SCHEME AND SYLLABI

FOR

THIRD TO EIGHTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING (Part Time)

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

Proposed Scheme of B.Tech Electrical & Electronics Engineering (Part Time) Branch

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Internal	Sem-end		
PTEN09 101	Engineering Mathematics I	2	1	-	30	70	3	4
PTEN09 102	Engineering Mathematics II	2	1	-	30	70	3	4
PTEN09103	Engineering Physics	1	1	-	30	70	3	3
PTEN09 104	Engineering Chemistry	1	1	-	30	70	3	3
PTEN09 105	Engineering Mechanics	2	1	-	30	70	3	4
PTEN09 106	Humanities and Social Science	2	-	-	30	70	3	3
PTEN09 107	Environmental Science	1	-	-	30	70	3	3
PTEN09 108(P)	*Computer Assisted Engineering Graphics*	-	-	2	50	50	3	3
PTEN09 109(P)	*Computer Programming in C*	1	-	1	50	50	3	3
	Total	**12**	**5**	**3**				**30**

Scheme of Combined First and Second Semesters (Common for all branches)

Scheme for B.Tch. Electrical and Electronics Engineering (Part Time) Branch for 3rd to 8th Semesters

3rd Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEN09 301	Engineering Mathematics III	2	1	-	30	70	3	4
PTEE09 302	Electric Circuit Theory	3	1	-	30	70	3	5
PTEE09 303	Electromagnetic Field Theory	2	1	-	30	70	3	4
PTEE09 304	Analog Electronics	2	1	-	30	70	3	4
PTEE09 305	Mechanical Engg	2	1	-	30	70	3	4
PTEE09 306(P)	*Basic Electrical Engg Lab*	-	-	2	50	50	3	2
PTEE09 307(P)	*Analog Electronics Lab*	-	-	2	50	50	3	2
	Total	**11**	**5**	**4**				**25**

4th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEN09 401 B	Engineering Mathematics IV	2	1	-	30	70	3	4
PTEE09 402	Signals and Systems	3	1	-	30	70	3	5
PTEE09 403	DC Machines and Transformers	2	1	-	30	70	3	4
PTEE09 404	Digital Electronics	2	1	-	30	70	3	4
PTEE09 405	Electrical Measurements & Instrumentation Systems	2	1	-	30	70	3	4
PTEE09 406(P)	*Mechanical Engg. Lab*	-	-	2	50	50	3	2
PTEE09 407(P)	*Electrical Measurements & Instrumentation Lab*	-	-	2	50	50	3	2
	Total	**11**	**5**	**4**				**25**

5th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEE09 501	Synchronous and Induction Machines	2	1	-	30	70	3	5
PTEE09 502	Power System Generation, Transmission and Distribution	1	1	-	30	70	3	4
PTEE09 503	Linear Control Systems	2	1	-	30	70	3	4
PTEE09 504	Power Electronics	2	1	-	30	70	3	4
PTEE09 505	Digital system Design	2	1	-	30	70	3	4
PTEE09 506	Electrical Material Science	1	1	-	30	70	3	3
PTEE09 507(P)	*Electrical Machines Lab I*	-	-	2	50	50	3	2
PTEE09 508(P)	*Digital Electronics Lab*	-	-	2	50	50	3	2
	Total	**10**	**6**	**4**				**28**

6th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEE09 601	Microprocessors and Microcontrollers	2	1	-	30	70	3	5
PTEE09 602	Engineering Economics and Principles of Management	2	1	-	30	70	3	4
PTEE09 603	Modern Control Theory	2	-	-	30	70	3	4
PTEE09 604	Electric Drives	2	1	-	30	70	3	4
PTEE09 605	Electrical Engg Drawing	-	-	2	30	70	3	3
PTEE09 Lxx	Elective I	2	1	-	30	70	3	4
PTEE09 607(P)	*Electrical Machines LabII*	-	-	2	50	50	3	2
PTEE09 608(P)	*Mini Project*	-	-	2	50	50	3	2
	Total	**10**	**4**	**6**				**28**

Elective I

EE09 L01 Generalized Machine Theory
EE09 L02 Numerical Analysis and Optimization Theory
EE09 L03 Computer Organization and Architecture
EE09 L04 Entrepreneurship
EE09 L05 Bio- Medical Engineering

7th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEE09 701	Power System Analysis	2	1	-	30	70	3	5
PTEE09 702	Analog and Digital Communication	2	1	-	30	70	3	4
PTEE09 703	Digital Signal Processing	1	1	-	30	70	3	3
PTEE09 704	Electrical Machine Design	1	1	-	30	70	3	3
PTEE09 Lxx	Elective II	2	1	-	30	70	3	4
PTEE09 Lxx	Elective III	1	1	-	30	70	3	4
PTEE09 707(P)	*Power electronics Lab*	-	-	2	50	50	3	2
PTEE09 708(P)	*Advanced Electrical Engg. Lab*	-	-	2	50	50	3	2
PTEE09 709(P)	*Project*	-	-	1	-	100	-	1
	Total	**9**	**6**	**5**				**28**

8th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
PTEE09 801	Electrical System Design	3	1	-	30	70	3	5
PTEE09 802	Power System Protection & Utilization	1	1	-	30	70	3	3
PTEE09 Lxx	Elective IV	2	1	-	30	70	3	4
PTEE09 Lxx	Elective V	2	1	-	30	70	3	4
PTEE09 805(P)	Seminar	-	-	2	100	-	-	2
PTEE09 806(P)	Project	-	-	6	100	-	-	7
PTEE09 807(P)	Viva Voce	-	-	-	100	-	-	3
	Total	**8**	**4**	**8**				**28**

Electives for 7th and 8th Semesters

PTEE09 L06	Special Electrical Machines
PTEE09 L07	Digital Control Systems.
PTEE09 L08	VLSI Design
PTEE09 L09	Energy Auditing, Conservation and Management
PTEE09 L10	Switched Mode Power Converters
PTEE09 L11	Professional Ethics
PTEE09 L12	Embedded Systems
PTEE09 L13	High voltage Engineering
PTEE09 L14	Advanced Topics in Power Systems
PTEE09 L15	Advanced Power system Analysis and control
PTEE09 L16	Optimal Control Theory
PTEE09 L17	Digital Image Processing
PTEE09 L18	Power System Planning and Load Forecasting
PTEE09 L19	Power Quality Issues and Remedial Measures
PTEE09 L20	Management Information Systems
PTEE09 L21	Organizational Behavior

Global Electives

EE09 L22	Soft Computing Techniques
EE09 L23	Process Control and Instrumentation
EE09 L24	Mechatronics
EE09 L25	Robotics & Automation
EE09 L26	Satellite Communication
ME09 L24	Industrial Safety
CS09 L24	Computer Based Numerical Methods
IC09 L23	Bio-Informatics
PE09 L24	Industrial Psychology
PE09 L25	Entrepreneurship
CH09 L23	Nanomaterial and Nanotechnology
BM09 L23	Operation Research

From 5th Semester onwards, the scheme and syllabi of Part Tme Course of Electrical and Electronics course is same as those of Regular course.

PTEN09 301: Engineering Mathematics III

(Common for all branches, Same as EN 09 301)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

This course provides a quick overview of the concepts and results in complex analysis that may be useful in engineering. Also it gives an introduction to linear algebra and Fourier transform which are wealths of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (9 hours)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: Z^n, sinz, cosz, sinhz, coshz, $(z+{}^1/_z)$– Mobius Transformation.

Module II: Functions of a Complex Variable (9 hours)

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series – Laurent series – Singularities and Zeros – Residues – Residue Integration method – Residues and Residue theorem – Evaluation of real integrals.

Module III: Linear Algebra (9 hours) - Proofs not required

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension – Ordered Basis – Coordinate Vectors – Transition Matrix – Orthogonal and Orthonormal Sets – Orthogonal and Orthonormal Basis – Gram-Schmidt orthogonolisation process – Inner product spaces –Examples.

Module IV: Fourier Transforms (9 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier Transforms – Fourier Sine and Cosine Transforms – Properties of Fourier Transforms.

Text Books

Module I:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.

Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.

Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:

Bernaed Kolman, David R Hill, *Introductory Linear Algebra, An Applied First Course,* Pearson Education.

Sections: 6.1, 6.2, 6.3, 6.4, 6.7, 6.8, Appendix.B.1

Module IV:

Wylie C.R and L.C. Barrett, *Advanced Engineering Mathematics*, McGraw Hill.

Sections: 9.1, 9.3, 9.5

Reference books

2. H S Kasana, *Complex Variables, Theory and Applications,* 2e, Prentice Hall of India.
3. John M Howie, *Complex Analysis,* Springer International Edition.
4. Shahnaz bathul, *Text book of Engineering Mathematics, Special functions and Complex Variables,* Prentice Hall of India.
5. Gerald Dennis Mahan, *Applied mathematics*, Springer International Edition.
6. David Towers, *Guide to Linear Algebra*, MacMillan Mathematical Guides.
7. Howard Anton, Chris Rorres, *Elementary Linear Algebra, Applications Version, 9e*, John Wiley and Sons.
8. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
9. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
10. B V Ramana, *Higher Engineering Mathematics,* McGrawHill.
11. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
12. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
13. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
14. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
15. N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e,* Infinity Science Press, Fire Wall Media.
16. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
17. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
18. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 302 ELECTRIC CIRCUIT THEORY
(Same as EE 09 303)

Teaching scheme **Credits:** 5
3 hours lecture and 1 hour tutorial per week

Objectives

- *Familiarization of various network topologies related to two- phase and three- phase systems.*
- *Understanding the various methods for analysis and synthesis of electrical networks.*
- *Design and set up of simple analog filter circuits.*

Module I (14 hours)

Network elements – dependent & independent voltage/current sources – mesh analysis – node analysis – super mesh & super node – source transformation – Superposition theorem – star-delta transformation – Thevenin's theorem – Norton's theorem – Maximum power transfer theorem – DC excitation only.

Steady state ac analysis – resonance – series resonance & parallel resonance – bandwidth, quality factor.

Review of 3-phase systems – active, reactive and apparent power in balanced and unbalanced load – 3 wire star & delta, 4 wire star – measurement of power and power factor – 1, 2 & 3 wattmeter methods – neutral shift – symmetrical components – analysis of unbalanced systems using symmetrical components.

Module II (14 hours)

Laplace transform – gate function – shifting theorem — initial & final value theorem – Laplace transform of periodic signals – inverse Laplace transform – convolution integral – convolution theorem .

Transients – steady state and transient response – DC response & sinusoidal response of R,L,C circuits – application of Laplace transform in transient analysis.

Transformed circuits – transform impedance/admittance of R, L, M & C – dot convention - mesh analysis and node analysis of transformed circuits – solution of transformed circuits including mutually coupled circuits.

Network functions – driving point immittance & transfer immittance functions – poles & zeros – pole-zero plot – time domain response from pole-zero plot.

Module III (13 hours)

Two port networks – Z, Y, h, g, T, T' parameters – relationship between parameter sets – condition for symmetry & reciprocity – interconnections of two port networks – open circuit and short circuit impedances – input & output impedances - image impedances – attenuation & phase constants – characteristic impedance – T-π transformation.

Symmetrical two port reactive networks as filters – classification – characteristics of filter networks – characteristic impedance, attenuation and phase constant in pass band and stop band, cut off frequency – constant-k filters – low pass, high pass, band pass, band stop – T & π section – m-derived filters – low pass and high pass – T & π section.

Module IV (13 hours)

Network Synthesis – positive real functions and Hurwitz polynomial – synthesis of one port networks with two kinds of elements - LC immittance function – RC impedance/RL admittance function – RL impedance/RC admittance function – properties – Foster form I & II – Cauer form I & II.

Network topology – graph, tree, incidence matrix – properties of incidence matrix – fundamental cut sets – cut set matrix – tie sets – fundamental tie sets – tie set matrix – relationships among incidence matrix, cut set matrix & tie set matrix – Kirchoff's laws in terms of network topological matrices – formulation and solution of network equations using topological methods – mesh analysis – node analysis – cut set analysis – I shift – V shift.

Text Books

1. Valkenberg, *Network Analysis*, Prentice-Hall of India
2. K.S. Suresh Kumar, *Electric Circuits & Networks*, Pearson Education
3. Roy Choudhury, *Networks & Systems*, New Age International publishers
4. Gopal G Bhise, *Engineering Network Analysis and Filter Design*, Umesh Publications

Reference Books

1. William H Hayt & Jack E Kemmerly, *Engineering Circuit Analysis*, Tata McGraw-Hill
1. A. Chakrabarti, *Circuit Theory (Analysis & Synthesis)*, Dhanpat Rai & Co.
2. B.C. Kuo, *Network analysis & synthesis* – Wiley-India
3. Edminister, *Electric Circuits – Schaum's Outline Series*, McGraw-Hill
4. Richard C. Dorf & J.A. Svoboda, *Introduction to electric circuits*, Wiley-India
5. Huelsman L.P., *Basic Circuit Theory*, Prentice Hall of India
6. K.M. Soni, *Circuits & Systems*, Katson Books
7. A. Sudhakar & Shyammohan S Palli, *Circuits and Networks, Analysis & Synthesis*, Tata McGraw-Hill
8. Nilsson & Riedel , *Electric Circuits*, Pearson Education
9. M.L. Soni, *A course in electrical circuit analysis*, Dhanpat Rai & Sons
10. Charles Alexander & Sadiku, *Fundamentals of electric circuits*, McGraw-Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 303 ELECTROMAGNETIC FIELD THEORY
(Same as EE 09 304)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the basic principle of Electric and Magnetic Fields.*
- *Studying the governing relations between electric and magnetic fields.*
- *Studying the principle behind electromagnetic wave propagation.*

Module I (9 hours)

Electric Field - Co-ordinate transformation, Vector fields, Divergence Theorem – Stokes Theorem, Static Electric field : Electric flux, Gauss's law, Electric scalar potential, Electric dipole moment, Electric field polarization, condition at boundary between dielectrics, method of images, Capacitance of isolated sphere, Capacitance between co-axial cylinder, Capacitance between parallel wires, Energy density in static field – Solution of Laplace's and Poisson's equation in electrostatics

Module II (8 hours)

Magnetic Field- : Steady magnetic field, Conduction current, Conduction current density, Biot-Savart's Law and Ampere's Law, Vector potential Concept of inductance, Inductance of solenoid, Toroid Concept of resistance, magnetic moment, Torque on a loop, transmission lines Electromagnetic induction – Faraday's law.

Module III (10 hours)

Maxwell's Equations - Continuity equation, Displacement current, Maxwell's equation, Plane waves, Poynting vector and Poynting's theorem, solutions for free space condition, wave equation for a conducting medium, Harmonically varying field, wave polarization, linear, elliptic and circular polarization

Module IV (9 hours)

Waves and Transmission Lines - Wave equation on transmission line. Co-axial and two wire transmission lines. Phase velocity and group velocity, Characteristic impedance, reflection coefficient, Standing wave ratio, Impedance matching, stub matching, Smith chart .Reflection and transmission of plane wave at boundaries, Continuity equation at boundaries, dielectric – dielectric boundary, dielectric – conductor boundary, Law of reflection, Law of refraction(Snell's law), Concept of Brewster's angle.

Text Books

1 W. H. Hayt, *Engineering Electromegnetics,* McGraw Hill
2 David K. Cheng, *Field and Wave Electromagnetics* , Pearson Education
3 Karl E. Lonngren et. al., *Fundamentals of electromagnetics,* Prentice Hall of India.

Reference Books

1 John D. Kraus, *Electromagnetics ,* Mc Graw Hill
2 Mattew N.O Sadiku, *Elements of Electromagnetics,* Addison – Wesley,2-nd edition
3 B. Premlet, *Electromagnetic Theory with Applications*, Phasor Books, Kollam
4 Guru and Hiziroglu, *Electromagnetic Field Theory- Fundamentals*,
5 Pramanik, *Electromagnetism, Theory and Applications*, Prentice Hall of India

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 304 Analog Electronics
(Same as EE 09 305)

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- To familiarize basic electronic elements and its characteristic
- To study linear and non linear applications of Opamp

Module I: Diode and transistor (9 hours)
Diode: Diode as a circuit element - Load line - Piecewise linear model - Single phase half wave and full wave rectifier circuits - Voltage regulation - Ripple factor - Rectifier efficiency - Transformer utilization factor - Bridge rectifier - Rectifier filters - Diode clipping circuits - Single level and two level clippers - Clamping circuits - Zener Voltage Regulators
BJT: Operating point of a BJT – DC Biasing - Bias stability - Thermal runaway - AC Concepts – Role of capacitors in amplifiers – Common Emitter AC Equivalent Circuit - Amplifier gain and impedance calculations- h parameter model of a BJT - Common Emitter and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers- Class B and Class AB - Power amplifiers using BJT
FET: Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers

Module II: Frequency response of amplifiers and feedback concepts (8 hours)
Frequency response of BJT amplifiers : Low Frequency Response-Gain Roll Off -High frequency response – BJT Internal Capacitance-Gain bandwidth product – Miller's Theorem – AC Equivalent Circuit-Gain Roll Off-Low and High Frequency response of FET
Feedback: - Concepts – negative and positive feed back – loop gain- advantages of negative feed back -Feedback Connection Types - Practical Feedback Circuits

Module III: Op amp basics and linear applications (9 hours)
Operational amplifier - Ideal op amp properties - Properties of practical opamps - Internally compensated and externally compensated opamps - Analysis of opamp circuits using ideal opamp model – Open loop and Closed loop Configuration-Concept of virtual short and its relation to negative feedback
Linear Op Amp Circuits: Non inverting amplifier -Voltage follower - Inverting amplifier - Summing amplifier - Subtracting circuits - Voltage to current converter for floating and grounded loads - Opamp integrator - Opamp differentiator – Precision rectifiers
Oscillators : Basics - stability and positive feed back- bark hausen's criterion – phase shift oscillators- wein bridge oscillators – crystal oscillators.

Module IV: Non linear IC applications using Opamp (10 hours)
Signal Generators: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation- monostable circuits- Principles of VCO circuits.
Comparator Circuits: Zero Crossing Detector- Regenerative comparator circuits
Active filters –Types- Characteristics- Frequency Response of different types of filters- Order and cut off frequency -Butterworth low pass filter –First order and second order filter design - Sallen

and Key second order LP filter - - Butterworth high pass filters - Second order wide band and narrow band filters.
Timer IC 555: Functional diagram- astable and monostable modes
Phase locked loops: Principles – Building blocks of PLL-Lock and Capture ranges - Capture process - Study of NE565 - Applications of PLL - Frequency multiplication - FSK demodulator - FM demodulation

Text Books

1. Robert T. Paynter, *Introductory Electronic Devices and Circuits*, Pearson Education
2. A. V. Boylestad and Nashelsky, *Electronic Devices and Circuits*, Prentice Hall of India
3. Ramakant A Gayakwad, *Op- Amps and Linear Integrated Circuits*, Prentice Hall of India

Reference Books

1. Schilling and Belove, *Electronic Circuits*, McGraw Hill
2. Theodore F. Bogart Jr., *Electronic Devices and Circuits,*
3. Coughlin and Driscoll, *Operational amplifiers and Linear Integrated Circuits,*
4. K. R. Botkar, *Integrated Circuits*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE 09 305 MECHANICAL ENGINEERING
(Same as EE 09 306)

Teaching scheme **Credits: 4**
2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basics of the application of dynamics, heat transfer, fluid mechanics, and hydraulic machines.*

(Steam table and Psychometric chart are permitted for the examination.)

Module 1 (9 Hrs.)
Engineering application of thermodynamics -Steam power cycle-Rankine cycle, thermal efficiency, methods of improvement of thermal efficiency -regenerative and reheat. Mollier diagram.
Gas turbine cycle- thermal efficiency, Brayton cycle, methods of improvement of thermal efficiency -regenerative, intercooler and reheat.
Refrigeration-vapour compression refrigeration system, air cycle refrigeration system -bell column cycle, simple air craft refrigeration system-psychometric chart. (Simple numerical problems).

Module 2 (9 Hrs.)
Modes of Heat Transfer, Fourier Law of Conduction and Thermal Conductivity, Conduction of Heat Through A Slab, Conduction of Heat transfer through Hollow Cylinder, Convection and Heat Transfer Coefficient, Natural and Forced Convection, Combined Conduction and Convection Heat Transfer, concept of thermal resistance. Critical thickness of insulation. Fins and their application. Heat Through composite wall and cylinder. Introduction to Radiation Heat Transfer, Concept of Black Body, Monochromatic and Total Emissive Power, Concept of Gray Body and Emissivity, Kirchhoff's Law, Heat Exchangers, LMTD, Overall Heat Transfer Coefficient, parallel and counter flow heat exchangers. (Simple numerical problems).

