

SANJAY GANDHI INSTITUTE OF ENGINEERING & TECHNOLOGY

Syllabus & Evaluation Scheme

(Effective from Session 2017-2018)

On

Choice Based Credit System (CBCS)

Electrical and Electronics Engineering

Bachelor of Technology (B.Tech.)

2nd Year (III & IV Semester)



NEHRU GRAM BHARATI VISHWAVIDYALAYA

KOTAWA-JAMUNIPUR-DUBAWAL

ALLAHABAD

TABLE OF CONTENTS

<u>S. No.</u>	<u>Topic</u>	<u>Page No.</u>
1.	Revised Syllabus Evaluation Scheme (Year-II, Semester-III)	4
2.	Revised Syllabus Evaluation Scheme (Year-II, Semester-IV)	5
3.	List of Science Based Open Electives	6
4.	EAS-301: Engineering Mathematics –III	6
5.	EAS-302/EAS-402: Environment & Ecology	7
6.	EVE-301/EVE-401: Human Values and Professional Ethics	7
7.	EEC-309: Analog & Digital Electronics	9
8.	EEE-301: Electrical & Electronics Engineering Materials	10
9.	EEE-302: Electrical Measurements & Instrumentation	10
10.	EEE-303: Basic Signals & Systems	11
11.	EEE-351: Electrical Workshop	12
12.	EEE-352: Electrical Measurements Lab	12
13.	EEE-353: Simulation Lab-I	13
14.	EEC-359: Electronics Lab	13
15.	EEC-402: Electromagnetic Field Theory	14
16.	EEE-401: Power Plant Engineering	15
17.	EEE-402: Electrical Machines-I	15
18.	EEE-405: Network Analysis and Synthesis	16
19.	EEE-451: Simulation Lab-II	17
20.	EEE-452: Electrical Machines Lab-I	17
21.	EEE-453: Network Lab	18
22.	EEE-454: Electrical Instrumentation Lab	18
23.	Science Based Open Electives	20
24.	EOE-030/EOE-040: Manufacturing Process	20
25.	EOE-031/EOE-041: Introduction to Soft Computing	21
26.	EOE-032/EOE-042: Nano Science	21
27.	EOE-033/EOE-043: Laser Systems and Applications	22
28.	EOE-034/EOE-044: Space Science	23
29.	EOE-035/EOE-045: Polymer Science and Technology	24
30.	EOE-036/EOE-046: Nuclear Science	24

31.	EOE-037/EOE-047: Material Science	25
32.	EOE-038/EOE-048: Discrete Mathematics	26
33.	EOE-039/EOE-049: Applied Linear Algebra	26

REVISED SYLLABUS & EVALUATION SCHEME

B.Tech. (Electrical and Electronics Engineering)

[Effective from the session 2017-18]

Year-2nd, Semester-III

S. No.	Subject Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	Assig/Att.	Total			
THEORY											
1.	EAS-301 /EOE-030 to 039	Engg. Mathematics-III/ Science Based Open Elective	3	1	0	20	10	30	70	100	4
2.	EVE-301/ EAS-302	Human Values & Professional Ethics/ Environment & Ecology	3	0	0	20	10	30	70	100	3
3.	EEC-309	Analog & Digital Electronics	3	0	0	20	10	30	70	100	3
4.	EEE-301	Electrical & Electronics Engineering Materials	3	0	0	20	10	30	70	100	3
5.	EEE-302	Electrical Measurements & Instrumentation	3	0	0	20	10	30	70	100	3
6.	EEE-303	Basic Signals & System	3	1	0	20	10	30	70	100	4
PRACTICAL / TRAINING / PROJECT											
7.	EEE-351	Electrical Workshop	0	0	2	30	20	50	50	100	1
8.	EEE-352	Electrical Measurements Lab	0	0	2	30	20	50	50	100	1
9.	EEE-353	Simulation Lab-I	0	0	2	30	20	50	50	100	1
10.	EEC-359	Electronics Lab	0	0	2	30	20	50	50	100	1
First Year Engineering Programme for B.Tech. 2nd Year lateral entry students belonging to B.Sc. Stream											
11.	EME-101	Elements of Mechanical Engineering*	3	1	0	20	10	30	70	100*	-
12.	ECE-151	Computer Aided Engineering Graphics*	0	0	3	30	20	50	50	100*	-
		Total	18	2	8	240	140	380	620	1000	24

L - Lecture

T - Tutorial

P - Practical

CT - Cumulative Test

Assig/Att. - Assessment/Assignment/Attendance

ESE - End Semester Exam.

