessment, strategies for disaster mitigation, structural mitigation and non-structural mitigation, disaster mitigation initiatives in India.

Module-III [10L]: Post Disaster Services for Recovery

Disaster Response

Need for coordinated disaster response, SPHERE standards in disaster response, role of government, international agencies and NGOs, post disaster situation awareness, post disaster damage and need assessment.

Disaster Recovery and Reconstruction

Post disaster effects and remedial measures, creation of livelihood options, disaster resistant house construction, sanitation and hygiene, education and awareness, dealing with victims' psychology, long-term counter disaster planning.

Module-IV [10L]: Disaster Management Technologies

Emergency communication infrastructures; emerging technologies for disaster resilience - drones, VR/AR, social media technologies, real-time mapping system; examples of disaster management information systems; examples of smartphone/ web based applications for disaster management.

References

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", NewRoyal book Company.
2. Bhattacharjee Suman, Roy Siuli, Das Bit Sipra, "Post-disaster Navigation and Allied Services over Opportunistic Networks", Springer Verlag, Singapore.
3. Basu Souvik, Roy Siuli, Das Bit Sipra, "Reliable Post Disaster Services over Smartphone Based DTN: An End-to-End Framework", Springer, Singapore.
4. Sahni, Pardeepet.al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall ofIndia, New Delhi.
5. Goel S. L., "Disaster Administration And Management Text and Case Studies", Deep &DeepPublication Pvt. Ltd., New Delhi.
6. Liu Zhi, Ota Kaoru, "Smart Technologies for Emergency Response and Disaster Management", IGI Global.
7. Rajib Shaw, "Disaster Risk Reduction - Methods, Approaches and Practices", Springer Verlag, Singapore.