Module 3 (9 Hrs.)
Fluid Mechanics Fluid properties density, viscosity, surface tension and capillarity Newton's Law of viscosity, Absolute and gauge pressure. Manometers, Bourdon tube pressure gauge. Pressure exerted by a liquid column. Simple numerical problems.
Fluid dynamics Continuity equation, one dimensional flow along a streamline - Euler's momentum equation, Bernoulli's equation. Flow measuring instruments-Venturimeter, orifice meter, nozzle meter, notches and weirs, Pitot tubes (simple numerical problems).

Module4 (9 Hrs.)
Main Parts of a Centrifugal Pump, Work Done by the Centrifugal Pump (or by Impeller) on Water, Definitions of Heads arid Efficiencies of a Centrifugal Pump, velocity diagram, Multistage Centrifugal Pumps ,Specific Speed of a Centrifugal Pump , Priming of a Centrifugal Pump, Characteristic Curves of Centrifugal Pumps, Cavitation, Maximum Suction Lift (or Suction Height) , Net Positive Suction Head (NPSH) : Positive displacement pumps- Reciprocating pumps

main parts, discharge work done and power required to drive a slip in a reciprocating pump simple(simple problems only),
Turbines, Definitions of Heads and Efficiencies of a Turbine, Classification of Hydraulic Turbines, Pelton Wheel ,main parts, Velocity Triangles and Work Done for Pelton Wheel, Radial Flow Reaction Turbines-Francis turbine ,main parts, Velocity Triangles and Work Done by water on runner, Degree of Reactions, draft tube, specific speed, Characteristic Curves (simple problems only)

Reference Books

1 Modi & Seth, Fluid Mechanics and Hydraulic machine,
2 Dr.D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, S.K.Kartha and sons.
3 Dr.R.K.Bensal, Fluid Mechanics and Hydraulic machine, Laxmi Publications (P) Ltd.
4 Domkundwar & Kothandaraman, Thermal engineering, Dhanpat rai & co. (P) Ltd.
5 P.K.Nag, Engineering thermodynamics, McGraw Hill
6 Holman. J.P. Heat Transfer. McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE 09 306(P) BASIC ELECTRICAL ENGINEERING LAB
(Same as EE 09 307(P))

Teaching Scheme **Credits**: 2
2 hours practical per week

Objectives

- *Implementation of basic electrical circuits and verification of basic theorems*

1. Study of PMMC/MI voltmeter/ammeter, dynamometer type wattmeter, clip on ammeter, analog/digital multimeters and static energy meters.
2. Determination of V-I characteristics of a) wire wound rheostat and b) incandescent lamps in series & parallel.
3. Measurement of linear resistance using voltmeter-ammeter method
4. Verification of Kirchoff's laws in DC circuit
5. Verification of Superposition theorem in DC circuit
6. Verification of Thevenin's theorem in DC circuit
7. Verification of Reciprocity theorem in DC circuit
8. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits.
9. Single phase power measurement using a) dynamometer type wattmeter b) 3 ammeters method and c) 3 voltmeters method in an RL load.
10. 3-phase power measurement using one wattmeter and two wattmeters.
11. Power factor improvement in an RL circuit

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 307(P) ANALOG ELECTRONICS LABORATORY
(Same as EE 09 308(P))

Teaching Scheme **Credits**: 2
2 hours per week

Objectives

- *To familiarize the various instruments used in electronics lab*
- *To familiarize and conduct experiments on various analog electronic circuits*
- *To introduce the concept of electronic circuit simulation*

1. Study & Use of CRO: a) Measurement of current voltage, frequency and phase shift.
2. Rectifiers and filters with and without shunt capacitors- Characteristics full wave rectifier- Ripple factor, Rectification efficiency, and % regulation.
3. Second order LP and BP/notch filters using single OPAMP
4. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
5. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
6. Characteristics of clipping and clamping circuits using diodes. Characteristics of voltage regulators- Design and testing of: zener regulator with emitter follower output
7. Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output
8. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator , differentiator ,comparator.
9. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
10. Waveform generation – Square, triangular and sawtooth wave form generation using OPAMPs.
11. IC 555 Applications
12. PLL IC 565/566 Frequency multiplying, FSK demodulation
13. Introduction to circuit simulation-simulation of OPAMP and other analog IC circuits.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEN09 401B: Engineering Mathematics IV

(Same as EN 09 401B)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *The objective of this course is to inculcate the students an adequate understanding of the basic concepts of probability theory to make them develop an interest in the area which may find useful to pursue their studies. Also it is intended to stimulate the students understanding of the Z-transform. A study of some important partial differential equations is also included to make the student get acquainted with the basics of PDE.*

Module I: Probability Distributions (9 hours)

Random variables – Mean and Variance of probability distributions – Binomial Distribution – Poisson Distribution – Poisson approximation to Binomial distribution – Hyper Geometric Distribution – Geometric Distribution – Probability densities – Normal Distribution – Uniform Distribution – Gamma Distribution.

Module II: Z Transforms (9hours)

Introduction – The Z transform – Z transform and Region of Convergence (ROC) of finite duration sequences – Properties of ROC – Properties of Z-Transforms: Linearity, Time Shifting, Multiplication by exponential sequence, Time reversal, Multiplication by *n*, Convolution, Time Expansion, Conjugation, Initial Value Theorem, Final Value Theorem – Methods to find inverse transforms – long division method – partial fraction method – residue method – Solutions of difference equations using Z Transforms.

Module III: Series Solutions of Differential Equations (9 hours)

Power series method for solving ordinary differential equations – Legendre's equation – Legendre polynomials – Rodrigue's formula – Generating functions – Relation between Legendre polynomials – Orthogonality property of Legendre polynomials (Proof not required) – Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions – Relation between Bessel functions – Orthogonality property of Bessel functions (Proof not required).

Module IV: Partial Differential Equations (9 hours)

Introduction – Solutions of equations of the form $F(p,q) = 0$; $F(x,p,q) = 0$; $F(y,p,q) = 0$; $F(z,p,q) = 0$; $F_1(x,q) = F_2(y,q)$; Clairaut's form, $z = px + qv + F(p,q)$; Legrange's form, $Pp + Qq = R$ – Classification of Linear PDE's – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables – D'Alembert's solution of one dimensional wave equation.

Text Books

Module I:
Richard A Johnson, CB Gupta, *Miller and Freund's Probability and statistics for Engineers, 7e*, Pearson Education - Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

Module II:
P Ramesh Babu, R Ananda Natarajan, *Signals and* Systems, 2e, Scitech Publications.
Sections: 10.1, 10.2, 10.3, 10.4, 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.12, 10.5.13, 10.6, 10.10

Module III:
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 4.1, 4.3, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e,* Infinity Science Press, Fire Wall Media.
Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 11.4, 9.8 Ex.3, 11.5

Reference books

1. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, *Probability and Statistics in Engineering,* 4e*,* John Wiley and Sons, Inc.
2. Sheldon M Ross, *Introduction to Probability and Statistics for Engineers and Scientists,* 3e, Elsevier, Academic Press.
3. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, 3e, Pearson Education.
4. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
5. B V Ramana, *Higher Engineering Mathematics,* McGrawHill.
6. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
7. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
8. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
9. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
10. Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
11. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
12. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
13. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
14. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PTEE09 402 SIGNALS AND SYSTEMS
(Same as EE 09 403)

Teaching scheme **Credits:** 5

3 hours lecture and 1 hour tutorial per week

Objective

- *Understand the concepts of signals and systems*

Module 1 (13 hours)

Signals – classification – continuous-time/discrete-time, deterministic/non-deterministic, periodic/ aperiodic, even/odd, energy/power signals – elementary signals – exponential, sinusoidal, unit step, impulse, ramp – time-shifting, scaling, folding.

System – classification – continuous-time/discrete-time, static/dynamic, linear/non-linear, time-invariant/variant, deterministic/stochastic, causal/non-causal, stable/unstable.

Linear Time Invariant (LTI) systems – impulse response – convolution integral – convolution-sum – condition for BIBO stability for CT and DT signals in terms of impulse response.

Module II (15 hours)

Representation of signals – Periodic signals – continuous-time fourier series (CTFS) – Trigonometric and exponential – symmetry conditions – amplitude & phase spectrum – properties of CTFS – Parserval's theorem for power signals – power spectral density.

Steady state solution of electric circuits with non-sinusoidal periodic inputs using Fourier series – effective values of voltages and currents – power due to non-sinusoidal voltages and currents. [R.B. 4]

Non-periodic signals - continuous-time fourier transform (CTFT) – amplitude & phase spectra - gate function – sampling function – properties – convolution – Parseval's theorem for energy signals – energy-spectral density - Frequency response.

Linear Constant-Coefficient Differential equations - review of Laplace transform – transfer function - relation between Laplace transform and Fourier transform - poles and zeros – pole-zero plots - basic concept of BIBO stability.

Module III (13 hours)

Periodic signals - Discrete-time Fourier series (DTFS) – properties of DTFS – aperiodic signals – discrete-time fourier transform (DTFT) – properties of DTFT - Parseval's theorem – energy spectral density – – frequency response - sampling – sampling theorem – impulse train - Nyquist rate - aliasing.

Module IV (13 hours)

Linear Constant-Coefficient Difference Equations (LCCDE) - Z-transform – Region of Convergence (ROC) – properties – inverse Z-transform – convolution - Long division method, partial fraction expansion method, residue method – one-sided Z-transform – properties – initial value & final value theorem - solution of LCCDE with initial conditions – zero input response and zero state response - system function – poles and zeros – basic concept of BIBO stability.

Text Books

1. Oppenheim A. V. & Schafer R. W., *Signals and Systems,* Pearson Education
2. Proakis J. G. & Manolakis D. G., *Digital Signal Processing, Principles, algorithms & applications*, Pearson Education.
3. Charles L. Phillips, John M. Parr & Eve A Riskin, *Signals, Systems and Transforms*, Pearson Education

Reference Books

1. Ramesh Babu P., *Signals and Systems*, Scitech Publications(India) Pvt. Ltd.
2. Simon Haykin & Barry Van Veen, *Signals and Systems*, Wiley-India.
3. D. Ganesh Rao & Satish Tunga, *Signals and Systems*, Sanguine Technical Publishers
4. Roy Choudhury, *Networks & Systems*, New Age International publishers
5. S.Palani , *Signals and Systems*, Ane Books Pvt.Ltd

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 403 DC MACHINES AND TRANSFORMERS
(Same as EE 09 404)

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the basic working principles of electrical machines*
- *Analysing the performance of electrical machines*
- *Conducting the performance analysis of a given electrical machine*

Module 1 (9 hours)
Magnetic circuit – mmf – reluctance – magnetization curves – magnetic hysteresis and hysteresis loss – interaction of magnetic fields (motor action) – developed torque – electromagnetically induced voltages (generator action) – energy conversion in rotating electrical machines – eddy currents and eddy current losses - construction of DC machines – flux distribution curve in the airgap - armature windings – lap and wave – equalizer rings – dummy coils.

Module II (9 hours)
DC generators – EMF equation – methods of excitation – separately and self excited – shunt, series, compound - armature reaction – effects of armature reaction - demagnetizing & cross magnetizing ampere-turns – compensating windings – interpoles - commutation – methods to improve commutation - voltage build-up – no load characteristics – load characteristics – losses and efficiency - power flow diagram –parallel operation – applications of dc generators.

ModuleIII (9 hours)
DC motor – principle of operation – back emf – classification – torque equation – losses and efficiency – power flow diagram – performance characteristics of shunt, series and compound motors – starting of dc motors – necessity and types of starters – design of starters – speed control – methods of speed control – solid state speed control (block diagram) – testing – Swinburne's test – Hopkinson's test – separation of losses – retardation test - applications of dc motors.

ModuleIV (9 hours)
Transformer – principle of operation - types and construction – ideal transformer – transformation ratio – dot convention – polarity test - practical transformer - equivalent circuit – phasor diagram – losses and efficiency – voltage regulation – OC & SC test – Sumpner's test – all day efficiency – autotransformer – saving of copper – 3-phase transformer – 3-phase transformer connections - Δ-Δ, Y-Y, Δ-Y, Y-Δ, V-V – vector groupings Yy0, Dd0, Yd1, Yd11, Dy1, Dy11 – Scott connection – three winding transformer – tertiary winding – per unit impedance – parallel operation – necessary and desirable conditions of parallel operation – wave shape of exciting current – applications.

Text Books

1. Clayton & Hancock, *Performance & Design of DC machines*, ELBS
2. P.S. Bhimbra, *Electrical Machinery*, Khanna Publishers
3. K. Murukesh Kumar, *DC machines and Transformers*, Vikas Publishing house Pvt Ltd

Reference Books

1. Fitzgerald A.E and Kingsley, *Electrical Machinery*, Mc Graw Hill
2. Langsdorf A S, *Theory of A C Machinery*, Mc Graw Hill
3. Nagrath I J and Kothari D P, *Electric Machines*,Tata Mc Graw Hill
4. Stephen J Chapman, *Electric Machinery Fundamentals*, Mc Graw Hill.
5. Vincent Del Toro, *Electrical Machines and Power Systems*, Prentice Hall
6. Charles Hubert, *Electric Machines*, Pearson Education
7. J.B Gupta, *Theory and Performance of Electrical Machines*, S.K. Kataria and Sons

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 404 DIGITAL ELECTRONICS
(Same as EE 09 405)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *Creation of awareness about the basic principles of digital electronics.*
- *Study of the logic design techniques.*
- *Understanding the concepts behind the hardware implementation of a digital computer.*

Module I (9 Hours)

Logic Families

Digital IC terminology- Current and Voltage Parameters, Fan Out, Propagation Delay, Power Requirements, Noise, Immunity, Current Sourcing and Sinking Action- TTL Logic Family- TTL Series Characteristics- TTL Loading and Fan Out- MOS Technology- Complementary MOS Logic- CMOS Series Characteristics- Low Voltage Technology- Tri- state Logic outputs- Tristate buffers- high Speed Bus interface logic- ECL Digital IC family- CMOS transmission gate- IC Interfacing- Mixed Voltage Interfacing.

Module II (9 Hours)

Combinational Circuits

Ideal Logic Gates-Truth Tables of basic gates- Number Systems-Binary Numbers-Hexadecimal Numbers-Complements- Signed and unsigned numbers-one's complement and two's complement-Arithmetic operations of Binary
and Hexadecimal Numbers-Binary codes - Boolean Functions-Canonical and Standard forms-Simplification of Boolean Functions by Karnaugh Map up to five variable map-NAND, NOR implementation –Multilevel NAND and NOR circuits-Code Converters –- Adders-Subtractors-BCD Adder-Magnitude Comparator-Decoders and Encoders-Multiplexers and Demultiplexers
Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL

Module III (9 Hours)

Sequential Circuits and Memories

Comparison of sequential and combinational circuits-Latches
Flip Flops - RS , JK , T and D Flip Flops - Triggering of Flip Flops
Registers - Shift Registers –Different types-bidirectional shift register- Ring Counter - Johnson Counter Ripple Counters –Counters with truncated sequences.
Synchronous Counters –design of synchronous counters-state tables and state diagrams-state reduction and assignment-Flip Flop Excitation Tables
Memories -ROM, Static and Dynamic RAM, Read/Write Memory, EPROM , EEPROM, Memory Decoding.

Module IV (9 Hours)

Computer Organization fundamentals- basic micro computer elements- data bus- control bus- address bus - arithmetic logic units- program counter- flag- instructions- single and multibyte instructions- basic micro computer operations – Introduction to 8085 microprocessor – Architecture – Basic Programming concepts. Introduction to VHDL-structural modeling with simple examples.

Text Books

1. A. V. Boylestad and Thomas L Floyd, *Digital Fundementals* , Pearson Education
2. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, *Digital Systems- Principles and Applications,* Pearson Education[Module I]
3. Ramesh S. Gaonkar, *Microprocessing Architecture- Programming and Application,* Wiley- Eastern.

Reference Books

1. A. Anand Kumar, *Digital Circuits*, Prentice Hall India Pvt. Ltd.
2. P. K. Ghosh, P. R. Sreedhar, *000 to 8085 Introduction to Microprocessors to Engineers and Scientists*, Prentice Hall India Pvt. Ltd.
3. B. Somanathan Nair, *Digital Electronics and Logic Design*, Prentice Hall India Pvt. Ltd.
4. John M. Yarbrough, *Digital Logic Application Design*, P W S Publishing Company

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 405 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION SYSTEMS
(Same as EE 09 406)

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the basic working principle of electrical measuring instruments*
- *To design and calibrate an electrical measuring instruments*
- *Develop an instrumentation system for a particular application*

Module I (9 hours)

Indicating Instruments: principle- Types of controls (spring and gravity controls) and Types of Damping (eddy current, air friction), Moving coil instruments - Permanent magnet, dynamometer type meters, Moving iron instruments – attraction and repulsion type, Dynamometer wattmeter – principles and torque equation – Classification of errors - errors in indicating instruments and compensation, Current transformers and Potential transformers – Phasor diagram – ratio and phase angle errors – use of instrument transformers with wattmeter

Module II (9 hours)

Watt meters and Energy Meters: Principle of working of ampere hour meter (AH mercury motor meter), single and three phase energy meters (principles and torque equation) – errors and compensation, static wattmeter's and energy meters - principle and block diagram, power factor meters (Dynamometer type –single and three phase), vibrating reed frequency meter.

Measurement of resistance: Ohmmeter, Megger – measurement of insulation resistance by direct deflection method – Testing of earth electrode resistance, localization of cable fault by Murray and Varley loop tests

AC bridges: Measurements of inductance using Maxwell and Anderson bridges – measurements of capacitance using Schering Bridge

Magnetic measurements: Measurement of flux, magnetizing force and permeability – Hibbert's magnetic standard – flux meter – Hall Effect gauss meter

Module III (9 hours)

Transducers: Definition - different types of transducers – criteria for selection –general characteristics –dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications

Instrumentation amplifiers – differential amplifiers –Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.

Module IV (9 hours)

Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications)

Text Books

1. Earnest O Doblin, *Measurement system application and design*, McGraw Hill
2. A.K. Sawhney, *A course in Electrical and Electronics Measurements and Instrumentation*, Dhanpat Rai and sons
3. Joseph J Carr, *Elements of electronic Instrumentation and Measurement*, Pearson Education

References

1. William David Cooper, *Electronic Instrumentation and Measurement Techniques*, Prentice Hall, India
2. K.B. Klaassan, *Electronic Measurements and Instrumentation*, Cambridge University Press
3. John Bentley, *Principles of Measurements Systems*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 406(P): Mechanical Engineering Lab
(Same as EE 09 407(P))

Teaching scheme **Credits:** 2
2 hours practical per week

Objectives

- *To strengthen the knowledge on principles of fluid mechanics and hydraulic machineries through experiments.*
- *To equip the students to carry out experiments, and to train them to analyse, report and infer the results.*
- *To acquaint the students with the measurement of various mechanical parameters.*

1. Study of plumbing tools and pipe fittings
2. Study of discharge measuring instruments
3. Measurement of pressure and velocity
4. Calibration of venturimeter, orifice meter, notches and weirs, nozzle meters, and rotameters
5. Pipe friction – minor losses in pipes - verification of Bernouli's theorem
6. Performance of turbines – operating characteristics: Pelton and Francis turbine
7. Performance of pumps: Centrifugal and Reciprocating pumps
8. Study of heat transfer equipments
9. Measurement of thermal conductivity of a metal rod
10. Performance studies on a shell and tube heat exchanger
11. Study of systems of petrol and diesel engines
12. Constant speed performance characteristics of petrol and diesel engines.