***B.Tech. 2nd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects EME-101/EME-201 and ECE-151/ECE-251 of the first year Engineering Programme along with the second year subjects.**

REVISED SYLLABUS & EVALUATION SCHEME

B.Tech. (Electrical and Electronics Engineering)

[Effective from the session 2017-18]

Year-2nd, Semester-IV

S. No.	Subject Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	Assig/Att.	Total			
THEORY											
1.	EOE-040 to 049/ EAS-401	Science Based Open Elective/ Engg. Mathematics-III	3	1	0	20	10	30	70	100	4
2.	EAS-402/ EVE-401	Environment & Ecology/ Human Values & Professional Ethics	3	0	0	20	10	30	70	100	3
3.	EEC-402	Electromagnetic Field Theory	3	1	0	20	10	30	70	100	4
4.	EEE-401	Power Plant Engineering	3	0	0	20	10	30	70	100	3
5.	EEE-402	Electrical Machines - I	3	0	0	20	10	30	70	100	3
6.	EEE-405	Network Analysis and Synthesis	3	0	0	20	10	30	70	100	3
PRACTICAL / TRAINING / PROJECT											
7.	EEE-451	Simulation Lab-II	0	0	2	30	20	50	50	100	1
8.	EEE-452	Electrical Machines Lab-I	0	0	2	30	20	50	50	100	1
9.	EEE-453	Network Lab	0	0	2	30	20	50	50	100	1
10.	EEE-454	Electrical Instrumentation Lab	0	0	2	30	20	50	50	100	1
First Year Engineering Programme for B.Tech. 2nd Year lateral entry students belonging to B.Sc. Stream											
11.	EME-201	Elements of Mechanical Engineering*	3	1	0	20	10	30	70	100*	-
12.	ECE-251	Computer Aided Engineering Graphics*	0	0	3	30	20	50	50	100*	-
		Total	18	2	8	240	140	380	620	1000	24

L - Lecture

T - Tutorial

P - Practical

CT - Cumulative Test

Assig/Att. - Assessment/Assignment/Attendance

ESE - End Semester Exam.

***B.Tech. 2nd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects EME-101/EME-201 and ECE-151/ECE-251 of the first year Engineering Programme along with the second year subjects.**

List of Science Based Open Electives:

1. EOE030/040 Manufacturing Process
2. EOE031/041 Introduction to Soft Computing
3. EOE032/042 Nano Science
4. EOE033/043 Laser System and Application
5. EOE034/044 Space Science
6. EOE035/045 Polymer Science & Technology
7. EOE036/046 Nuclear Science
8. EOE037/047 Material Science
9. EOE038/048 Discrete Mathematics
10. EOE039/049 Applied Linear Algebra

EAS-301: ENGINEERING MATHEMATICS - III

L T P
3 1 0

Unit - I

Function of Complex variable: Analytic function, C-R equations, Harmonic Functions, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions, Taylor's and Laurent's series, Singularities, Zeroes and Poles, Residue theorem, Evaluation of real integrals of the type

Unit – II

Statistical Techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non-linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of significations: Chi-square test, t-test.

Unit – III

Numerical Techniques–I: Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.

Unit – IV

Numerical Techniques–II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss- Seidel method. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eight rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge- Kutta methods.

Unit – V

Numerical Techniques-III: Boundary Value Problem, Finite Difference Method, Eigen Value Problems, Condition Number, Polynomial Method, Power Method, Numerical solution of partial differential equations, Elliptic, parabolic and Hyperbolic equations.

OR

Integral Transforms: Fourier integral, Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- transform and its application to solve difference equations.

Test Books:

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi.
3. JN Kapur, Mathematical Statistics, S. Chand & company Ltd.
4. BS Grewal, Higher Engineering Mathematics, Khanna Publishers.

Reference Books:

1. RK Jain & SRK Iyenger, Advance Engineering Mathematics, Narosa Publication House.
2. Chandrika Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya, 1996.
3. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Limited, New Delhi
4. E. Balagurusamy, Numerical Methods, Tata McGraw-Hill Publishing Company Limited, New Delhi
5. T. Veerajan & T. Ramchandrandran, Theory & Problems in Numerical Methods, TMH, New Delhi.

EAS-302/EAS-402: ENVIRONMENT & ECOLOGY**L T P
3 0 0****UNIT-I**

Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system - Balanced ecosystem, Human activities - Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.

UNIT-II

Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water Induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur Cycles.

Energy - Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources - Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Biogas. Hydrogen as an alternative future source of Energy.

UNIT-III

Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management, e-waste management.

Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution. Acid Rain Ozone Layer depletion, Animal Husbandry.

UNIT-IV

Environmental Protection- Role of Government, Legal aspects, initiatives by Non-Governmental organizations (NGO), Environmental Education, Women Education.