Reference Books

1. I. H. Shames, *Fluid Mechanics*, 4th Edition, McGraw Hill
2. J. P. Holman, Experimental methods for Engineers, McGraw Hill
3. D. G. Shepherd, Principles of Turbo Machinery, Mc Millan
4. J. P. Holman, Heat Transfer, McGraw Hill
5. P. L. Bellani, *Thermal Engineering*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60%- Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

(Same as EE 09 408(P))

Teaching Scheme **Credits**: 2
2 hours per week

Objective

- *Calibration of various electrical measuring instruments*
- *Measurement of different physical parameters using transducers*

MEASUREMENTS LAB

1. a) Calibration of single phase energy meter by direct loading
   b) Calibration of single phase static energy meter
2. Calibration of single phase energy meter by phantom loading with and without phase shifting transformer
3. Calibration of 3 phase energy meter a) phantom loading b) using phase shifting transformer
4. Measurement of self and mutual inductance a) air cored coil b) iron cored coil
5. a) Determination of B- H curve
   b) Determination of hysteresis loop using six point method .
6. Calibration of ammeter, voltmeter and wattmeter using vernier potentiometer

INSTRUMENTATION LAB

1. Measurement of resistance using Wheastone's Bridge and Kelvin Double bridge
2. Extension of range of wattmeter using CT & PT
3. Measurement of displacement using LVDT
4. Measurement of current/ voltage using Hall effect transducer
5. Thermocouple based ON – OFF controller
6. Measurement of physical quantities – strain, torque and angle
7. Measurement of temperature by RTD method

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 501 Synchronous and Induction Machines
(Same as EE 09 501)

Teaching scheme **Credits:** 5

2 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the basic working principle of electrical machines*
- *To analyse the performance of synchronous and induction machines*

Module I (9 hours)

Alternators : Construction – Principle of operation – Types – AC windings –Distribution factor – Chording factor - EMF equation – Armature reaction – phasor diagrams - voltage regulation – Predetermination of voltage regulation – EMF method – short circuit ratio(SCR) - significance of SCR – MMF method – Potier method — Two reaction theory – modified phasor diagram – Analysis by two reaction theory – Slip test – Reluctance Power – Power angle characteristics – symmetrical short circuit transient —transient and subtransient reactances – losses and efficiency.

Module II (9 hours)

Synchronous generator – parallel operation – methods of synchronizing - alternator connected to infinite bus – two identical generators in parallel - load sharing – effect of change of fuel supply – effect of change of excitation – governor characteristics – synchronizing power and torque– locus of generated voltage for constant real power and variable excitation.

Synchronous motor - Principle of operation — different starting methods - equivalent circuit – phasor diagram- torque and power relations – effect of load changes on synchronous motor – mechanical load diagram – armature current as a function of power developed– O curves -armature current as function of excitation–V curves – inverted V curves – transition of a machine from generator mode to motor mode – hunting - synchronous condenser - applications of synchronous motors.

Module III (9 hours)

Theory of induction machines – 3 phase induction motors – construction – principle of operation – rotating magnetic field — slip and rotor frequency – phasor diagram – equivalent circuit – torque equation - mechanical power developed – maximum torque – torque slip characteristics – losses and efficiency – no load and blocked rotor tests – circle diagram – single phasing – effect of deep bar and double cage rotors – effects of air gap flux harmonics – cogging and crawling – induction generator - line excited and self excited – principle of operation - applications.

Module IV (9 hours)

Starting and speed control of induction motors – starting methods for three phase induction motors – direct on line starting – stator impedance starting - autotransformer starting – star delta starting – rotor resistance starting – speed control – voltage control – frequency control – rotor resistance control – pole changing – static frequency conversion and slip power recovery scheme.

Single phase induction motors – double revolving field theory – equivalent circuit – no-load and blocked-rotor tests - types of single phase induction motors - principle of operation of linear induction motor – applications of induction motors.

Text Books

1. M.G. Say, *Performance and Design of AC machines*, Pitman ELBS
2. P.S. Bhimbra, *Electrical Machinery*, Khanna Publishers
3. K. Murukesh Kumar, *Induction and Synchronous Machines*, Vikas Publishing house Pvt Ltd

Reference Books

1. Fitzgerald A.E and Kingsley, *Electrical Machinery*,Mc Graw Hill.
2. Langsdorf A S, *Theory of A C Machinery*, Mc Graw Hill
3. Nagrath I J and Kothari D P, *Electric Machines*,Tata Mc Graw Hill
4. Stephen J Chapman, *Electric Machinery Fundamentals*, Mc Graw Hill.
5. Vincent Del Toro, *Electrical Machines and Power Systems*,Prentice Hall
6. Charles Hubert, *Electric Machines*, Pearson Education
7. J.B Gupta, *Theory and Performance of Electrical Machines*, S.K. Kataria and Sons

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marksks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 502 ELECTRICAL POWER GENERATION , TRANSMISSION AND DISTRIBUTION
(Same as EE 09 502)

Teaching scheme **Credits:** 4
1 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the various conventional and non- conventional energy sources.*
- *To develop an understanding about transmission and distribution systems.*
- *To evaluate the performance of transmission lines*

Module I (9 Hrs)
Conventional & non-conventional sources of energy – thermal, hydroelectric, diesel, nuclear power plants - solar, wind geothermal, tidal, MHD power Generation.[Layout & description needed] – Power Plant economics-load factor – demand factor – diversity factor – plant factor – tariff – depreciation – economics of pf improvement – capacity of phase advancing plant.

Module II (9 Hrs)
Overhead Transmission Systems**:** Arrangement of conductors, calculation of sag and tension, transmission line supports and their location, economic span, choice of transmission voltage, line insulation types, string efficiency, impulse ratio, arcing horns and rings, failure of insulation.
Corona: Disruptive critical voltage, advantages and disadvantages of corona

Module III (9 Hrs)
Distribution systems – classification and arrangement of distribution systems –Voltage drop calculations in radial and ring mains – comparison of different systems - DC, AC - single phase, three phase 3 wire - 4 wire systems

Underground cables: Different types, insulation resistance, capacitance of single core cables, grading of cables, capacitance of three core cables, sheath effects, laying and testing of cables.

Module 4 (9 Hrs)
Performance of Transmission Lines: Calculation of transmission line inductance and capacitance, GMD and GMR, bundled conductors, transposition, representation of short, medium and long lines, ABCD constants**,** Effect of capacitance: Nominal **T** and **π** methods of calculations, rigorous solution of long lines., power flow through a transmission line.

Text Books

1. S. Sivanagaraju & S. Satyanarayana , *Electric Power Transmission and Distribution*, Pearson Edn
2. S. N. Singh, *Electric Power Generation, Transmission and Distribution*, PHI
3. Sony, Gupta, Bhatnagar, *A Course in Electrical Power*, Dhanpat Rai and Sons
4. V. K. Mehta, *Electric Power Systems,* S. Chand & sons

Reference Books

1. C. L. Wadhwa, *Electric Power Systems*, Wiley Eastern Ltd.
2. S. L. Uppal, *Electrical Power*, Khanna Publishers.
3. A. S. Pabla, *Electric Power Distribution Systems*, Tata Mc Graw Hill
4. B. R. Gupta, *Power System Analysis and Design,* Wheeler Publishing Company, New Delhi

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 503 LINEAR CONTROL SYSTEMS
(Same as EE 09 503)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- *Understanding system analysis and design in classical control theory based on time domain and frequency domain approaches.*

Module 1(9 Hrs)

Principle of Automatic control- Open loop and closed loop systems – examples
System modeling & approximations -modeling of electrical systems – dynamic equations using KCL & KVL of RL, RC and RLC circuits - development of block diagrams of electrical networks - block diagram reduction - signal flow graphs - Mason's gain formula -Modeling of translational and rotational mechanical systems - differential equations for mass, spring, dashpot elements - D'Alembert's principle - dynamic equations & transfer function for typical mechanical systems - analogous systems - force-voltage & force-current analogy - toque-voltage & torque-current analogy – electromechanical systems - transfer function of armature controlled dc motor & field controlled dc motor.

Module II(9 Hrs)

Time domain analysis – continuous systems -standard test signals - step, ramp, parabolic, impulse - transient and steady state response –first order systems - unit impulse, step & ramp responses of first order systems - second order systems -- unit step response- under damped and over damped systems - time domain specifications - steady state error - static position, velocity & acceleration error constants -Concept of stability - stability & location of the poles in S-plane - Routh-Hurwitz stability criterion-Root Locus Method-Construction of root locus- Effect of poles and zeros and their location on the root locus-

Module III(9 Hrs)

Frequency Domain Analysis- Frequency Response representation- Polar Plot-Logarithmic Plots-Frequency Domain Specifications- Non- Minimum Phase Systems-Transportation Lag- Nyquist Stability Criterion—Stability from polar and Bode Plots-Relative Stability- Gain Margin and Phase Margin- M- N Circles-Nichols Chart

Sampled data Control Systems - data reconstruction and hold circuits- zero and first order hold –Pulse transfer function- stability in the z- plane- extension of Routh's stability criterion for discrete data systems-Jury's stability test.

Module IV (9 Hrs)

Design Using Conventional Methods- Cascade Compensation- PI, PD and PID controllers – tuning of PID Controller- Lead, Lag and Lead- Lag compensation using RC networks-Design of lead, lag and lead- lag compensators using frequency response and root locus methods.

Text Books

1. Nagrath & Gopal, *Control Systems Engineering*, New Age International (P) Limited
2. Katsuhiko Ogata, *Modem Control Engineering*, Pearson Education

Reference Books

1. Kuo, *Automatic Control Systems,* Prentice Hall
2. Norman S. Nise, *Control Systems Engineering,* Wiley India Pvt. Ltd.
3. S. Palani, *Control Systems Engineering,* Tata McGraw Hill
4. K. Ogata, *Discrete- Time Control Systems,* Pearson Education
5. A. Nagoorkani, *Control Systems,* RBA Publications
6. A. Anand Kumar, *Control Systems*, PHI

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 504 POWER ELECTRONICS
(Same as EE 09 504)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the fundamentals of various power electronic components. Study and develop simple circuits involving power electronic components.*
- *Control of electric power using power electronic devices.*

Module 1(9 Hrs)

Silicon Controlled Rectifier-structure- V-I Characteristics- Two transistor analogy- turn-on methods – gate triggering circuits-turn on characteristics- turn-off characteristics-methods of commutation - series and parallel connection of SCRs-structure and characteristics of GTO thyristors, power diodes, power transistors, power MOSFET and IGBT-working of TRIAC-DIAC. Comparison of Power Semiconductor devices.

Module II (9 Hrs)

Phase control using SCR-single phase half wave converters with R and RL loads- single phase half controlled and fully controlled bridge converter with R and RL loads- output voltage and waveforms-principle of discontinuous operation- fully controlled and half controlled 3 phase bridge converter- output voltage and waveforms- dual converter-Inverters-single phase series and parallel inverters-single phase bridge inverter- 3 phase bridge inverter-120° and 180° operation-PWM inverters using single pulse, multiple pulse and SPWM techniques.

Module III(9 Hrs)

Choppers-step down chopper-principle of operation-classes of chopper - step up chopper-Four quadrant operation of a chopper with motor load- single phase to single phase cycloconverters- principle of operation-single phase ac regulator-R and RL loads.

Module IV (9 Hrs)

Switching regulators-buck regulators-boost regulators- buck boost regulators- cuk regulators- Principle of operation- Continuous Conduction Mode-Output voltage equation-switched mode power supply- push pull converter - principle of operation and analysis-comparison with linear power supply-. Applications (block diagram approach) –induction cooking- electronic ballast- ups

Text Books

1. H. Rashid, *Power Electronics*, Pearson Education, Third Edn.
2. Ned Mohan, *Power Electronics*, John Wiley Publications

Reference Books

1. Singh MD & Khanchandani KB, *Power Electronics*, Mc Graw Hill
2. Dubey.G.K., *Thyristorised Power Controllers*,
3. Ashfaq Ahmed, *Power Electronics for Technology*, Pearson Education
4. P.S. Bimbhra, *Power Electronics*,

S

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 505: Digital System Design
(Same as EE 09 505)

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *To make students able to design and build real digital circuits*
- *To make students able to do VHDL programming*

Module I (9 hours)

Hardware description languages-HDL based digital design-VHDL hardware description language- Program structure-Types, constants and arrays-Functions and procedures-libraries and packages-structural design elements-data flow design elements- behavioral design elements-time dimension-simulation –test benches-VHDL features for sequential logic design.

Module II (9 hours)

Combinational logic design-analysis procedure-design procedure-documentation-block diagram-gate symbols-signal names and active levels-bubble-to- bubble logic design-signal namings in HDL programs-schematic structures. Circuit timing- timing diagrams-propagation delay- timing specifications.
Design using VHDL-decoders-encoders-tri state devices-multiplexer-parity generators-comparators- adders- subtractors and ALUs –combinational multiplexers.

Module III (9 hours)

Sequential logic design-clocked synchronous state machine analysis-state machine structure-output logic-characteristic equations-state table-state equations-state diagram-Flip-Flop input equations-Analysis of state machines with D Flip-Flops, JK Flip-Flops.
Synchronous state machine design- state table design example- state minimisation- state assignment- synthesis using D and JK Flip-Flops- Clocked sequential circuit design using VHDL- state machine design-state assignment-pipelined outputs.

Module IV (9 hours)

Feedback sequential circuit-basic analysis-analysing circuits with multiple feedback loops-races-state tables and flow tables
Design of feedback sequential circuits-latches-designing fundemental-mode flow tables-flow table minimisation-race-free state assignment-excitation equations-design using VHDL.
Algorithmic state machine-introduction-components of ASM chart-salient features-examples.
Complex programmable logic devices and FPGAs-Xilinx XC 9500 CPLD family-function block architecture- nput output block architecture-switch matrix.
FPGAs-Xilinx XC4000 FPGA family-configurable logic block-input output block-programmable interconnect.

Text Books

1. John F Wakerly, *Digital Design*, Pearson Education, Delhi, 2002
2. Morris Mano,*Digital Design,* Pearson Education, Delhi, 2002
3. A Anandakumar, *Digital Electronics*,Prentice Hall India Feb 2009.(Module IV)

Reference Books

1. Ian Grout*, Digital Systems Design with FPGAs,*Elsevier.
2. Volnei A Pedroni *Digital Electronics and Design with VHDL*,Elsevier
3. R Padmanabhan, B Bala Tripura Sundari, *Design through Verilog HDL,*Wiley India
4. David Money Harris and Sarah L Harris, *Digital Design and Computer Archiecture*, Elsevier
5. James R Armstrong, F Gail Gray, *VHDL Design/Representation and Synthesis,* Pearson Education, Delhi, 2002
6. Charles S. Roth, *Fundamentals of Logic Design*, Jaico Publishing House, 1999
7. Stephen Brown and Zvonoko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, McGraw Hill
8. B.Holdsworth, R.C Woods, *Digital Logic Design*, Newnes, Elsevier
9. Mohammad A. Karim, Xinghao Chen, *Digital Design. Basic Concepts and Principles*

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40*

Maximum Total Marks: 70

PTEE09 506 ELECTRICAL MATERIAL SCIENCE
(Same as EE 09 506)

Teaching scheme **Credits:** 3

1 hours lecture and 1 hour tutorial per week

Objectives

- *To study the properties of various materials used in Electrical Engineering*
- *Selection of proper material for a particular application*

Module 1(9 hours)

Conducting materials: Review of metallic conduction on the basis of free electron theory - Fermi-Dirac distribution - Variation of conductivity with temperature and composition - Contact potential - Materials for electric resistances, brushes of electrical machines, lamp filaments, fuses and solders.

Semiconductors: Compound semiconductors - Basic ideas of amorphous and organic semiconductors

Magnetic materials: Classification of magnetic materials - Ferromagnetism - Hysteresis curve - Ferromagnetic domains (qualitative explanation only) - Curie - Weiss law - Hard and soft magnetic materials and applications - Ferrites - Magnetic materials used in electrical machines, instruments and relays.

Module II(9 hours)

Dielectrics: Dielectric polarization under static fields - Derivation of the expression for electronic polarization in monoatomic gases - Expressions for electronic, ionic and dipolar polarizations in polyatomic gases - Derivation of expression for polarization in solids and liquids - Clausius - Mosotti relation - Behaviour of dielectrics in alternating fields - Complex dielectric constant - Dipolar relaxation - Dielectric loss - Ferro electricity - Main features - Domain theory and explanation of hysteresis curve - (qualitative explanations only)

Module III (9 hours)

Dielectric breakdown: Mechanism of breakdown in gases, liquids and solids - Factors influencing dielectric strength - Capacitor materials.

Insulating materials: Good insulator properties and classification on temperature basis - Common insulator materials used in electrical apparatus - Inorganic materials (Mica, glass, porcelain, asbestos) - Organic materials (Paper, rubber, cotton silk fibre, wood, plastics, bakelite) - Resins and varnishes - Liquid insulators (transformer oil) - Gaseous insulators (air, SF6, and hydrogen) - Ageing of insulators.

Module IV(9 Hrs)

Solar energy materials: Photo thermal conversion - Use of coatings for enhanced solar thermal energy collection - Solar selective coatings - Cold mirror coatings - Heat mirror coatings - Antireflection coatings - Photovoltaic conversion - Solar cells - Silicon, Cadmium sulphide and Gallium arsenide - Magnetic resonance - Nuclear magnetic resonance - Electron spin resonance - Ferromagnetic resonance .

Text Books

1. Indulkar C. S. & Thiruvengadam S., *An Introduction to Electrical Engineering Materials,* S. Chand & Co.
2. Seth S. P. & Gupta P. V., *A Course in Electrical Engineering Materials*, Dhanpath Rai & Sons.

Reference Books

1. A. J. Dekker, *Electrical Engineering Materials,* Prentice Hall of India
2. Agnihotri O. P. and Gupta B. K., *Solar Selective Surfaces*, John wiley.
3. Tereey, *Electrical Engineering Materials,* Mir Publishers.
4. Arumugham M., *Material Science,* Anuradha Agencies

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer

PTEE09 507(P) ELECTRICAL MACHINES LAB I
(Same as EE 09 507(P))

Teaching Scheme **Credits**: 2
2 hours per week

Objective

- *To conduct various tests on dc machines and transformers and to study the performance.*

1. Obtain the open circuit characteristics of self excited DC shunt generator at rated speed
Objectives:
a) Predetermine the OCC at different speeds
b) Determine the critical field resistance
c) Obtain maximum voltage built up with given shunt field resistance
c) Obtain critical speed for a given shunt field resistance

2. Load test on DC shunt generator
Objectives:
a) Determine the external & internal characteristics
b) Deduce the armature reaction curve

3. Brake test on DC shunt / series motor
Objectives:
Plot the following characteristics
i) Efficiency Vs Output
ii) Line current Vs Output
iii) Speed Vs Output
iv) Speed Vs Torque
v) Line current Vs Torque

4. Perform Swinburne's test on a DC shunt machine

Objectives:
Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.

5. Hopkinson's test on a pair of DC machines
Objectives:
Determination of the efficiency of the given dc shunt machine working as a motor and generator under various load conditions.

6. Retardation test on a DC machine
Objectives:
a) Separation of hysteresis, eddy current, friction & windage losses
b) Find the moment of inertia of the rotating system

7. No load test at different excitations on a DC shunt motor
Objectives:
a) Separation of hysteresis, eddy current, friction & windage losses
b) Plot the losses vs. speed curves

8. O.C. & S.C. tests on the single phase transformer
Objectives:
Predetermination of the following
a) Efficiency at different load conditions and different power factors
b) Regulation at different load conditions and different power factors
c) Equivalent circuit referred to HV and LV sides
d) UPF load at which efficiency is maximum
f) Power factors at which regulation is maximum and zero
g) Plot % regulation vs. p.f. curves

9. Load test on the single phase transformer
Objectives:
a) Determination of the efficiency at different load conditions and unity power factor
b) Determination of the regulation at different load conditions and unity power factor
c) Plot efficient vs. output & regulation Vs output curves

10. Separation of losses in a single phase transformer
Objectives:
Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence

i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & plot losses vs. frequency curves
ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages &
plot losses vs. voltage curves.

11. Sumpner's test
Objective:
a) Predetermination of efficiency at different load conditions and power factors
b) Predetermination of regulation at different load conditions and power factors

c) Plot efficiency vs. output & regulation vs. power factor curves
d) Obtain the equivalent circuit referred to LV & HV sides

12. Scott connection of the single phase transformers
Objectives:
Determine the efficiency at different load conditions when
a) Main transformer alone loaded
b) Teaser transformer along loaded
c) both transformers loaded under balanced conditions
d) both transformers loaded under unbalanced conditions
Plot efficiency vs. output curves for each case.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

Teaching Scheme **Credits**: 2
2 hours per week

Objective

- *Design and implementation of basic digital circuits*
- *Familiarisation of Hardware Description Language (VHDL)*
- *Introduction of 8085 microprocessor programming and interfacing.*

1. Design of Half adder and half subtractor circuits with NAND gates using mode control.
2. Design and realization of ripple counter using JK flip-flop.
3. Design and realization of Johnson & Ring Counter using a) JK Flip Flop b) Shift Register
4. Synchronous UP/DOWN Counter design and realization.
5. Implementation of multiplexer and demultiplexer using gates.
6. Logic circuit implementation using multiplexer IC.
7. VHDL implementation of adder circuit and three bit counter.
8. VHDL simulation of adder circuit and counter.
9. 8085 simple programming addition, data transfer, multiplication.
10. 8085 interfacing –waveform generation-square wave generation, saw-tooth wave and triangular wave.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 601 MICROPROCESSORS AND MICROCONTROLLERS

Teaching scheme **Credits:** 5
2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the architecture and programming of 8086 microprocessor.*
- *Interfacing the microprocessor with the peripherals for a specific application.*
- *Understanding the architecture, programming and interfacing of basic microcontrollers.*

Module I (Architecture of 8086 and Pentium) (9Hours)
Architecture of Intel 8086 processor – Pin description – Internal Operation – Memory Decoding– 8086 configurations: Minimum mode and Maximum mode - Instruction execution – system bus timing - Timing diagrams – Interrupts : Interrupt mechanism – Types and priority – Interrupt vector table – Software interrupts – Non maskable interrupts. Direct memory access - Introduction to Pentium microprocessor – Special features - Pentium registers – Pentium memory management

Module II (Assembly Language Programming) (9 Hours)
8086 Addressing modes – Instruction set – Data transfer Instructions – String Instructions – Logical Instructions – Arithmetic Instructions – transfer control Instructions – Processor control instructions. Basic Concepts of modular programming – Assembler directives – Memory organization – full segments and models – Macros Assembly language programming examples for block transfer, multi precision arithmetic operations, Code conversion, searching Sorting, subroutine calls, stack operations, Time delay loops, simple programs using DOS and BIOS interrupts etc. Concepts of executing assembly language programs using MASM.

Module III (Interfacing with 8086) (9hours)

Programmable Peripheral interface (8255) – Mode 0,1,2 operations – Interfacing programs – A/D and D/A interfacing and programming examples . Serial Communication Interfaces – Asynchronous communication – Synchronous communication – Programmable communication Interface (8251) – Interfacing programs –Programmable interval timers – Operating modes – Interfacing and Programming Intel 8253 – Interval timer application A/D interfacing. DMA Controller – Organization of Intel 8237 – Different modes of operation. Interrupt Controller - Organization of programmable interrupt controller 8259. Keyboard and Display interface – key board display controller – Internal block diagram of 8279. Interfacing of matrix key board, seven segment LED display using 8279 – Interfacing programs for key board and LED display.

Module IV (Microcontroller 8051) (9 Hours)

Overview of 8051 microcontrollers – Architecture – Assembly programming –data types and directives –flag bits – register banks and stack – loop and Jump instructions – call instructions – Arithmetic and Logic instructions and simple programs – 8051 interrupts – programming timer interrupts. Interfacing of microcontroller – External memory interfacing-LCD and Keyboard interfacing – Parallel and serial ADC interfacing – DAC interfacing – Interfacing 8255 - Stepper motor control – DC motor interfacing.

Text Books

1. Liu, Gibson, *Microcomputer systems: 8086/ 8088 family Architecture, Programming and Design*, Prentice Hall India 2004.
2. Walter A.Triebel, Avathar Singh, *The 8088 and 8086 Microprocessors Programming, interfacing Software and Hardware Applications*, Pearson Education 2008
3. Mohamed Ali Mazidi, Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded systems*, Pearson Education 2007.

Reference Books

1. John Uffen buck, *The 8086 / 8088 Family Design, Programming and Interfacing*, Prentice Hall of India, 2002
2. Brey B.B., *The Intel Micrprocessor system – Architecture, programming and Interfacing*
3. Hall D.V. , *Microprocessor and Interfacing* , Tata McGraw Hill
4. Dr. K. Uma RAo, Dr. Andhe Pallavi, *The 8051 Microcontroller,* Sanguine Technical Publishers

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

PTEE 09 602: Engineering Economics and Principles of Management

(Common for AI, EE, BM, and IC)

Teaching scheme **Credits:** 4

1 hour lecture and 1 hour tutorial per week

Section 1: Engineering Economics

Objective

Impart fundamental economic principles that can assist engineers to make more efficient and economical decisions.

Module1 (9 Hrs)

Economic reasoning, Circular Flow in an economy, Law of supply and demand, Economic efficiency. Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Private and Social cost, Opportunity cost. Functions of Money and commercial Banking. Inflation and deflation: concepts and regulatory measures. Economic Policy Reforms in India since 1991: Industrial policy, Foreign Trade policy, Monetary and fiscal policy, Impact on industry.

Module II (9 Hrs)

Value Analysis – Function, aims, procedure.–Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor. Methods of project analysis (pay back, ARR, NPV, IRR and Benefit -Cost ratio) Break-even analysis-, Process planning.

Text books

1. Panneer Selvam, R, Engineering economics, Prentice Hall of India, New Delhi, 2002.
2. Wheeler R (Ed) Engineering economic analysis, Oxford University Press, 2004.

Internal Continuous Assessment *(Maximum Marks-15)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern – for Section 1
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*2 x 2 marks=4 marks* *1 x 1 mark = 1 mark*
PART B:	*Analytical/Problem solving questions* Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.	*2 x 5 marks=10 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*2 x 10 marks=20 marks*

Maximum Total Marks: 35

Section 2: Principles of Management

Objective

- *To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams*

Module I (9 hours)
Principles of management – Evolution of management theory and functions of management Organizational structure – Principle and types. Decision making – Strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree
Human resource management – Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations

Module II (9 hours)
Financial management – Time value of money and comparison of alternative methods. Costing – Elements & components of cost, allocation of overheads, preparation of cost sheet, break even analysis. Basics of accounting – Principles of accounting, basic concepts of journal, ledger, trade, profit &loss account and balance sheet. Marketing management – Basic concepts of marketing environment, marketing mix, advertising and sales promotion. Project management – Phases, organisation, planning, estimating, planning using PERT & CPM

Internal Continuous Assessment *(Maximum Marks-15)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

References

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. Lucy C Morse and Daniel L Babcock, *Managing engineering and technology*, Pearson Prentice Hall
3. O. P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, Delhi, 2003.
4. P. Kotler, *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall, New Jersey, 2001
5. Venkata Ratnam C.S & Srivastva B.K, *Personnel Management and Human Resources*, Tata McGraw Hill.
6. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
7. Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing
8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India
9. Koontz H, O'Donnel C & Weihrich H, *Essentials of Management*, McGraw Hill.
10. Ramaswamy V.S & Namakumari S, *Marketing Management : Planning, Implementation and Control*, MacMillan

University Examination Pattern – for Section 2
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A: Short answer questions (one/two sentences) — *2 x 2 marks=4 marks*, *1 x 1 mark = 1 mark*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions — *2 x 5 marks=10 marks*

Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions — *2 x 10 marks=20 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 35

PTEE09 603 MODERN CONTROL THEORY

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To give an overview of system analysis and design based on state space techniques for linear and non- linear systems.*

Module I (9Hours)

State Space Analysis -Concept of State, state variables, state vector and state space - comparison with transfer function approach- state models for typical electrical, mechanical and electro-mechanical systems - state space representation of linear time-invariant systems- phase variable form- Diagonalisation - Diagonal and Jordan canonical forms- Transfer function from state model- Transfer function Decomposition- state diagrams- solution of time invariant state equation- Zero state and Zero input response- State transition matrix- properties-Discrete time state model. Introduction to CS tool box in Matlab.

Module II (9 Hours)

Non- linear Systems- Introduction- Characteristics of non- linear systems- Types of non-lineraities- Phase plane analysis- Construction of phase trajectory - Isocline method- delta method - Singular points- Classification of singular points.

Describing function Analysis- Basis of Describing function approach- Definition- Describing functions of common non- linearities namely dead zone$_5$ saturation, ideal relay, combined dead- zone and saturation, relay with hysteresis- Application of describing function for the stability analysis- Amplitude and frequency of limit cycle using DF.

Module III (9 Hours)

Liapunov Methods- Liapunov Stability- Definition of stability, Asymptotic stability and instability- Quadratic forms and sign definiteness of scalar function- Liapunov stability theorems- Liapunov stability analysis of LTI continuous and discrete time systems- methods of construction of Liapunov function for non- linear systems-Krasovskii' s method and variable gradient method.

Module IV (9 Hours)

Controllability and Observability - Concept and criteria for controllability and observability- Transfer function and controllability/ observability -State Feedback- Design for continuous and discrete systems via pole placement.

Introduction to optimal control- Formulation of the optimal control problem- Typical optimal control performance measures- Optimal control based on Quadratic performance measures- Infinite time regulator problem- Solution of reduced matrix Ricatti equation.

Text Books

1. I. J. Nagrath & M. Gopal, *Control Systems Engineering*, New Age International (P) Limited
2. Katsuhiko Ogata, *Modem Control Engineering*, Pearson Education
3. Dr. K. P. Mohandas, *Modern Control Engineering,* Sanguine Technical Publishers.

Reference Books

1. Norman S. Nise, *Control Systems Engineering,* Wiley India Pvt. Ltd.
2. M. Gopal, *Control Systems, Principles and Design*, Tata McGraw Hill
3. G. F. Franklin, David Powell, Abbas Emami- Nacini,*Feedback Control of Dynamic Systems*, Pearson Education
4. A. Nagoorkani, *Advanced Control Theory,* RBA Publications
5. A. Anand Kumar, *Control Systems*, PHI

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 604 ELECTRIC DRIVES

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the basic principle and operation of drives*
- *Analysis and design of an electric drive for a given application*

Module I (9 Hours)

Concept of Electric Drives –parts of electrical Drives – Dynamics of electric drive – torque equation –Four quadrant operation of electric drives– Loads with rotational and translational motion – Steady state stability- components of load torques – nature and classification of load torques –load equalization – control of electrical drives – closed loop speed control – current limit control – closed loop torque control –Phase Locked Loop control- Energy conservation of electrical drives

Module II (9 Hours)

Dc motor drives – basic equations – constant torque and constant power control – fully controlled converter fed DC drives – continuous and discontinuous operation – three phase controlled rectifier fed dc drives – Four quadrant operation of drive using dual converter- Chopper fed dc drives- closed loop control scheme for control below and above base speed

Module III (9 Hours)

Three phase induction motor drives-AC Voltage controlled drives –-variable frequency control - V/f control— Space Vector Modulation - Slip Power recovery schemes- rotor frequency control - VSI fed induction motor drive- CSI controlled induction motor drives.

Vector Control – Basic principle of vector control – Direct and quadrate axis transformation – Indirect vector control - Direct vector control

Module IV (9 Hours)

Synchronous motor drives –Cylindrical rotor motors - Salient pole motors - Reluctance motors - Permanent Magnet ac motor drives-sinusoidal PMAC-Brushless DC (Trapezoidal PMAC) motor drives – Switched reluctance motors-closed loop control of synchronous motors - Stepper motor control.

Traction: Important features of traction drives-Conventional DC and AC traction drives – DC & AC traction using PWM VSI SCIM drives

Text Books

1. Dubey G. K., *Fundamentals of Electric Drives*
2. M. H. Rashid, *Power Electronics Circuits, Devices and Applications*, Prentice Hall of India

Reference Books

1. Sen P. C., *Thyristor DC Drives,* Tata McGraw Hill
2. B. K. Bose, *Modern Power Electronics and AC Drives*, Pearson Education
3. R. Krishnan*, Electric Motor Drives- Modelling, Analysis and control*, Pearson education
4. M. D. Singh & K. B. Khanchandani, *Power Electronics*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 605 ELECTRICAL ENGINEERING DRAWING

Teaching scheme **Credits:** 3
2 hours drawing per week

Objectives

- *To make students to be able to plan and draw different views of electrical machines and transformers*
- *To make the students to draw different types of windings used in electrical machines*
- *Introduction to AutoCAD in Electrical engineering drawing*

Module I (9Hours)
DC Windings: Simplex lap and wave dc armature windings.
AC Windings: Mush and concentric type single layer three phase ac armature windings. Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings.
Introduction to AUTOCAD- Developed winding diagrams (Auto Cad not included for Examination)

Module II (9 Hours)

1. Sectional plan and elevation of a transformer limb with windings.
2. Sectional plan and elevation of the core assembly of a power transformer.
3. Sectional plan and elevation of a distribution transformer tank with its accessories.
4. Sketches of capacitor and oil filled type transformer bushings.
5. Layout and single line diagram of a distribution transformer.

Substation Layouts:

1. Layouts and single line diagrams of outdoor and indoor substations.
2. Layout of a 220KV substation.
3. Layout of a captive power substation.
4. Single line diagram of a distribution centre.

Module III (18hours)
DC Machines:

1. Sectional front and side elevation of armature with commutator of a dc machine.
2. Sectional front and side elevation of the yoke and pole assembly with field winding of a dc machine.
3. Sectional front and side elevation of an assembled dc Machine.

Alternators:

1. Sectional front and side elevation of a water wheel rotor assembly with winding.
2. Sectional front and side elevation of a salient pole alternator.
3. Sectional front and side elevation of a Turbo alternator
4. Sketches of the methods of pole fixing and slot details of Turbo and Water wheel alternators**.**

Induction motors:

1. Sectional front and side elevation of a slip ring induction motor.
2.
3. Sectional front and side elevation of a squirrel cage induction motor.

Text Books

1. Narang K. L., *A text book of Electrical Engineering Drawing*, Tech India Publications
2. C. R. Dargan, Electrical Drawing and Estimation, New Asian Publishers

Reference Books

1. Bhattacharya S.K., *Electrical Engineering Drawing*, Wiley Eastern.
2. Clayton and Hancock, *Performance and design of dc machines*, ELBS.
3. Sawhney, *Electrical Machine Design*, Dhanpath Rai &Sons.
4. Say M.G, Performance and design of AC machines, Pitman, ELBS

Internal Continuous Assessment *(Maximum Marks-30)*

30% - Tests
60% - Assignments such as class work, home work
10% - Regularity in the class

University Examination Pattern

Q I - 2 questions A and B of 15 marks from Module I with choice to answer any one.

Q II - 2 questions A and B of 20 marks from Module II with choice to answer any one.

Q III - 2 questions of 35 marks from Module III with choice to answer any one.

PTEE09 L01 GENERALIZED MACHINE THEORY

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- *To provide the basic ideas of mathematical modelling and analysis of electric machines*

Module I (9 Hours)

Modeling and analysis of DC machines: Introduction to generalized machine theory-diagrammatic representation of generalized machine-formation of emf equations-expression s for power and torque-representation of D C machines.

Electro dynamical equations and their solution - a spring and plunger system - rotational motion system - mutually coupled coils - Lagrange's equation - application of Lagrange's equation to electromechanical systems - solution of electro dynamical equations by Euler's method and Runge-Kutta method - linearization of the dynamic equations and small signal stability - *the primitive 4 winding commutator machine*- the commutator primitive machine - the brush axis and its significance - self and mutually induced voltages in the stationary and commutator windings - speed emf induced in commutator winding - rotational inductance coefficients - sign of speed emf terms in the voltage equation - the complete voltage equation of primitive 4 winding commutator machine - the torque equation - *DC Machines* - analysis of simple DC machines using the primitive machine equations - analysis of cross-field DC machines using the primitive machine equations

Module II (9 Hours)

Modeling and analysis of induction motors: Representation of Induction machine using Generalized machine theory - Formation of general equations - *The three phase induction motor* - equivalent two phase machine by m.m.f equivalence - equivalent two phase machine currents from three phase machine currents - power invariant phase transformation - voltage transformation - voltage and torque equations of the equivalent two phase machine - commutator transformation and its interpretation - transformed equations - different reference frames for induction motor analysis - choice of reference frame- nonlinearities in machine equations - equations under steady state - solution of large signal transients in an induction machine - linearised equations of induction machine in current variables and flux linkage variables - small signal stability - eigen values - transfer function formulation - application of large signal and small signal equations

Module III (9 Hours)

Modelling and analysis of synchronous machines: Modeling and analysis of synchronous machines - Synchronous machine representation using generalized machine theory - general equations - three phase to two phase transformation - voltage and torque equations in stator, rotor and air-gap field reference frames - commutator transformation and transformed equations - parks transformation - suitability of reference frame Vs kind of analysis to be carried out - steady state analysis - large signal transient analysis - linearization and eigen value analysis - general equations for small oscillations - small oscillation equations in state variable form - damping and synchronizing torques in small oscillation stability analysis - application of small oscillation models in power system dynamics

Module IV (9 Hours)

Dynamical analysis of interconnected machines: Machine interconnection matrices - transformation of voltage and torque equations using interconnection matrix - large signal transient analysis using transformed equations - small signal model using transformed

equations - the DC generator/DC motor system - the alternator/synchronous motor system - the Ward-Leonard system - hunting analysis of interconnected machines - selection of proper reference frames for individual machines in an interconnected system

Text Books

1. Dr. P. S. Bhimbra, *Generalised Machine Theory*, Khanna Publishers.
2. Sengupta D. P. & Lynn J. B., *Electrical Machine Dynamics,* The Mac Millan Press Ltd.

Reference Books

1. Jones C. V., *The Unified Theory of Electrical Machines*, Butterworth
2. Woodson & Melcher, *Electromechanical dynamics*, John Wiley
3. Kraus P. C., *Analysis of Electrical Machines*, McGraw Hill Book Company
4. Boldia I & Nasar S. A., *Electrical Machine Dynamics*, The Mac Millan Press Ltd.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 02 NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart knowledge in:*
  - *Finding the numerical solution of algebraic and transcendental equations*
  - *Finding the solution of a system of linear algebraic equations*
  - *Finding the numerical solution of ordinary and partial differential equations*
  - *Different optimization techniques*

Module I (9 Hours)

Numerical Analysis - Errors in numerical calculations - sources of errors - significant digits - Numerical solution of polynomial and transidental equations - Bisection method - Regula falsi method - Newton - Raphson method - Fixed point method of iteration - Rates of convergence of these methods - solution of system of algebraic equations - Exact methods - Guass elimination - Crout's triangularization method - Iterative methods - Guass-Jacobi and Guass siedal method - Relaxation method.

Polynomial interpolation - Lagrange interpolation polynomial - Divided differences- Newton divided difference interpolation polynomial - finite differences - operators Δ,δ,V, E - Gregory Newton forward and backward difference interpolation polynomials- central differences - sterlings interpolation formula.

Module II (9 Hours)

Numerical differentiation - Differentiation formula in the case of equally spaced points - Numerical integration - Trapezoidal and Simpsons rules - Compounded rules - errors of interpolation and integration formulae - Numerical solution of ordinary differential equations - single step methods - Taylor series - Eulers and Modified Eulers methods - Picard's iteration method - Runga-Kutta methods (Second ,third and forth order formulae, third and forth order derivations not required) Multi step method - Milne's predictor and corrector formulae.

Module III (9 Hours)

Optimization Methods - Systems of linear equation and inequalities - Basic concepts of linear vector spaces - Mathematical formulation of linear programming problem - Theory of simplex method - Simplex algorithm - Charnes M method - Two phase technique - Duality - Dual simplex method.

Module IV (9 Hours)

Transportation, Assignment and routing problems - Dynamic programming - (Introduction and mathematical formulation only) Belman's optimality principle.

.

.