Text Books:

1. Environmental Studies-Benny Joseph-Tata McGrawHill-2005.
2. Environmental Studies- Dr. D.L. Manjunath, Pearson Education-2006.
3. Environmental Studies – R. Rajagopalan -Oxford Publication- 2005.
4. Text book of Environmental Science & Technology- M. Anji Reddy- US Publication.

Reference Books:

1. Principle of Environmental Science and Engineering - P. Venugoplan Rao, Prentice Hall of India.
2. Environmental Science and Engineering Meenakshi, Prentice Hall India.

EVE-301/EVE-401: HUMAN VALUES & PROFESSIONAL ETHICS**L T P
3 0 0****UNIT-I: Course Introduction – Need, Basic Guidelines, Content and Process for Value Education.**

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration – What is it? – Its content and process; ‘Natural Acceptance’ and Experiential Validation – As the mechanism for self exploration
3. Continuous Happiness and Prosperity – A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facilities – the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT-II: Understanding Harmony in the Human Being – Harmony in Myself?

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' – **Sukh and Suvindha**
9. Understanding Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: **Sanyam and Swasthya**; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure **Sanyam and Swasthya** – Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT-III: Understanding Harmony in the Family and Society – Harmony in Human – Human Relationship

13. Understanding harmony in the Family - the basic unit of human interaction
14. Understanding values in human – human relationship; meaning of Nyaya and program for its fulfillment to ensure **Ubhay-tripti**; Trust (**Vishwas**) and Respect (**Samman**) as the foundational values of relationship
15. Understanding the meaning of **Vishwas**; Difference between intention and competence
16. Understanding the meaning of **Samman**, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): **Samadhan, Samridhi, Abhay, Sah-astitva** as comprehensive Human Goals
18. Visualizing a universal harmonious order in society – Undivided Society (**Akhand Samaj**), Universal Order (**Sarvbhaum Vyavastha**) – from family to world family!
– Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT-IV: Understanding Harmony in the Nature and Existence – Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness in the mutual fulfillment among the four orders of nature – recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (**Sah-astitva**) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence – Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in professional ethics:
 - (a) Ability to utilize the professional competence for augmenting universal human order,
 - (b) Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems,
 - (c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:

- (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers,
- (b) At the level of society: as mutually enriching institutions and organizations.

Text Book:

1. R. R. Gaur, R. Sangal, G.P. Bagaria, 2009, **A Foundation Course in Value Education**.

Reference Books:

1. Ivan Illich, 1974, **Energy & Equity**, The Trinity Press , Worcester, and HarperCollins, USA
2. PL Dhar, RR Gaur, 1990, **Science and Humanism**, Commonwealth Purblishers.
3. A.N. Tripathy, 2003, **Human Values**, New Age International Publishers.
4. E.G. Seebauer & Robert L. Berry, 2000, **Fundamentals of Ethics for Scientists & Engineers**, Oxford University Press
5. M. Govindrajran, S. Natrajan & V.S. Senthil Kumar, **Engineering Ethichs (including Human Values)**, Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, <http://www.uptu.ac.in>
2. Story of Stuff, <http://www.storyofstuff.com>
3. Al Gore, **An Inconvenient Truth**, Paramount Classics, USA
4. Charlie Chaplin, **Modern Times**, United Artists, USA
5. IIT Delhi, **Modern Technology - The Untold Story**
6. Gandhi A., Right Here Right Now, Cyclewala Productions

EEC-309: ANALOG & DIGITAL ELECTRONICS

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UNIT-I

Special Diodes-LED, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications. Introduction to Power devices- Characteristics of SCR, TRIAC, DIAC.

UNIT-II

Amplifier and Frequency Response-Introduction to Amplifier, Transfer Function, Frequency Response of Common Emitter, Multistage amplifier. Frequency response of Common source MOSFET Amplifier.

UNIT-III

Feedback- General feedback structure; properties of negative feedback; series-series, series-shunt, shunt-series and shunt-shunt feedback amplifiers. Oscillators-Basic principle of sinusoidal oscillator, R-C Phase Shift , Wein Bridge oscillators, tuned oscillators- Collpits and Hartley; Crystal oscillator, CLAP Oscillator.

UNIT-IV

Number System, Gate Level Minimization (up to three Variables), SOP, POS Simplification. Combinational Logic Circuits: Binary Adder/ Subtractor, Multiplexer/ Demultiplexer, Decoder/ Encoder Sequential Logic: Introduction to latches, flip-flops- S-R, T, D, J-K. V

UNIT-V

Registers & Counter: Serial and parallel data transfer, shift left/right registers, universal shift register. Mode N Counters, ripple counters, synchronous counters, Ring/Johnson counters. Memory: Introduction to ROM, RAM, PLA, PAL.