Text Books

1. Dr. M. K. Venkataraman, *Numerical Methods in Science and Engineering,* National Publishing Company
2. Kanti Swarup, Gupta and Manmohan, *Introduction to Linear Programming,* Tata Mc Graw Hill

Reference Books

1. S. S. Sasthry, *Numerical Analysis*, Prentice Hall of India
2. Gerald, *Applied Numerical Analysis,* Addison Wesley
3. Kandaswamy P., Thilakavathy K., Gunavathy K., *Numerical Methods,* S. Chand & Co.
4. Hadley G., *Linear Programming,* National Publishing Company
5. Dr. M. K. Venkataraman, *Linear Programming,,* National Publishing Company
6. Garwin W. W., *Introduction to Linear Programming,* Mc Graw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L03 COMPUTER ORGANISATION AND ARCHITECTURE

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objective

Module I (9 Hours)

Computer abstraction and technology - basic principles - historical perspective - measuring performance - relating the metrics, evaluating, comparing and summarizing performance - case study: SPEC95 benchmark - instructions - operations and operands of the computer hardware - representing instructions - making decision - supporting procedures - beyond numbers - other styles of addressing - starting a program - case study - 80x86 instructions

Module II (9 Hours)

Computer arithmetic - signed and unsigned numbers - addition and subtraction - logical operations - constructing an ALU - multiplication and division - floating point - case study - floating point in 80x86 - the processor - building a data path - simple and multicycle implementations - microprogramming - exceptions - case study - pentium pro implementation

Module III (9 Hours)

Pipelining - overview - pipelined datapath - control - pipeline hazards - exceptions - superscalar and dynamic pipelining - case study - Pentium pro pipeline - memory hierarchy - caches - cache performance - virtual memory - common framework for memory hierarchies - case study - Pentium pro memory hierarchy

Module IV (9 Hours)

Input/output - I/O performance measures, types and characteristics of I/O devices - buses - interfaces in I/O devices - design of an I/O system - multiprocessors - programming - bus and network connected multiprocessors - clusters - network topologies

Text Books

1. Pattersen D. A. & Hennesy J. L., *Computer Organisation and Design: The Hardware / Software Interface*, Harcourt Asia Pvt Ltd. (Morgan Kaufman)

Reference Books

1. Heuring V. P. & Jordan H. F., *Computer System Design and Architecture*, Addison Wesley
2. Hamacher, Vranesic & Zaky, *Computer Organisation*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 04 ENTREPRENEURSHIP

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

Module I (10 Hours)
Entrepreneurial perspectives - understanding of entrepreneurship process - entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur - entrepreneurial competencies - managerial functions for enterprise

Module II (8 Hours)
Process of business opportunity identification and evaluation - industrial policy - environment - market survey and market assessment - project report preparation - study of feasibility and viability of a project - assessment of risk in the industry

Module III (9 Hours)
Process and strategies for starting a venture - stages of small business growth - entrepreneurship in international environment - entrepreneurship - achievement motivation - time management creativity and innovation structure of the enterprise - planning, implementation and growth

Module IV (9 Hours)
Technology acquisition for small units - formalities to be completed for setting up a small scale unit - forms of organizations for small scale units - financing of project and working capital - venture capital and other equity assistance available - break even analysis and economic ratios technology transfer and business incubation

Reference Books

1. Harold Koontz & Heinz Weihrich, *Essentials of Management,* McGraw Hill International
2. Hirich R. D. & Peters Irwin M. P., *Entrepreneurship,* McGraw Hill
3. Rao T. V. & Deshpande M. V., Prayag Mehta, Nadakarni M. S., *Developing Enterpreneurship, A Handbook,* Learning Systems
4. Peter F. Drucker, *Innovation and Entrepreneurship*, Elsevier India Pvt. Ltd.
5. Donald Kurado & Hodgelts R. M., *Entrepreneurship, A Contemporary Approach,* The Dryden Press
6. Dr. Patel V. G., *Seven Business Crisis,* Tata McGrawHill
7. Timmons J. A., *New Venture Creation- Entrepreneurship for 21st Century*, McGraw Hill International
8. Patel J. B., Noid S. S., *A manual on Business Opportunity Identification, Selections,* EDII
9. Rao C. R., *Finance for Small Scale Industries*
10. Pandey G. W., *A Complete Guide to Successful Entrepreneurship, Vikas Publishing Company*

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L05 BIO- MEDICAL ENGINEERING

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *This course gives a brief introduction to human physiology and presents various instrumentations system for measurement and analysis of physiological parameters.*

Module I (9 hours)

Development of biomedical instrumentation, biometrics, man instrument system components block diagram, physiological systems of the body (brief discussion on Heart and cardio vascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements.

Sources of bioelectric potentials – resting and action potentials - propagation of action potentials – bio electric potentials example (ECG, EEG, EMG ,ERG, EOG,EGG etc.)

Bio potential electrodes – theory – microelectrodes – skin surface electrodes – needle electrodes – biochemical transducers – transducers for biomedical applications.

Module II (9 hours)

Electro-conduction system of the heart. Electro cardiography – electrodes and leads – Einthoven triangle, ECG read out devices, ECG machine – block diagram. Measurement of blood pressure – direct and indirect measurement – oscillometric measurement – ultrasonic method, measurement of blood flow and cardiac output, plethysmography – photo electric and impedance plethysmographs, measurement of heart sounds – phonocardiography.

Cardiac pacemakers – internal and external pacemakers, defibrillators.

Module III (9 hours)

Electro encephalogram –neuronal communication – EEG measurement. Muscle response – Electromyogram (EMG) – Nerve Conduction velocity measurements- Electromyogram measurements. Respiratory parameters – Spiro meter, pneumograph, gas exchange and distribution, respiratory therapy equipment.

Ventilators, artificial heart valves, heart lung machine, hemodialysis, lithotripsy, infant incubators

Module IV (9 hours)

X-rays- principles of generation, uses of X-rays- diagnostic still picture, fluoroscopy, angiography, endoscopy, diathermy. Basic principle of computed tomography, magnetic resonance imaging system and nuclear medicine system – radiation therapy. Ultrasonic imaging system - introduction and basic principle.

Instruments for clinical laboratory – test on blood cells – chemical tests - electrical safety – physiological effects of electric current – shock hazards from electrical equipment – method of accident prevention, introduction to tele- medicine.

Text Books

1. L. Cromwell, F. J. Weibell and L. A. Pfeiffer, *Biomedical Instrumentation Measurements,* Pearson education, Delhi, 1990.
2. J. G. Webster, *Medical Instrumentation, Application and Design*, John Wiley and Sons

Reference Books

1. R. S. Khandpur, *Handbook of Biomedical Instrumentation,* Tata Mc Graw Hill
2. J. J. Carr and J. M. Brown, *Introduction to Biomedical Equipment Technology,* Pearson Education.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 607(P) ELECTRICAL MACHINES LAB II

Teaching Scheme **Credits**: 2
2 hours per week

Objective

- *To conduct various tests on different ac machines and transformers and to study the performance.*

1. No load & blocked rotor tests on 3 phase squirrel cage & slip ring induction motors
Objectives:

i) Determine the equivalent circuit parameters and hence predetermine the performance at full load from the equivalent circuit and
ii) Draw the circle diagram and hence predetermine the performance at full load from circle diagram.
iii) Plot the performance characteristics from circle diagram

2. Brake test on 3 phase squirrel cage & slip ring induction motors
Objectives:

1) Plot the following performance characteristics.
   a) Electrical characteristics – Speed, line current, torque, power factor, efficiency & % slip Vs output power
   b) Mechanical characteristics – Torque Vs speed/slip
2) Find the additional kVAR required to improve the power factor to 0.95 at various loads.

3. Performance of induction machine as a generator and motor
Objectives:

i) Operate the given 3 phase induction machine as a) induction motor and b) induction generator
ii) Conduct load test in both generating and motor modes
iii) Plot efficiency vs. output curves
iv) Plot output vs. slip and hence determine the hysteresis power.

4. Slip test on 3-phase salient pole alternator
Objectives:

i) Determine the direct axis and quadrature axis synchronous reactances
ii) Predetermine the voltage regulation at different loads and power factors and plot regulation vs. power factor
iii) Draw the power vs. torque angle characteristics for a specified induced emf.

5. Voltage regulation of alternator
Objectives:

Predetermine the voltage regulation of the given 3 phase alternator by i) emf method ii) mmf method and iii) Zero power factor (Potier) method.

6. Load test on pole changing induction motor

Objectives:

i) Study the different modes of operation of a 3 phase pole changing induction motor

ii) Perform load test on pole changing induction motor and plot the various performance characteristics for low speed and high speed operation.

7. No load & blocked rotor tests on single phase induction motor

Objectives:

i) Conduct the no load and blocked rotor tests on single phase induction motor

ii) Find the equivalent circuit parameters

iii) Predetermine its performance at rated speed.

8. V curves on synchronous machine

Objectives:

i) Synchronize a 3 phase alternator to the supply mains using Dark/Bright lamp method

ii) Plot the V curves and inverted V curves when synchronous machine is acting as generator and motor at no load and constant power.

9. Speed control of induction motor by variable frequency method

Objectives:

Control the speed of the 3 phase induction motor by changing the supply frequency on no load and at given load and plot the speed vs. frequency curve.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 608 (P) MINI PROJECT

Teaching scheme **Credits:** 2
2 hours practical per week

Objectives

- *To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electrical/electronic system.*
- *For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.*

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electrical/electronic system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project. A committee consisting of minimum three faculty members will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee.
50% of the total marks to be awarded by the guide/Co-ordinator and the remaining 50% by the evaluation committee.

Internal Continuous Assessment *(Maximum marks - 50)*
40% - Design and development
30% - Final result and Demonstration
20% - Report
10% - Regularity in the class

Semester End Examination *(Maximum Marks-50)*

20% - Demonstration of mini project
50% - Practical test connected with mini project
20% - Viva voce
10% - Final Report

PTEE09 701 POWER SYSTEM ANALYSIS

Teaching scheme **Credits:** 5

2 hours lecture and 1 hour tutorial per week

Objective

- *Development of a power system model*
- *Analysing the power system model under normal and abnormal conditions*

Module I (9 Hours)

Representation of power systems – one line diagrams, impedance and reactance diagrams, per unit and percent quantities , primitive networks , Y-bus matrix formulation by singular transformation and Direct determination, Z-bus matrices – Building algorithm.

Load flow studies: problem formulation, classification of buses, Gauss –Seidal method, Newton -Raphson method and fast decoupled load flow method

Module II (9 Hours)

Economic load dispatch: system constraints, unit commitment, economic dispatch of thermal plants neglecting line losses, optimum load dispatch including transmission line losses, exact transmission loss formula, automatic load dispatching, hydrothermal coordination.

Speed governing mechanism: speed governing of turbo generator, load sharing and governor characteristics, transfer function model, Load Frequency Control, Automatic Voltage Regulation

Module III (9 Hours)

Short circuit studies : Faults on power systems , three phase to ground faults, SLG , DLG , LL faults, Sequence impedance and sequence networks, symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator, Faults on power systems, fault analysis using Z-bus, faults through impedance , short circuit capacity of a bus and circuit breaker rating

Module IV (9 Hours)

Power system stability studies: steady state, transient and dynamic stability, electrical stiffness, Swing equation, inertia constant , equal area criterion, Step by step method of solution of swing equation , factors affecting stability.

Multi machine stability analysis using forward Euler's method, electromechanical oscillations, sub-synchronous resonance.

Voltage stability problem, causes and improvement methods

Text Books

1. Stevenson Jr., *Elements of Power System Analysis*, tata Mc Graw Hill
2. I. J. Nagrath & D. P. Kothari, *Modern Power System Analysis*, Tata Mc Graw Hill
3. C. L. Wadhwa, *Electric Power Systems*, Wiley Eastern Ltd.
4. J. Wood, B. F. Woollenberg, *Power Generation, Operation and Control*, John Wiley & Sons, New York, 1984
5. C. W. Taylor, *Power System Voltage Stability*, Mc Graw Hill Inc.

Reference Books

1. S. S. Wadhera, *Power System Analysis & Stability,* Khanna Publishers.
2. O. I. Elgerd, *Electric Energy System Theory- An Introduction*, Tata McGraw Hill
3. B. F. Wollenberg, *Power System Engineering*
4. B. R. Gupta, *Power System Analysis and Design*, Wheeler Publishing& Co. New Delhi

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 702 ANALOG AND DIGITAL COMMUNICATION

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of analog & digital modulation schemes*
- *To develop understanding about power line communication.*

Module I (9 hours)
Amplitude Modulation: spectrum power relations-Modulator and demodulator circuits-AM transmitter block diagram-TRF and superhetrodyne receivers-Principles of different types of transmission. Frequency Modulation: Modulation index-Spectrum of FM signal-JFET reactance modulator-FET transmitter block digram-Foster seeley discriminator.pre-emphasis and de-emphasis.

Module II (9 hours)
Frequency domain representation of finite energy signal and periodic signals-ESD,PSD-Convolution theorem-Sampling and re-construction - LTI system-Random process-Ensemble and tune average-Ergodicity- Stationary signal-Winer-Khintchine-Einstein theorem-properties of Gausscian Random process-Whife noise.

Module III (9 hours)
Analog pulse modulation scheme: PAM-PWM-PPM, Digital pulse modulation scheme: PCM-DPCM and delta modulation, Base band data transmission: Base band model-matched filter receiver-ISI
Digital pass band transmission: principles of ASK,PSK and FSK (qualitative level) Multiple Access: TDM-FDM-CDMA-Frequency hopped and direct sequence CDMA. Computer network:-circuit switching- packet switching –basic concept of OSI

Module IV (9 hours)
Power line carrier Communication: Principle, purpose, types of coupling, Interface equipment and communication standards. Power line modems and networks, Digital PLCC, broadband over powerline, Applications

Text Books

1. Simon Haykin**,** 'Communication Systems' Wiley India, New Delhi,4th Ed., 2008
2. Dennis Roddy and John Coolen**, '**Electronic Communication Systems' PHI
3. B.P. Lathi, "Modern digital & Analog communication systems', 3rd Ed., Oxford University press
4. N.N.Biswas, 'Power line communication', Asia Publishing House

Reference Books

1. Sam Shanmugam- Digital and Analog Communication systems; Wiley Student Edition McGraw Hill, New Delhi, 2003
2. Simon Haykin, 'Digital Communication', Wiley India
3. Ziemmer,'Principles Of Communication, Wiley India, New Delhi,5Ed., 2009
4. Wayne Tomasi, 'Electronic Communication Systems: Fundamentals Through Advanced' Pearson Education

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 703 DIGITAL SIGNAL PROCESSING

Teaching scheme **Credits:** 3

1 hours lecture and 1 hour tutorial per week

Objective

- *To study the various methods for the analysis of digital systems*
- *Design a digital filter for the given specifications*
- *To study the architecture of digital signal processors*

Module I (10 Hours)

Review of signals and systems – Review of discrete-time Fourier transform (DTFT) – Discrete Fourier Transform – properties – inverse DFT – relationship between DFT and Z-transform – circular convolution – linear convolution using DFT – overlap add/save method – Fast Fourier Transform (FFT) - Decimation-in-time (DIT) & Decimation-in-Frequency (DIF) FFT algorithms.

Module II (8 Hours)

Realization of IIR filters – direct form I & II – cascade – parallel – lattice-ladder – state space realizations – type I & II – realization of FIR filters – direct form – cascade – linear phase realizations – lattice – conversion from lattice to direct form

Module III (10 Hours)

Digital filter design – analog to digital transformation – backward-difference technique – impulse invariant – bilinear transformation – design of IIR filter from analog filter – Butterworth & Chebyshev filter – FIR filter design – Fourier series method – design using windows – Rectangular, Bartlett, Hanning, Hamming, Blackman, Kaiser windows - comparison of FIR & IIR filters.

Module IV (8 Hours)

Finite word length effects – fixed point and floating point formats – quantization errors – limit cycle oscillations - Digital signal processors – selection of digital signal processors – Von Neumann & Harvard architecture – Multiply Accumulate Unit (MAC) - architecture of DSP processor - fixed point (TMS320C54x) & floating point (TMS320C67x) (block diagram approach) - applications of digital signal processors.

Text Books

1. Oppenheim A. V. & Schafer R. W., *Discrete- time Signal Processing*, Pearson Education
2. Proakis J. G. & Manolakis D. G., *Digital Signal Processing, Principles, algorithms & applications*, Pearson Education.
3. Ramesh Babu P., *Digital Signal Processing*, Scitech Publications(India) Pvt. Ltd.

Reference Books

1. Li Tan, *Digital Signal Processors- Architectures, Implementations and applications,* Academic Press *(*Elsevier)
2. Sen M. Kuo & Woon-Seng S. Gan, *Digital Signal Processors- Architectures, Implementations and Applications*, Pearson Education.
3. A. V. Oppenheim & R. W. Schafer, *Digital Signal Processing*, Prentice- Hall of India
4. Sanjit K. Mitra, *Digital Signal Processing- A computer based approach*, Tata Mc Graw Hill
5. Emmanuel C. Ifeachor, Barrie W. Jervis, *Digital Signal Processing- A practical approach,* Pearson education.
6. Ludeman, *Fundamentals of Digital Signal Processing*, Wiley India Pvt. Ltd.
7. D. Ganesh Rao & Vineeta P Gejji, *Digital Signal Processing,* Sanguine Technical Publishers
8. Richard G. Lyons, *Understanding Digital Signal Processing*, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 704 ELECTRICAL MACHINE DESIGN

Teaching scheme **Credits:** 3

1 hours lecture and 1 hour tutorial per week

Objective

- *Design of Electrical machines and transformers for the given specifications*

Module I (9 Hours)

DC Machines : Output equation – Main dimensions – Choice of specific electric and magnetic loadings – Choice of speed and number of poles – Design of armature conductors, slots and winding – Design of air-gap, field system, commutator, interpoles, compensating winding and brushes – Carter's coefficient – Real and apparent flux density – Design examples.

Module II (9 Hours)

Transformers: Single phase and three phase power transformers – Output equation – main dimensions – Choice of specific electric and magnetic loadings – Design of core, LV winding, tank and cooling tubes – Prediction of no load current, forces on winding during short circuit, leakage reactance and equivalent circuit based on design data – Design examples – Design principles of current transformers – Temperature rise calculations – continuous and intermittent rating.

Module III (9 Hours)

Alternators: Salient pole and turbo alternators – Output equation – Main dimensions – choice of specific electric and magnetic loadings – choice of speed and number of poles – design of armature conductors, slots and winding – Design of air-gap, field system and damper winding – prediction of open circuit characteristics and regulation of the alternator based on design data – design examples

Module IV (9 Hours)

Induction machines: Output equation – Main dimensions – choice of specific electric and magnetic loadings – Design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors – calculation of rotor bar and end ring currents in cage rotor – calculation of equivalent circuit parameters and prediction of magnetizing current based on design data – Design examples

Text Books

1. Sawhney A. K., *Electrical Machine Design*, Dhanpath Rai & Sons.

Reference Books

1. Clayton & Hancock, *Performance and Design of DC Machines*, ELBS
2. Say M. G., *Performance and Design of AC machines*, Pitman, ELBS
3. Bhattacharya, *Electrical Machine Design*

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 707(P) POWER ELECTRONICS LAB

Teaching Scheme **Credits**: 2

2 hours per week

Objective

- *To familiarize different power electronic devices and circuits*

1. Characteristics of SCR
   Aim: To plot static and dynamic characteristics of SCR
2. Phase Control using R and RC firing
   Aim: Analysis of load voltage for different firing angles for Rand RC firing
3. UJT Trigger circuit with Single phase controlled Rectifier
   Aim: Obtain the load voltage waveform
4. AC Voltage Controller using TRIAC
   Aim: Speed Control of fan using TRIAC
5. Single Phase fully Controlled SCR Bridge circuit
   Aim: To study the operation of single phase full converter with RL load & with and without FD
6. IGBT based PWM inverter
   Aim: To control the output of the IGBT based inverter using PWM technique
7. Step down Chopper using MOSFET
   Aim: To obtain the output voltage waveform for resistive load
8. Simulation of PWM inverter
   Aim: To simulate three phase PWM inverter for RL load using SPWM
9. Simulation of three phase bridge converter
   Aim: To simulate three phase bridge converter for RL load
10. Simulation and Analysis of Performance of DC motor with different control schemes(PID, Fuzzy, ANFIS etc)
11. Simulation and Analysis of three phase induction motor drives with different control schemes(Voltage, V/f)
12. Design and Simulation of Buck Converter

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 708(P) ADVANCED ELECTRICAL ENGINEERING LAB

Teaching scheme **Credits:** 2
2 hours practical per week

Objective

- *Familiarisation control system concepts using hardware and simulation experiments*
- *Experiments on microprocessors and microcontrollers and its interfacing*
- *Simulation study and analysis of power system circuits*

1. Determination of transfer function of DC motor a) armature control b) field control
2. Design and experimental determination of frequency response of lead/lag networks
3. Experiments using PLC
4. Relay characteristics
5. Study of 8086 microprocessor and implementation of simple programs
6. Study of 8051 microcontroller and implementation of simple programs
7. Interfacing an ADC with microcontroller to read an analogue signal
8. Generate a square wave, saw tooth wave and triangular wave using 8051 microcontroller
9. Generate a sine wave using 8051 microcontroller
10. Familiarization with MATLAB – simple programs
11. Simulation using MATLAB, SIMULINK, RL tool etc.
12. Familiarization of P, PI, PD & PID controllers
13. Power flow analysis of the system with the given single line diagram using the given power flow analysis package.
14. Transient stability analysis of the system with the given single line diagram using the given package. The disturbance is 3-phase to ground solid SC fault at t=0. The fault is cleared at time t=5 cycles by permanently removing the fault line.
15. Experiments by interfacing transducers like strain gauge, LVDT etc with 8085/8086.

Note: Any 10 out of the 15 experiments need be done.The list of experiments given in EE09 708(P) Advanced Electrical Engineering Lab may be updated as and when required to suit the technological developments, with the approval of concerned body.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

PTEE09 709 (P) PROJECT

Teaching scheme **Credit:** 1

1 hour practical per week

Objectives

- *To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.*

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. The project work may be undertaken in electrical power systems / machines/ electronics / computer / instrumentation / biomedical engg. or any allied area and must have relevance in electrical or electronics engineering. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field. will perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent.
Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.
Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment	
20% - Technical relevance of the project	:
40% - Literature survey and data collection	
20% - Progress of the project and presentation	:
10% - Report	
10% - Regularity in the class	

PTEE09 801 ELECTRICAL SYSTEM DESIGN

Teaching scheme **Credits:** 5
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of various electrical installations*
- *To study the design and estimation of different electrical installations.*

Module I (13 hours)
General: Salient features of Indian Electricity Act, Indian Electricity Rules and Energy Conservation Act - General safety precautions - Role and scope of National Electric Code - IS codes and IEC codes - Classification of supply systems: TN, TT and IT systems.
Accessories and protective devices: Load break switches, Switch Fuse Units, Fuse Switches, Circuit Breakers: MCB, MCCB, ELCB, ACB, OCB and VCB - Different types of fuses- Protection against over load
Service connections - Reception and distribution of main supply - Schematic and wiring diagrams - Estimation of wiring materials used for a small residential building - Neutral and earth wire - Earth bus- Design of earthing systems: pipe earthing.

Module II (14 hours)
Load Factor - Demand Factor - Diversity Factor - Design of LT panels - Electrical installations of high rise buildings: Design - Schematic diagram - Layout - Design of Main Supply Board (MSB) and Distribution Boards (DB's) including air conditioners and lifts with provision for standby generators and its protection - Grading - Estimation of material required - Safety aspects - Electrical installation of commercial buildings - Safety aspects - Selection of LT cables - Cinema Act - Electrical installation in a cinema theater
Design of UPS systems for computer labs and IT industries - Effect of harmonics and harmonic elimination - Paralleling of UPS Systems - Automatic Power Factor Correction (APFC).

Module III (13 hours)
Design of HT and EHT installations: Selection of EHV and HV power and distribution transformers and switchgears - Case studies - Design - Layout - Schematic diagram - (a) 16 MVA - 110/11KV outdoor substation having one or two incoming and 8 or less outgoing - (b) 11KV/415V outdoor substations upto 630KVA - (c) 11KV/415V indoor substation upto 630KVA - Design of earthing systems: Measurement of earth resistance using earth megger - Standards - Earthmat design - Design of plate earthing - Shielding of electrical system - Lightning protection of buildings.

Module IV (14 hours)
Design of illumination schemes: Qualities of good lighting schemes - Definition of different terms: Luminous flux - Luminous intensity - Illuminance and luminance - Reflection and reflection factor - Laws illumination - Types of lighting schemes - Mounting of luminaries - Reflectors and diffusers - Refraction - Photometric diagram - MSCP and MHCP – Different types of lamps - Lamp efficiency and lamp efficacy - Maintenance factor - Absorption factor - Reflection factor - Coefficient of utilization - Calculation of COU based on room index using tables - Norms for comfort lighting - Shielding angle - Colour rendering - General rules for interior lighting - Office building lighting - Industrial lighting - Hospital lighting - Design of interior lighting by average illumination - Design of street lighting ,Flood lighting and Air port lighting - LED lighting.

Reference Books

1. IE Rules 1956, IE Act 2003, National Electric Code, IS Codes, NBC 2006, Bureau of Indian Standard Publications, Cinema Regulation (Rules) & Act
2. Raina & Battacharya, Electrical System Design, Estimation & Costing, Wiley Eastern
3. Gupta J.B., Electrica Installating, Estimating & Costing, Kataria & Sons
4. ER. V. K. Jain & ER. Amitabh Bajaj, Design of Electrical Installations, Lakshmi Publications
5. B. R. Gupta, Power System Analysis and Design, Wheeler Publicationg & Co.
6. ABB Switchgear Manual

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 802 POWER SYSTEM PROTECTION AND UTILIZATION

Teaching scheme **Credits:** 3

1 hours lecture and 1 hour tutorial per week

- *Studying the various protection schemes and principle of operations of various circuit breakers and relays.*
- *Understanding the utilization fundamentals with reference to traction and heating*
- *Understanding advanced power system control using SCADA and FACTS*

Module I (8 hours)

Protective Relays: Protective zones, requirement of protective relaying, different types of relays and their applications, generalized theory of relays, protection scheme for generator, transformers, lines and busbars.

Module II (10 hours)

Circuit Breakers : Principles of operation, different types and their operations, ABCB, oil CB, SF6, vacuum CB, circuit breaker ratings, cause of over voltages, protection against lightning, earth wires, lightning diverters, surge absorbers, arcing ground, neutral earthing, basic concepts of insulation levels and their selection, BIL, coordination of insulation.

Module III (8 hours)

Static relays: Amplitude and phase comparators, block diagrams of static relays, microprocessor based protective relaying - over current & impedance relays. Introduction to numerical relays

Surges and traveling waves, voltage waves on transmission line, reflection and attenuation,

Module IV (10 hours)

Electric Traction: Systems of traction, speed time curve, mechanics of traction, braking, power supply, systems of current collection.

Electric Heating: Advantage of electric heating, resistance and induction arc furnaces, construction and field of application, high frequency power supply and the principle and application of dielectric heating

Text Books

1. Sunil S. Rao, *Switch gear and Protection,* Khanna Publishers, 11th Edn.
2. Soni, Gupta and Bhatnagar, *A Course in Electrical Power,* Dhanpat Rai & Sons

Reference Books

1. Madhav Rao, *Introduction to Static Relays,*
2. BadriRam, D. N. Viswakarma, *Power System Protection and Switch Gear,* Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PTEE09 805(P) SEMINAR

Teaching scheme **Credits:** 2

2 hours per week

Objective

- *To assess the ability of the student to study and present a seminar on a topic of current relevance in electrical/electronics/computer/ biomedical/ instrumentation engg. or allied areas.*

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

Internal Continuous Assessment *(Maximum marks – 100)*
20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

PTEE09 806 (P) PROJECT

Teaching scheme **Total Credits:** 7

6 hours practical per week

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in electrical power system / machines/ electronics/ computer/ instrumentation/ biomedical Engg. etc.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment *(Maximum Marks-100)*
40% - Design and development/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

PTEE09 807 (P) VIVA VOCE

Credits: 3

Objective

- *To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination*

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, mini project, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of mini project, seminar, and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

Assessment in Viva-voce *(Maxim marks – 100)*

40% - Subjects
30% - Project and Mini Project
20% - Seminar
10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

Electives for VII th & VIII th Semester

PTEE09 L06 SPECIAL ELECTRICAL MACHINES

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To introduce special types of electric machines and their controls for special applications.*

ModuleI (9 hours)

Stepping Motors - Constructional features, principle of operation, modes of excitation, single phase stepping motors, torque production in variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, Closed loop control of stepping motor, microprocessor based controller.

ModuleII (9 hours)

Switched Reluctance Motors - Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control. Microprocessor based controller. Sensor less control.

Synchronous Reluctance Motors-Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – Phasor diagram, motor characteristics.

ModuleIII (9 hours)

Permanent Magnet Brushless DC Motors - Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessor based controller. Sensorless control.

ModuleIV(9 hours)

Permanent Magnet Synchronous Motors - Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self control, Vector control, Current control schemes. Sensor less control.

Text Books

1. Miller T J E, *Switched Reluctance Motor and Their Control*, Clarendon Press, Oxford, 1993.
2. Miller T J E, *Brushless Permanent Magnet and Reluctance Motor Drives*, Clarendon Press, Oxford,1989.
3. B K Bose, *Modern Power Electronics & AC drives,* Pearson, 2002.
4. Athani V.V. "stepper motors – Fundamentals, Applications &Design" New Age International

Reference Books

1. Kenjo T, Sugawara A, *Stepping Motors and Their Microprocessor Control*, Clarendon Press, Oxford, 1994.
2. Kenjo T, *Power Electronics for the Microprocessor Age*, Oxford University Press, 1990.
3. Ali Emadi (Ed), *Handbook of Automotive Power Electronics and Motor Drives*, CRC Press, 2005.
4. R Krishnan, *Electric Motor Drives – Modeling, Analysis and Control*, PHI, 2003.
5. H A Toliyat, S Campbell, *DSP Based Electro Mechanical Motion Control*, CRC Press, 2004.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L07 DIGITAL CONTROL SYSTEMS

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To familiarise digital controllers.*
- *To understand the analysis and design of digital control system.*

Module I (9 Hours)

Introduction to discrete time control system- Block diagram of a digital control system- Typical examples- Sampling process- Data reconstruction and hold circuits-Zero and first order hold- Review of z- transforms and inverse z- transforms- solution of difference equations- pulse transfer function- pulse transfer function with dead time- system time response- Realization of pulse transfer functions(Digital Controllers)- Direct Programming- Standard Programming- Series programming- parallel programming- ladder programming.

Module II (9 Hours)

Review of stability analysis in z- plane- Jury's stability test and extension of Routh's stability criterion to discrete systems- Transient and Steady state response analysis- transient response specifications- steady state error analysis- Construction of root loci- effect of sampling period on transient response specifications- frequency response specifications- Nyquist stability criterion in the z- plane- Digital Controllers- PI, PD & PID Controllers- Lag, lead, and lag-lead compensators- Design of lag compensator and lead compensator based on root locus and Bode plot approaches

Module III (9 Hours)

State Space analysis of digital control systems- state space representation of discrete time systems- Transfer function from state model- Diagonal/ Jordan Canonical forms from transfer function- Solution of linear time invariant discrete time state equations- discretization of continuous time space equation- representing state models in CCF, OCF, DCF/ JCF using transformation matrix

Module IV (9 Hours)

Concept of controllability and observability for a linear time invariant discrete time control system- condition for controllability and observability- state feedback- condition for arbitrary pole placement- design via pole placement- state observers- design of full order state observer.

Text Books

1. K. Ogata, *Discrete- time control systems,* Pearson Education
2. M. Gopal, *Digital Control and State Variable Methods*, Tata McGraw Hill

Reference Books

1. B. C. Kuo, *Digital Control Systems,* Prentice Hall
2. Charles L. Philip and Troy Nagle, *Digital control Systems*, Prentice Hall

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L08 VLSI DESIGN

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- Overview of VLSI System Design and fabrication

Module I (9 Hours)

Overview Of VLSI Design Methodology: VLSI design process -. Architectural design -Logical design -Physical design -Layout styles -Full custom -Semi custom approaches. .

VLSI Fabrication Techniques : .An overview of wafer fabrication –Wafer Processing -Oxidation -Patterning -Diffusion -Ion Implantation -Deposition –Silicon gate nMOS process -CMOS processes -nWel1 -PWell -Twin tub -Silicon on insulator-CMOS process (enhancements -Interconnect -Circuit elements. (5)

Module II (9 Hours)

Basic Electrical Properties Of MOS And CMOS Circuits: nMOS enhancement transistor -PMOS enhancement transistor -Threshold voltage - Threshold voltage equations -MOS device equations -Basic DC equations -Second order effects - MOS Modules -Small signal AC characteristics -nMOS inverter -Steered input to an nMOS inverter -Depletion mode and enhancement mode pull ups –CMOS inverter -DC characteristics -Inverter delay -Pass transistor -Transmission gate. (12)

Module III (9 Hours)

Layout Design Rules: Need for design rules -Mead conway design rules for the.silicon gate nMOS process -CMOS nwell-Pwel1 design rules -Simple layout examples - Sheet resistance -Area capacitance -Wiring capacitance -Drive large capacitive loads. (8)

Module IV (9 Hours)

Logic Design : Switch logic -Pass transistor and transmission gate -Gate logic - Inverter -Two input NAND gate -NOR gate -Other forms of CMOS logic –Dynamic CMOS logic -Clocked CMOS logic -Precharged domino CMOS logic -Structured design -Simple combinational logic design examples –Parity generator -Multiplexers –Clocked sequential circuits -Two phase clocking -Charge storage –Dynamic register element -nMOS and CMOS -Dynamic shift register -Semi static register - JK flip flop circuit. (12)

Text Books

1. Doglas A. PuckJ1ell and Kamran Eshranghian, *Basic VLSI design*, Prentice Hall of India, New Delhi
2. Neil H. E. West and Kamran Eshranghian, *Principles of CMOS VLSI Design: A System Perspective*, Addison- Wesley.
3. Amar Mukherjee, *Introduction to nMos and CMOS VLSI System Design*, Prentice Hall, USA.,

Reference Books

1. Caver Mead and LyTUI Conway, *Introduction to VLSI Systems*, Addison- Wesley, USA.
2. Eugene D. Fabricus, *Introduction to VLSI Design,* McGraw Hill International Edn.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 09 ENERGY AUDITING, CONSERVATION AND MANAGEMENT

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objective

- *To familiarise with the different renewable energy resources*
- *To give a fundamental knowledge of electricity billing, energy conservation and management.*

Module I (9 Hours)

Concept of renewable energy-Various forms of renewable energy-solar energy –wind energy- bio energy -geothermal energy-wave and tidal energy-Applications and advantages of renewable energy- -potential of renewable energy in India.
Fundamentals of energy conversion using solar – photovoltaic- fuel cell- biogas- wind mini-hydel and tidal resources-cogeneration

Module II (9 Hours)

Electrical system: Electricity billing- Time of Use Billing or TOD metering-electrical load management and maximum demand control- power factor improvement and its benefits- selection and location of capacitors
Electric motors: Types- losses in induction motors- motor efficiency- energy efficient motors- factors affecting energy efficiency and minimizing motor losses in operation.

Module III (9 Hours)

Energy Economics : Cost benefit analysis-simple pay back period method-Internal rate of return-Net present value method-Life cycle costing-Risk analysis-Depreciation.
Energy conservation: Importance-energy saving measures in DG set-fans and blowers-pumps-air conditioning system-energy efficient lighting controls-energy efficient transformers.

Module IV (9 Hours)

Energy management & audit: Energy Management Methods-Demand Management methods- Audit- Definition- Importance and types of energy audit-Steps in energy audit-Energy Conservation Options- Energy management (audit) approach- Specific energy Consumption- case study in an educational Institution(Class Assignment).

Text Books

1. Dr, Clive Beggs, *Energy Management, Supply and Conservation,* Butterworth Heinmann
2. LCwitte, psSchmidt, Dr. Brown, *Industrial Energy Management and Utilization,* Hemisphere Publications, Washington
3. Cory and Weedy, *Power Systems,*

Reference Books

1. Albert Thumann and Paul Mehta, *HandBook of Energy Engineering,* The Fairmont Press.
2. National Productivity Council Energy Audit Reports
3. www.bee-india.nic.in

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 10 SWITCHED MODE POWER CONVERTERS

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *To get general idea of various switched mode dc- dc converters, dc- ac converters and resonant converters*

Module I (9 Hours)
Linear Power supplies- Introduction to Switched Mode DC-to-DC Converter - **Step-down converters** - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Discontinuous conduction mode with constant output voltage- Output voltage ripple
Step-up converters - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Discontinuous conduction mode
Buck Boost converters - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Output voltage ripple –Cuk dc-dc converter
Full Bridge dc-dc Converter – PWM with bipolar voltage and unipolar voltage Switching – dc-dc converter comparison

Module II (9 Hours)
Introduction to Switched Mode DC-to-AC Converter – Basic concepts – PWM switching scheme – square wave switching scheme – single and three phase inverters – switching utilization – ripple in inverter output – effect of blanking time on voltage in PWM inverters
Square wave pulse switching – programmed harmonic elimination switching – current regulated modulation

Module III (9 Hours)
Resonant Converters- Introduction – Switch mode inductive current switching – Zero voltage and Zero current switching
Classification of Resonant Converters – Basic Resonant Circuit concepts –
Load Resonant Converters – Series Loaded and Parallel Loaded Resonant dc-dc converters (Discontinuous conduction mode only) -Resonant switch Converters (ZCS and ZVS)

Module IV (9 Hours)
Switching DC supplies with isolation – dc to dc converters with electrical isolation – fly back converters – double ended fly back converters – forward converters – double ended forward converters – push pull converters – half bridge converters – full bridge converters
Power line disturbances – Power conditioners – Uninterruptible power supplies.

Text Books

1. Mohan Undeland Robbins, *Power Electronics – Converters Application and Design* ,John Wiley and sons

Reference Books

1. Abraham Presman, *Switching Power supply Design*, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L11 PROFESSIONAL ETHICS

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To instill moral and social values and loyalty.*
- *To appreciate the rights of others.*
- *To create an awareness on Engineering Ethics and Human Values.*

Module I (9 hours)

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories. Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

Module II (9 hours)

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

Module III (9 hours)

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India) IE(I), Indian Institute of Materials Management, IETE (Institution of electronics and telecommunication engineers ,India), etc.

Module IV (9 hours)

Human Values-Morals ,values and ethics-Integrity- Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character

Text Books

1.Govindarajan M., Natarajan S., Sentril Kumar V. S., *Engineering Ethics*, Prentice Hall India
2. Mike Martin and Ronald Schinzinger, *Ethics in Engineering,* Tata McGraw Hill

Reference Books

1. Charles D. Fleddermann, *Engineering Ethics,* Pearson Education
2. Charles E. Harris, Michael S. Protchard and Michael J. Rabins, *Engineering Ethics-Concepts and Cases*, Wadsworth Thompson Learning, United States, 2000
3. John R. Boatright, *ethics and the Conduct of Business*, Pearson Education.
4. Edmund G. Seebauer and Robert L. Barry, *Fundamentals of Ethics for Scientists and Engineers,* Oxford University Press.
5. Rinku Sanjeev and Parul Khanna, *Ethics and Values in Business Managemant*, Ane's Books, India.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L12 EMBEDDED SYSTEMS

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To give sufficient background for undertaking embedded system design*
- *To introduce students to the embedded systems, its hardware and software.*
- *To introduce devices and buses used for embedded networking*
- *To explain programming concepts and embedded programming in C and C++*
- *To explain real time operating systems, inter- task communication and an exemplary case of MUCOS- IIRTOS*

Module I (8 hours)

Introduction to Embedded Systems: Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

Module II (9 hours)

I/O Devices - Device I/O Types and Examples – Synchronous - Iso-synchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices - UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - '12C', 'USB', 'CAN' and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses

Module III (9 hours)

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, 'C' Program compilers – Cross compiler – Optimization of memory codes.

Module IV (10 hours)

Definitions of process, tasks and threads – Clear cut distinction between functions – ISRs and tasks by their characteristics – Operating System Services- Goals – Structures- Kernel - Process Management – Memory Management – Device Management – File System Organization and Implementation – I/O Subsystems – Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics – Co-operative Round Robin Scheduling – Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) – Preemptive Scheduling Model strategy by a Scheduler – Critical Section Service by a Preemptive Scheduler – Fixed (Static) Real time scheduling of tasks - INTER PROCESS COMMUNICATION AND SYNCHRONISATION – Shared data problem – Use of Semaphore(s) – Priority Inversion Problem and Deadlock Situations – Inter Process Communications using Signals – Semaphore Flag or mutex as Resource key – Message Queues – Mailboxes – Pipes – Virtual (Logical) Sockets – Remote Procedure Calls (RPCs). Study of Micro C/OS-II or Vx Works or Any other popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS –

Understanding Case Definition – Multiple Tasks and their functions – Creating a list of tasks – Functions and IPCs – Exemplary Coding Steps.

Text Books

1. Rajkamal, *Embedded Systems Architecture, Programming and Design,* Tata McGraw Hill

Reference Books

1. Steve Heath, *Embedded Systems Design,* Newnes
2. David E. Simon, *An Embedded Software Primer,* Pearson Education.
3. Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design,* Harcourt India, Morgan Kaufman Publishers.
4. Frank Vahid and Tony Givargis,*Embedded Systems Design- A Unified Hardware/ Software Introduction*, John Wiley & Sons.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L13 HIGH VOLTAGE ENGINEERING

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- *To study the breakdown mechanisms in electrical insulators*
- *To study the generation and measurement of high AC, DC and impulse voltages*
- *Testing of high voltage equipments*

Module I (9 Hours)

Breakdown mechanisms in solids , liquids, vacuum , gases & gas mixtures- breakdown in uniform fields- breakdown in composite dielectrics - partial discharge , penning effect time tag & paschen's law. Townsends criterion

Module II (9 Hours)

Generation of High Voltages and Currents: D.C.Voltages : voltage doubler, cascade circuits, electrostatic machines, voltage stabilization. A.C. Voltages : Cascade transformers, series resonance circuits.Impulse Voltages : Single stage and multistage circuits, wave shaping, tripping and control of impulse generators, synchronization with oscilloscope, generation of

switching surge voltage, generation of impulse currents

Module III (9 Hours)

Measurement of High Voltages and Currents : D.C.,A.C. and impulse voltages and currents, CRO, electrostatic generating and peak voltmeters, sphere gaps, factors affecting measurements, potential dividers(capacitive and resistive) ,series impedance ammeters, Ragowski coils, magnetic links, Hall effect generators, PT's (magnetic and capacitive types) and CT's.

Module IV (9 Hours)

Dielectric loss measurements:- Schering's bridge- inductively coupled ratio arm bridge.
Partial discharge measurement technologies. radio interference measurements.
Over voltage phenomenon -travelling waves- line equations ,wave transmission , reflection & attenuation, lightning phenomenon. -Switching surges- protection against surges. Testing of circuit breakers and generators.

Text Books

1. Naidu M. S. & Kamaraju V., *High Voltage Engineering,* Tata Mc Graw Hill

Reference Books

1. Bewley L. V. Lines, *Travelling Waves on Transmission,* Dover Publishers.
2. Kuffel and Abdulla M., *High Voltage Engineering,* Pergman Press.
3. Alston L. L., *H. V. Technology,* Oxford University Press
4. Craggs J. D. & Meed J. M., *H. V. technique,* Butterworth
5. Dieter Kind, *An Introduction to HV*, Wiley Ltd.
6. Kreuger Haywood, *Discharge Detection in HV,* London Equipment
7. B. Thapar et. Al., *Power System Transients and High Voltage Principles,* Capital Pub
8. *IEEE Standard Technique for High Voltage Testing*, IEEE John Wiley and Sons
9. *Indian Standards:*
   IS: 2070-1962 IS:2070- 1962
   IS: 2544- 1963 IS: 2079- 1962
   IS:2099-1962 IS:2026-1962
   IS:166-1962 IS:5959- 1970
   IS:1544-1964,1970 IS: 7098- 1973
   IS: 3070- 1965 IS:4004-1967
   IS:6209-1971 IS: 4950- 1968
   British Standards: B5: 3659, B5: 3070, B%: 2914- 1957
   IEC Publications: No. 99-1, Part1-1970

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L14 ADVANCED TOPICS IN POWER SYSTEMS

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the concepts of power electronics based conversion and its variations that enable different power systems applications.*
- *To study the fundamentals of HVDC transmission and the various topologies.*
- *To study the technology of various FACTS devices and their application to improve power system operation.*
- *To introduce the basic concepts on power sector restructuring and market reforms.*

Module I (9 hours)

Types and characteristics of high-power devices-Thyristor based converters with gate turn-on and synchronous converters with gate turn -off devices- Basic concepts on voltage source converters and current sourced converters-Current source versus voltage source converters- various options to meet high converter ratings. Introduction to HVDC transmission - EHV AC versus HVDC Transmission, Kinds of DC links -power flow through HVDC link, equation-HVDC power flow, effect of delay angle and angle of advance

Module II (9 hours)

Transmission interconnections-Power Flow in AC System – stability considerations -controllable parameters. Definitions on FACTS - Basic Types of FACTS Controllers- FACTS Concept and General System Considerations- Static shunt and series compensators-objectives of shunt compensation- objectives of series compensation-

Module III (9 hours)

SVC and STATCOM- basic Operation - Comparison between SVC and STATCOM - STATCOM for transient and dynamic stability enhancement. TCSC and SSSC- basic Operation- comparison between TCSC and SSSC - SSR and its damping. Unified Power Flow Controller-basic Operation -Comparison with other FACTS devices

Module IV (9 hours)

Vertically integrated utility and its traditional regulated structure- Why Deregulation - Restructure models - Functional units- GENCOS, DISCOS, TRANSCOS, ISO, PX, TSP, - Distributed generation and spot prices- Transmission open Access - Power wheeling

Text Books

1. N.G. Hingorani & L. Gyugyi, *Understanding FACTS: Concepts and Technology of Flexible AC transmission Systems,* IEEE Press 2000
2. K. R. Padiyar, *HVDC Power Transmission Systems: Technology and System Interactions,* New Age International Publishers, 2008
3. Dr. Loi Lei Lai, *Power System Restructuring and Deregulation*, John Wiley Inc. 2001.

Reference Books

1. Ned Mohan et. Al., *Power Electronics,* John Wiley and Sons.
2. Yong Hua & Allan T. Johns, *Flexible AC Transmission Systems(FACTS),* Power and Energy Series 30, IET
3. E. W. Kimbark, *Direct Current Transmission,* John Wiley and Sons
4. Adamson C. Hingorani N. G., HVDC Transmission
5. Regulation in Infrastrusture Services: Progress and the way forward- TERI 2001.
6. Various Publications, reports and presentations by Prayas Engineering Group, Pune- www.prayaspune.org

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L15 ADVANCED POWER SYSTEM ANALYSIS AND CONTROL

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To prepare students for a career as power system engineers with a basic understanding of modern tools and practices*
- *To impart an understanding of the activities in load dispatch centers*
- *To instill an awareness of current research topics*

Module I (9 hours)

Optimization: Economic Dispach- Definition- Problem formulation, assumptions and solution algorithm using Lagrangian for both exact and approximate coordination equations

Unit Commitment- Problem Definition- System constraints- Priority ordering- Dynamic programming

Optimal Power Flow - Problem statement- Lagrangian Solution method- Algorithm- How violations of control and dependant variables are treated

Hydrothermal scheduling- Problem modeling and statement - Discretizaton- solution algorithm

Module II (9 hours)

Power System Security: Definition- Security functions- State transition diagram- selection of contingency and modeling for analysis- Contingency analysis using (a) sensitivity method- derivation of generalized constants- Analysis of a contingency case of removal of a line or transformer of series impedance Z_S

(b) using ac load flow method

Module III (9 hours)

State Estimation: Introduction to SCADA - block diagram concept -definition of state estimation and requirement for an estimator- Problem statement and LSE and weighted LSE - Basic solution- Sequential solution- extension to power system

Module IV (9 hours)

Control area concepts -P-f control of single control area- ACE- Two area control- tie line bias control - extension to pool operation or multi control area systems – ABT (and a case study in India)- control issues in deregulated power markets.

Text books

1. A. K. Mahalanabis, D. P. Kothari, S I Ahson, *Computer Aided Power System Analysis and Control,* Tata McGrawHill .
2. O. I. Elgard, *Electrical Energy System Theory: An Introduction ,*

Reference Books

1. G. W. Stagg, A H. El- Abiad,*Computer Methods in Power System Analysis,* Tata McGraw Hill
2. John J. Grainger, W. D. Stevenson, *Power System Analysis,* Tata McGraw Hill
3. B. R. Gupta, *Power System Analysis and Design*, A. H. Wheeler & Co.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L16 OPTIMAL CONTROL THEORY

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To give an overview of theoptimal control problem and different solution methods.*

Module I (9 hours)

Introduction . Optimal control problem . Problem Formulation . Performance measures for various types of optimal control problems- -Minimum time problem- Minimum fuel problem- Minimum energy problem- Tracking problem- Regulator problem—selection of a performance measure-Example..

Module II (9 hours)

Dynamic programming-The optimal control law- principle of optimality-Recurrence relation of dynamic programming- computational procedure for solving optimal control problems-Characteristics of Dynamic programming solution-Discrete linear regulator problem-Hamilton Jacobi Bellman equation-Continuous linear regulator problem.

Module III (9 hours)

Calculus of variations- Fundamental concepts . Functional of single function- Euler - equation-General variation of a functional-Functionals of several independent functions- Boundary conditions. Piecewise smooth extremals. Constrained extremisation of functionals-Point constraints-differential equation constraints-isoperimetric constraints.

Module IV (9 hours)

Variational approach to optimal control problems-Necessary conditions for optimal control -Boundary conditions in optimal control problem. Linear regulator problem . Linear Tracking problem. Pontryagin.s minimum principle- State inequality constraints - Minimum time problems- Minimum control effort problems.

Text Books

1. Donald E. Kirk, *Optimal Control Theory: An introduction*, Dover Publications 2004.

Reference Books

1. Andrew P. Sage*, Optimum Systems Control*, Prentice Hall,1977.
2. HSU and Meyer, *Modern Control- Principles and Applications*, McGraw Hill,1968.
3. Brian D.O. Anderson, John B Moore*, Linear Optimal Control*, Prentice hall, 1991.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PTEE09 L17 DIGITAL IMAGE PROCESSING

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To study the image fundamentals and mathematical transforms necessary for image processing.*
- *To study the image enhancement techniques*
- *To study image restoration procedures.*
- *To study the image compression procedures*
- *To study the image segmentation and representation techniques*.

Module I (9 hours)

Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms

Module II (9 hours)

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering.

Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition

Module III (9 hours)

Lossless compression: Variable length coding – LZW coding – Bit plane coding-predictive coding-DPCM.

Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG,Basics of Vector quantization

Module IV (9 hours)

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors-

Text Books

1. Rafael C. Gonzalez, Richard E. Woods,*Digital Image Processing*, Pearson Education

Reference Books

1. Chandra Dutta MAgundar, *Digital Image Processing and Applications,* PHI
2. Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniv, *Image Processing Analysis and Machine Vision*
3. A. K. Jain, *Fundamentals of Digital Image Processing*, PHI
4. William K. Pratt, *Digital Image Processing,* John Wiley & Sons

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L18 POWER SYSTEM PLANNING AND LOAD FORECASTING

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *The students acquire a comprehensive idea on the various aspects of planning on power system*

Module I (9 hours)

Forecasting-Needs uses and current status of forecasting- Fundamentals of quantitative forecasting- Explanatory and time serious forecasting-least square estimates- Peak load forecasting- Accuracy of forecasting methods. Regression methods- Box Jenkins time serious methods.

Module II (9 hours)

Problems facing electricity industry-Long term forecasting techniques-Methods of long term forecasting- spatial load forecasting- Multivariate procedures-Short term forecasting techniques-

Module III (9 hours)

Forecasting and planning. The role of forecasting in planning-Comparison and selection of forecasting methods _ The accuracy of forecasting methods- Pattern of the Data and its effects on individual forecasting methods- Time horizon effects on forecasting methods.

Module IV (9 hours)

Generation planning-Fundamental economic analysis-Generation planning optimized according to generating unit categories-distribution & Transmission system planning.

Text Books

1. Sullivan R. L., *Power System Planing*, Mc. Graw Hill,

References

1. Makridakis, Spyros, *Forecasting Methods and Applications,* John Wiley & Sons.
2. X. Wang & J. R. Mc Donald, *Modern Power System Planning,* McGraw Hill
3. S. Pabla, *Electrical Power System Planning,* Mac Millan, Delhi.
4. Lakervi E., E. J. Holmes, *Electricity Distribution Network Design,* IEE 2nd Edn.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L19 POWER QUALITY ISSUES AND REMEDIAL MEASURES

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the various Power Quality issues and its mitigation techniques.*

Module I (9 hours)

Power Quality –overview of power quality phenomena -Basic terminologies –Power Quality Issues – Causes for reduction in Power Quality — Power Quality Standards and indices

Module II (9 hours)

Voltage sags-Causes of voltage sags – magnitude & duration of voltage sags – effect on drives and peripherals– monitoring & mitigation of voltage sags.

Interruptions -Origin of Long & Short interruptions – influence on various equipments – monitoring & mitigation of interruptions.

Harmonics-important harmonic introducing devices-SMPS-Three phase power converters-arcing devices-saturable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Module III (9 hours)

Power factor improvement- Passive Compensation- Passive Filtering- Harmonic Resonance - Impedance Scan Analysis- Active Power Factor Corrected Single Phase Front End-Control Methods for Single Phase APFC-Three Phase APFC and Control Techniques- PFC Based on Bilateral Single Phase and Three Phase Converter-static var compensators-SVC and STATCOM

Module IV (9 hours)

Active Harmonic Filtering-Shunt Injection Filter for single phase , three-phase three-wire and three-phase four-wire systems-d-q domain control of three phase shunt active filters - UPS-constant voltage transformers- series active power filtering techniques for harmonic cancellation and isolation . Dynamic Voltage Restorers for sag , swell and flicker problems.

Grounding and wiring-introduction-NEC grounding requirements-reasons for grounding-typical grounding and wiring problems-solutions to grounding and wiring problems.

References

1. Pogei C. Dugan, Mark F. McGranghan, Surya santoso, H. Wayne Beaty, *Electrical power system quality* , Second edition, McGraw Hill Pub.
2. G.T.Heydt, *Electric Power Quality*, Stars in a Circle Publications, 1991
3. Math H. Bollen , *Understanding Power Quality Problems*, IEEE Press, 1st Edition,2001
4. J. Arrillaga, *Power System Quality Assessment*, John Wiley, 2000
5. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood, *Power system Harmonic Analysis*, Wiley, 1997
6. Wilson E Kazibwe, Musoke H Sendaula, *Electic Power quality control techniques*, Van Nostrand Reinhold , NewYork,1993
7. J. Schlabbach,D. Blume,T. Stephanblome , *Voltage quality in Electrical Power Systems*, IEE, 2001

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L20 MANAGEMENT INFORMATION SYSTEMS

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the relationships among management, information, and systems.*
- *To understand how information technology can be used by a business organization to gain a competitive advantage.*
- *To understand the types of information systems that are needed to support the various levels of a business enterprise and the process of analyzing, designing, and developing an information system*

Module I (9 hours)
MIS Definition, Characteristics, Subsystem of MIS –evolution - logical foundations – typical MIS – future. Information Systems and organizations – Information system structure – Classification – support for functional areas of management – BIS – Organisational information systems – MIS in organizations

Module II (10 hours)
Influence of computers, information technology and communication on MIS. Data Base Management – Operations data base – managerial database – comparison of DBMS – Data base approach -use – architecture – DBMS – RDBMS – current developments.

Module III (8 hours)
Decision Making Process : Stages in Decision Making, Individual and Organizational Decision Making Models, Information System support for Decision Making Phases Decision Support Systems – definition – evolution – model management – DSS generators – Multicriteria modeling

MODULE IV (9 Hours)
The role of Expert systems and Artificial intelligence in intelligent decision making process. System analysis and design - The work of system analyst – The assignment brief and mutual investigation –feasibility study – system design – Data collection and preparation – Detailed system - Design – Implementation – Evaluation and maintenance of MIS

Text Book:
1. “Management Information Systems”, S.Sadagopan, PHI, 1/e, 2005
References:
1. “Introduction to Information System”, James A. O’ Brien, Tata McGraw Hill, 12th Edtion.
2. “Management Information Systems”, Effy Oz, Thomson Course Technology, 3/e, 2003
3. K. C. Louden & J. P. Louden : Management Information Systems, Prentice Hall/ Pearson Education
4. Gordon B Davis & Margrethe H Olson : Management Information Systems -Conceptual Foundations, Structure and Development , Tata Mcgraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 21 ORGANIZATIONAL BEHAVIOR

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To develop positive attitude, leadership qualities, effective organizational skills and to attain proficiency in communication skills*

Module I (9 hours)

Nature of Organization - Organizational Goals - Definition of Organizational Behavior – Nature of people – Personality – Perception – Learning and behavior modification – Attitudes and Values.

Module II (9 hours)

Motivation – Theories of Motivation – Need theory – Hygiene theory – Theory X and Y – Expectancy model – ERG Theory – Job Design and Motivation.

Communication – Dynamics of Communication – Process and Forms of Communication – Barriers in Communication – Managing Communication.

Module III (9 hours)

Interpersonal Behavior – Group and Group Dynamics – Group Behavior – Group Effectiveness.

Leadership – Theories of Leadership – Triat Theory – Behavioral Theory – Situational and Contigency model – Leadership Styles.

Module IV (9 hours)

Organizational Change – Nature and Factors – Resistance to Change – Organizational Effectiveness – Approach to measure Organizational Effectiveness.

Organizational Development – Concept of Organizational Development –Organizational Development Interventions - Values and Organizational Development.

Text Books

1. Uma Sekharan, *Organizational Behavior,* Tata Mc Graw Hill Publishing Company Ltd.
2. L. M. Prasad, *Organizational Behavior,* S. Chand & Sons.

Reference Books

1. Schermerhom J. R. Jr., Hunt J. G. & Osborn R. N., *Managing OrganizationalBehavior,* John Wiley & Sons.
2. Luthans, *Organizational Behavior,* McGraw Hill International
3. Kieth Davis, *Human Relations at Work,* Mc Graw Hill Inc.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PTEE09 L 22 SOFT COMPUTING TECHNIQUES

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint the students with the important soft computing methodologies- neural networks, fuzzy logic, genetic algorithms and genetic programming*

Module I (9 Hours)
Artificial Intelligent systems – Neural Networks, Fuzzy Logic and Evolutionary Programming concepts. Artificial Neural Networks – Biological neural networks – Model of an artificial neuron- Comparison between biological neuron and artificial neuron– Basic models of artificial neural network –Learning methods – - Activation function and terminologies of ANN- - Mc Culloch Pitts Neuron – Linear Separability – Hebb network – Perceptron Networks , Adaline, Madaline.

MODULE II (9 Hours)
Back propagation Networks : Architecture - Multi layer perceptron –Back propagation learning – Input layer, Hidden Layer , Output Layer computations, Calculation of error, Training of ANN, Back propagation Algorithm, Momentum and Learning rate, Selection of various parameters in BP networks- Radial Basis Function Networks [T. B. 1].
Variations in standard BP algorithms – Decremental iteration procedure, Adaptive BP, GA based BP, Quick prop training, Augmented BP networks, Sequential learning Approach for single hidden layer Neural networks.

Module III (9 Hours)
Fuzzy sets and crisp sets-Fuzzy sets –Fuzzy set operations-Fuzzy relations- Membership functions – Features of the membership functions-Fuzzification- Methods of membership value assignments-Defuzzification- Defuzzification methods-Fuzzy Rule Base and approximate reasoning- Truth values and tables in fuzzy logic, Fuzzy propositions, Formation of rules, Decomposition of rules, Aggregation of fuzzy rules- Fuzzy Inference Systems- Construction and Working Principle of FIS- Methods of FIS- Mamdani FIS and Sugeno FIS- Fuzzy Logic Control Systems- Architecture and Operation of FLC System- FLC System Models- Application of FLC Systems.

Module IV (9 Hours)
Genetic Algorithms- Basic Concepts- Creation of off- springs- Working Principle- Encoding- Fitness function- Reproduction- Roulette- Wheel Selection, Boltzmann Selection- Tournament selection- Rank Selection- Steady- State Selection- Elitism- Generation gap and steady state replacement- Inheritance operators- Cross Over- Inversion and deletion- Mutation Operator- Bit-wise operators- Generational Cycle- Convergence of Genetic Algorithm- Differences and Similarities between GA and other traditional methods- Applications.
.

Text Books

1. S. N. Sivanandam, S. N. Deepa, *Principles of Soft Computing,* Wiley India Pvt. Ltd.[Module I& III]
2. R.Rajasekharan and G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications,* Prentice Hall of India. [Module II, & IV]

Reference Books

1. Fakhreddine O.Karray, Clarence De Silva, Intelligent Systems Design, Theory, Tools and Application, Pearson Education
2. S. Haykins, Neural Networks – A Comprehensive Foundation , Prentice Hall 2002.
3. L. Fausett, Fundamentals of Neural Networks, Prentice Hall 1994.
4. T.Ross, Fuzzy Logic with Engineering Applications, Tata McGrawHill, New Delhi 1995.
5. D.E. Goldberg, Genetic Algorithms in search, Optimization and Machine Learning, Addison Wesley MA, 1989.
6. John Yen, Reza Lengari, *Fuzzy Logic- Intelligence, Control and Information,*Pearson Education

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: *One of the assignments may be simulation o fsoft computing systems using any technical software*

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L23 PROCESS CONTROL AND INSTRUMENTATION

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To create an awareness of the different transducers used in industry and signal conditioning*
- *To familiarize the process control elements and their control characteristics*

Module I (8 hours)

Signal Conditioning – Analog – Digital - Signal conversions - Process Control Principles - Identification of elements, block diagram, the loop, control system evaluation stability, regulation, evaluation criteria, and cyclic response.

Module II (8 hours)

Final Control Element: Final control operation, signal conversions, analog electrical signal, digital electrical signals, Direct action – pneumatic signals, Actuators – electrical actuators, pneumatic actuators, control elements – fluid valves. Signal Conditioning of Transducers- Temperature Transducers - flow transducers

Module III (9 hours)

Controller Principles - Process characteristics, control system parameters, controller modes, discontinuous controller modes, continuous controller modes, composite controller modes.
Analog Controllers - Electronic controller – Direct action, reverse action, proportional mode, integral mode, derivative mode, composite controller modes. Pneumatic controllers – implementation of PI, PID, PD. Design consideration.

Module IV (9 hours)

Control Loop Characteristics: Control system configurations, cascade control, multivariable control, feed forward control, Split range control, inferential control, Adaptive control, control system quality – loop disturbance, optimum control, measure of quality, Stability, process loop tuning

Text Books

1. Curtis D. Johnson, *Process Control Instrumentation Technology,* Pearson Education.

Reference Books

1. Curtis D. Johnson, *Microprocessors in Process Control,* PHI
2. George Stephanopoulis, *Chemical Process Control*
3. Caughner, *Process Analysis and Control*
4. Deshpande and Ash, *Elements of computer process control of Industrial processes,* ISA
5. Jayantha K. Paul, *Real- Time microcomputer control of Industrial processes*, Kluwer Publications, Netherlands.
6. S. K. Singh, *Computer Aided Process Control*, PHI2
7. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mekkichamp, *Process Dynamics and Control,* Wiley India

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks:

PTEE09 L24 Mechatronics

Teaching scheme **Credits:** 4
2 hours lecture and 1 hour tutorial per week

Objectives:

- *To provide knowledge on the fundamentals of mechatronics, Numerical control machine tools, part programming and robotics*.

Module I (9 hours)
Introduction to Mechatronics.- Mechatronics in manufacturing- Mechatronics in products-Scope of Mechatronics.
Fundamentals of numerical control-advantages of NC systems- Classification of NC systems-Point to point and contouring systems- NC and CNC – Incremental and absolute systems-Open loop and closed loop systems-features of NC machine tools- Fundamentals of machining-Design consideration of NC machine tools-Methods of improving machine accuracy and productivity-Special tool holders

Module II (9 hours)
System devices: System drives-hydraulic systems, DC motors, stepping motors, AC motors-Feedback devices-Encoders, pulse digitizers, resolvers, Inductosyn, tachometers.- Counting devices-Flip Flops, counters ,decoders, digital to analog converters. Interpolation- linear interpolator-circular interpolators, CNC software interpolator-Flow of data in NC machines.

Module III (9 hours)
NC Part programming: Manual Programming-Concepts-tape formats- tab sequential- fixed block word address and variable block formats- Part Programming examples-Point to point programming and simple contour programming- Computer aided programming- Concepts – Post processor programming languages- APT programming-Part programming examples.

Module IV (9 hours)
Industrial Robotics: Basic concepts- Robotics and automation- Specification of Robots-Resolution, Repeatability and accuracy of manipulator- Classification of Robots- Industrial application- Robot drives- Characteristics of end of arm tooling- Sensors-Tactile, proximity and range sensors- contact and non-contact sensors- velocity sensors- touch and slip sensors- Force and torque sensors- Programming- Lead through programming- Textual programming- Programming languages - On line and offline programming- Intelligent Robots.

References

1. Yoram Koren, *Computer Control of Manufacturing Systems*, McGrawHill
2. Michel P. Groover, *Industrial Robots-Technology, Programming and Applications*, McGrawHill
3. Fu K.S , Gonzales et al, *Robotics-Control, sensing, vision and intelligence*, McGrawHill.
4. Yoram Koren and Ben Yuri, *Numerical Control of machine tools*, Khanna Publishers.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PTEE09 L 25 ROBOTICS AND AUTOMATION

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To give an introduction of industrial robotics and automation*

Module I (9 Hours)

Automation and Robotics - Robotics in Science Fiction - A Brief History of Robotics - The Robot and Its Peripherals-Robot Activation and Feedback Components - Position Sensors - Velocity Sensors - Actuators - Power Transmissions Systems - Robot Joint Control Design- Introduction to Manipulator Kinematics - Homogeneous Transformations and Robot Kinematics -Manipulator Path Control - Robot Dynamics - Configuration of a Robot Controller.

Module II (9 Hours)

Types of End Effectors - Mechanical Grippers - Other Types of Grippers - Tools as End Effectors - The Robot/End Effector Interface - Considerations in Gripper Selection and Design - Sensors in Robotics - Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor-Based Systems - Uses of Sensors in Robotics - Introduction to Machine Vision - The Sensing and Digitizing Function in Machine Vision - Image Processing and Analysis - Training and Vision System - Robotic Applications.

Module III (9 Hours)

Methods of Robot Programming – Lead through Programming Methods - A Robot Program as a Path in Space - Motion Interpolation - WAIT, SIGNAL, and DELAY Commands - Branching - capabilities and Limitations of Lead through Methods - The Textual Robot Languages - Generations of Robot Programming Languages - Robot Language Structure - Constants, Variables, and Other Data Objects - Motion Commands - End Effector and Sensor Commands - Computations and operations - Program Control and Subroutines - Communications and Data Processing - Monitor Mode Commands.

Module IV (9 Hours)

Introduction to robot intelligence and task planning- state space search-problem reduction-use of predicate logic-means –end analysis-problem-solving –robot learning-robot task planning-expert systems and knowledge learning.

Text Books

1. Mikell P. Groover- et. Al, *Industrial robotics, Technology, programming and Applications*, McGraw Hill
2. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, *Robotics, Control, Sensing and Intelligence,* McGraw Hill

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

PTEE09 L 26 SATELLITE COMMUNICATION SYSTEMS

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an introduction of industrial robotics and automation*

Module I (13 hours)
Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations - launching of geostationary satellites - Hohmann transfer - effect of earth's shape - other heavenly bodies - atmospheric drag and radiation pressure on the satellite's orbit

Module II (13 hours)
Communication satellites - spacecraft subsystems - payload - repeater, antenna, altitude and control systems - telemetry, tracking and command - power sub system and thermal control
Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations

Module III (13 hours)
Communication link design - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) - VSAT design issues

Module IV (13 hours)
Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data tarffic

Text books

1. Richharia M., *Satellite Communication Systems*, Macmillan Press Ltd.
2. Gagliardi R.M., *Satellite Communication*, CBS
3. Ha T.T., *Digital Satellite Communication,* MGH

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

GLOBAL ELECTIVES

ME09 L23: Industrial Safety Engineering

Teaching scheme

Credits: 4

3 hours lecture and I hour tutorial per week

Objectives

- *To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.*

Pre-requisites: *Nil*

Module I (14 Hours)

Introduction to the concept of safety-Need-safety provisions in the factory Act-Laws related to the industrial safety-Measurement of safety performance, Safety Audit, Work permit system, injury and accidents-Definitions-Unsafe act –unsafe condition- causes, investigations and prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, hazard identifications and control techniques-HAZOP, FMEA,FMECA etc.

Module II (14 Hours)

Concept of Industrial hygiene, programmes-Recognition –Evaluation- Control, Noise-source –effects and noise control, exposure limits –standards, Hearing conservation programmes, Fire –fire load-control and industrial fire protection systems, Fire Hydrant and extinguishers, Electrical Hazards, protection and interlock-Discharge rod and earthling device, safety in the use of portable tools.

Module III (13 Hours)

Logics of consequence analysis-Estimation-Toxic release and toxic effects-Threshold limit values, Emergency planning and preparedness, Air pollution-classification- Dispersion modeling -pollution source and effects- -control method and equipments-Gravitational settling chambers-cyclone separators-Fabric filter systems-scrubbers etc.

Module IV (13 Hours)

Concept of reliability-Definition-Failure rate and Hazard function, System reliability models-series, parallel systems, reliability hazard function for distribution functions-exponential-normal –lognormal-weibull and gamma distribution.

Text books

1. Thomas J. Anton, *Occupational Safety and Health Management*, McGraw Hill
2. Ian T.Cameron & Raghu Raman, *Process Systems Risk Management*, ELSEVIER Academic press.
3. C.S.Rao, *Environmental Pollution Control Engineering*, New Age International Limited
4. L. S. Srinath, *Reliability Engineering*, East west Press, New Delhi.

Reference books

1. Frank E. McErloy,P.E; C.S.P, *Accident Prevention Manual for Industrial Operations*,NSC Chicago.
2. Lees F.P, *Loss Prevention in Process Industries*, Butterworths, New Delhi.
3. BHEL,*Occupational Safety Manual*, Tiruchirappalli.
4. Dr. A.K. Gupta, *Reliability, Maintenance and Safety Engineering*, Laxmi Publications, New Delhi.

Internal Continuous Assessment (Maximum Marks-30)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz,
literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

CS09 L24 : Computer Based Numerical Methods

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To impart the basic concepts of mathematical modelling of problems in science and engineering and to know procedures for solving different kinds of problems.*
- *To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.*

Module I (13 hours)
Errors in numerical computation - mathematical preliminaries - errors and their analysis - machine computations - computer software. Algebraic and Transcendental Equations - bisection method - iteration method - method of false position - rate of convergence - method for complex root - Muller's method - quotient difference method - Newton-Raphson method.

Module II (13 hours)
Interpolation – introduction - errors in polynomial interpolation - finite differences - decision of errors - Newton's formula for interpolation. Gauss, Sterling, Bessel's, Everett's Formula - interpolation by unevenly spaced points - Lagrange interpolation formula - divided difference - Newton's general interpolation formula.

Module III (13 hours)
Numerical Integration and Differentiation – introduction - numerical differentiation - numerical integration - trapezoidal rule - Simpson 1/3 rule - Simpson 3/8 rule - Boole's and Weddle's rules - Euler-Maclariaun formula - Gaussian formula - numerical evaluation of singular integrals.

Module IV (13 hours)
Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear and nonlinear regression - multiple regression - statistical quality control methods.

Text Books

1. E. Balagurusamy, *Numerical Methods*, Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 1999.
2. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis, 6th Ed.*, Pearson Education Asia, New Delhi, 2002.

Reference Books

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, *Numerical Methods*, S.Chand Co. Ltd., New Delhi, 2003.
2. R.L. Burden and T.D. Faires, *Numerical Analysis, 7th Ed.*, Thomson Asia Pvt. Ltd., Singapore, 2002.
3. Shastri, *Introductory methods of numerical analysis*, Prentice Hall International.
4. V. Rajaraman, *Introduction to Numerical Methods*, Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

IC09 L23 Bioinformatics

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives:

- *To get the students acquainted with the interdisciplinary field of bioinformatics*
- *To expose the students to the biological database resources and tools*
- *To provide an introduction to the important problems and algorithms in bioinformatics.*

Prerequisites

Familiarity with internet resources and an aptitude for learning algorithms along with high school level knowledge in biology.

Module I (14hours)
The biological backdrop:

Cells-Prokaryotes and Eukaryotes-DNA double helix- central dogma – DNA, RNA, aminoacids, Proteins -string representations- different levels of protein structures-DNA cloning- RFLP-SNP-Polymerase chain reaction (PCR)-gel electrophoresis-hybridization-A brief introduction to different mappings techniques of genomes- genome sequencing methods-DNA micro arrays – Human Genome Project-A glossary of biological terms.

Module II (14hours)
Bioinformatics-the big picture and the biological database resources:

Scope of bioinformatics-Genomics and Proteomics- A very brief introduction to major problems in bioinformatics like sequence alignment, phylogeny, gene finding, microarray analysis, secondary structure prediction, protein structure prediction, comparative genomics and drug design.
An introduction to the major resources at NCBI, EBI and ExPASy- Nucleic acid sequence databases: GenBank, EMBL, DDBJ -Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD - Genome Databases at NCBI, EBI, TIGR, SANGER – How to access these databases and to make use of the tools available. Various file formats for bio-molecular sequences like genbank and fasta.
The concept of profiles- The derived databases- Prosite, Pfam, PRINTS, CATH, SCOP

Module III (13 hours)
Sequence alignment algorithms and Tools:

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues.
Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM matrices, differences between distance & similarity matrix.
Pairwise sequence alignments: basic concepts of sequence alignment, Needleman & Wuncsh, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA and their versions.
Multiple sequence alignments (MSA): the need for MSA, basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW.

Module IV (13 hours)

Phylogeny, gene finding and molecular visualization:

Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining.

Gene Finding: The six reading frames-Computational gene finding in prokaryotes and eukaryotes Basic signals –start and stop codons, promoters etc- important coding measures- Regular expressions- Introduction to Hidden Markov models- Introduction to genomic signal processing

Molecular visualization: Visualization of protein structures using Rasmol or Rastop

Text Books

1. Dan E. Krane and Michael L. Raymer, *Fundamental concepts of Bioinformatics*, Pearson Education
2. T. K. Attwood and D. J. Parry-Smith, *Introduction to Bioinformatics*, Pearson Education, 2003.
3. Claverie & Notredame, *Bioinformatics - A Beginners Guide*, Wiley-Dreamtech India Pvt
4. Neil C. Jones and PavelA. Pevzner, *An introductin to bioinformatics algorithms*, Ane Books
5. Gary Benson and Roderic Page, *Alogorithms in Bioinformatics*, Springer.
6. R. Durbin et.al., *Biological Sequence Analysis*, Cambridge University Press.
7. Gauthm, *Bioinformatics databases and algorithms*, Narosa Publishers

References

1. Dan Gusfield, *Algorithms On Strings, Trees And Sequences*, Cambridge University Press
2. Resources at web sites of NCBI, EBI, SANGER, PDB etc

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

PE09 L24: Industrial Psychology

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To give awareness on the Human and Industrial Psychology*

Module I (14 hours)

Introduction- psychology as a science- area of applications – study of individual- individual differences- study of behaviour- stimulus- response behaviour- heredity and environment- human mind- cognition- character- thinking- attention- memory- emotion- traits- attitude- personality

Module II (14 hours)

Organizational behaviour- definition –development- fundamental concept- nature of people- nature of organization – an organizational behaviour system- models- autocratic model- hybrid model- understanding a social-system social culture- managing communication- downward, upward and other forms of communication

Module III 13 hours)

Motivation- motivation driver- human needs- behavior modification- goal setting- expectancy model- comparison models- interpreting motivational models- leadership- path goal model- style – contingency approach

Module IV (13 hours)

Special topics in industrial psychology- managing group in organization- group and inter group dynamics- managing change and organizational development- nature planned change- resistance- characteristic of OD-OD process

Text Books

1. Davis K. & Newstrom J.W., *Human Behaviour at work*, Mcgraw Hill International

Reference Books

1. Schermerhorn J.R.Jr., Hunt J.G &Osborn R.N., *Managing Organizational Behaviour*, John Wiley
2. Luthans, *Organizational Behaviour*, McGraw Hill, International
3. Morgan C.t.,King R.A.,John Rweisz &John Schoples, *Introduction to Psychology*, McHraw Hill
4. Blum M.L. Naylor J.C., Harper & Row, *Industrial Psychology*, CBS Publisher

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

PE09 L25: Entrepreneurship

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To give an idea on entrepreneurial perspectives*

Module I (14 hours)
Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneur- entrepreneurial competencies- managerial functions for enterprise.

Module II (14 hours)
Process of business opportunity identification and evaluation- industrial policy- environment- market survey and market assessment- project report preparation-study of feasibility and viability of a project-assessment of risk in the industry

Module III (13 hours)
Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management creativity and innovation structure of the enterprise- planning, implementation and growth

Module IV (13 hours)
Technology acquisition for small units- formalities to be completed for setting up a small scale unit-forms of organizations for small scale units-financing of project and working capital-venture capital and other equity assistance available- break even analysis and economic ratios technology transfer and business incubation

Text Books

1. Harold Koontz & Heinz Weihrich, *Essentials of Management*, McGraw hill International
2 Hirich R.D. &Peters Irwin M.P., *Entrepreneurship*, McGraw Hill
3. Rao T.V., Deshpande M.V., Prayag Mehta &Manohar S. Nadakarni, *Developing Entrepreneurship a Hand Book*, Learning systems
4. Donald Kurado & Hodgelts R.M., *Entrepreneurship A contemporary Approach*, The Dryden Press
5. Dr. Patel V.G., *Seven Business Crisis*, Tata McGraw hill
Timmons J.A., *New venture Creation- Entrepreneurship for 21st century*, McGraw Hill International
6. Patel J.B., Noid S.S., *A manual on Business Oppurnity Identification*, selections, EDII
7. Rao C.R., *Finance for small scale Industries*
8. Pandey G.W., *A complete Guide to successful Entrepreneurship*, Vikas Publishing

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each module with choice to answer one question.	*4 x 10 marks=40 marks*

Maximum Total Marks: 70

CH09 L23 NANOMATERIAL AND NANOTECHNOLOGY

Teaching scheme **Credits:** 4

3 hours lecture & 1 hour tutorial per week

Objectives

- *To impart the basic concepts of nanotechnology*
- *To develop understanding about application of nanomaterials.*

No Pre-requisites

Module 1 (13 Hours)

Introduction to nanotechnology, nanoscale, electromagnetic spectrum, top down and bottom up approach, particle size, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum effects.

Module 2 (13 Hours)

Nanomaterials, preparation of nanomaterials like gold, silver, different types of nano-oxides, Al_2O_3, TiO_2, ZnO etc. Sol-gel methods, chemical vapour deposition, ball milling etc. Carbon nanotubes, preparation properties and applications like field emission displays. Different types of characterization techniques like SEM, AFM, TEM & STM.

Module 3 (13 Hours)

Nanocomposites, nanofillers, high performance materials, polymer nanocomposites, nanoclays, nanowires, nanotubes, nanoclusters etc. Smart materials, self assembly of materials, safety issues with nanoscale powders.

Module 4 (13 Hours)

Nanomanipulation, Micro and nanofabrication techniques, Photolithography, E-beam, FIB etc. Nanolithography., softlithography, photoresist materials. Introduction to MEMS, NEMS and nanoelectronics. Introduction to bionanotechnology and nanomedicines.

References:

1. Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005
2. Nanolithography and patterning techniques in microelectronics, David G. Bucknall, Wood head publishing 2005
3. Transport in Nanostructures, D.K. Ferry and S.M. Goodmick, Cambridge university press 1997.
4. Optical properties of solids, F. Wooten, Academic press 1972
5. Micro and Nanofabrication, Zheng Cui, Springer 2005
6. Nanostructured materials, Jackie Y. Ying, Academic press 2001
7. Nanotechnology and nanoelectronics, W.R, Fahrner, Springer 2005
8. Nanoengineering of structural, functional and smart materials, Mark J. Schulz, Taylor & Francis 2006.
9. Hand book of Nanoscience, Engineering, and Technology, William A. Goddard, CRC press 2003.
10. Nanoelectronics and Information Technology, Rainer Waser, Wiley-VCH 2003.
11. The MEMS Handbook Frank Kreith, CRC press 2002.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

BM09 L23: Operations Research

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

Objective of this introductory course on operations research is to give the students the essential tools of operations research. This will enable them to model and make scientifically based decisions in economic and production environments

Module 1 (13 hours)
Introduction to operation research: OR model, solving the OR model, simulation models, art of modeling, phases of OR study.
Linear programming: Formulation (Identification of decision variables, constructing objective functions and constraints, assumption), Graphical LP solution,

Module II (14 hours)
Simplex Method: Standard LP form, basic solution,, the M-method, the two-phase method, degeneracy, alternative optimal solution, unbounded solution, infeasible solution.
Sensitivity analysis and dual problem : Definition of the dual problem, the relationship between the optimal primal and dual solution, economic interpretation of duality, the dual Simplex method, primal-dual computations, sensitivity analysis

Module III (13 hours)
Transportation Model: Definition of the transportation model, determination of a starting solution, the transportation algorithm, definition of the assignment problem, the Hungarian method.
Network models : Network definition, minimal spanning tree algorithm, shortest route problem, shortest route algorithm, maximal flow model, enumeration of cuts, maximal flow algorithm, CPM, PERT

Module IV (14 hours)
Queuing systems: Elements of a queuing model, role of exponential distribution, birth and death models, steady state measures of performance, single server models
Game theory: Formulation of two person zero sum games, solution of simple games, mixed strategy games(using graphical method and Lp), saddle point condition.

Text Books

1. H. Taha, *Operations Research: an introduction*, 8th Edition, 2007.
2. F. Hillier, *Introduction to Operations Research*, 7th. Ed. December, 2000. McGraw-Hill.
3. W. Winston, *Operations Research: Applications and Algorithms*, Duxbury Press, 2003.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70