Text Books:

1. A.S. Sedra and K.C. Smith "Microelectronics Circuits" Oxford University Press (India)
2. Malvino& Leach, "Digital Principles and applications" Tata Mc. Graw Hill
3. R.A. Gayakwad "Op amps and Linear Integrated Circuits" Prentice Hall of India.
4. Balbir Kumar and ShailB. Jain, "Electronic Devices and Circuits" Prentice Hall of India, 2007

Reference Books:

1. Taub & Schilling "Digital Electronics"- Tata McGraw Hill
2. Anil K. Maini, "Digital Electronics: Principles and Integrated circuits" Wiley India Ltd, 2008.
3. Millman, J. and Grabel A, "Microelectronics" McGraw Hill
4. Anand Kumar, "Switching Theory and Logic Design" Prentice Hall of India, 2008.
5. Alope. K. Dutta, "Semiconductor Devices and circuits", Oxford University Press, 2008.

EEE-301: ELECTRICAL & ELECTRONICS ENGINEERING MATERIALS**L T P
3 0 0****UNIT-I**

DIELECTRIC MATERIALS: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT-II

MAGNETIC MATERIALS: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

UNIT-III

SEMICONDUCTOR MATERIALS: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

UNIT-IV

MATERIALS FOR ELECTRICAL APPLICATIONS: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation.

UNIT-V

SPECIAL PURPOSE MATERIALS: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI Reading.

Text Books:

1. RK Rajput, A course in Electrical Engineering Materials, Laxmi Publications, 2009
2. TK Basak, A course in Electrical Engineering Materials, New Age Science Publications, 2009
3. Adrianus J. Dekker, Electrical Engineering Materials, Pearson, 2016.

Reference Books:

1. TTTI Madras, Electrical Engineering Materials.
2. C S Indulkar & S Thiruvengadam, Electrical Engineering Materials.

EEE-302: ELECTRICAL MEASUREMENTS & INSTRUMENTATION**L T P
3 0 0****UNIT-I**

Electrical Measurements: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Review of indicating and integrating instruments: Voltmeter, Ammeter, Three phase Wattmeter, Multimeter and Energy meter.

UNIT-II

Measurement of Resistance, Inductance and Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

UNIT-III

Instrument Transformers: Current and Potential transformer, ratio and phase angle errors, design considerations and testing.

UNIT-IV

Electronic Measurements: Electronic voltmeter, Multimeter, Wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Spectrum & Wave analyzer. Digital counter, frequency meter, voltmeter, multimeter and storage oscilloscope.

UNIT-V

Instrumentation: Transducers, classification & selection of transducers, strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of motion, force, pressure, temperature, flow and liquid level, basic concepts of smart sensors and application. Data Acquisition Systems.

Text Book:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India.
2. B.C. Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2nd Edition.
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH.

Reference Books:

1. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
2. M.B. Stout, "Basic Electrical Measurement", Prentice Hall of India
3. W.D. Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
4. E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A.W. Wheeler & Co. Pvt. Ltd. India.

EEE-303: BASIC SIGNALS & SYSTEMS

L T P
3 1 0

UNIT-I

Introduction To Continuous Time Signals And Systems: Introduction to continuous time and discrete time signals, Classification of signals with their mathematical representation and characteristics. Transformation of independent variable, Introduction to various type of system, basic system properties.
Analogous System: Linear mechanical elements, force-voltage and force-current analogy, modeling of mechanical and electro-mechanical systems: Analysis of first and second order linear systems by classical method.

UNIT-II

Fourier Transform Analysis: Exponential form and Compact trigonometric form of Fourier series, Fourier symmetry, Fourier transform: Properties, application to network analysis. Definition of DTFS, and DTFT, Sampling Theorem.

UNIT-III

Laplace Transform Analysis: Review of Laplace Transform, Properties of Laplace Transform, Initial & Final value Theorems, Inverse Laplace Transform, Convolution Theorem, Impulse response, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform to complex waveforms.

UNIT-IV

State – Variable analysis: Introduction, State Space representation of linear systems, Transfer function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State – Variable technique to the analysis of linear systems.

UNIT-V

Z – Transform Analysis: Concept of Z – Transform, Z – Transform of common functions, Inverse Z – Transform, Initial & Final value Theorems, Applications to solution of difference equations, Properties of Z-transform.

Text Books:

1. Oppenheim, Wilsky, Nawab, "Signals & Systems", PHI.
2. Anand Kumar, " Signals & Systems", PHI.
3. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.

Reference Books:

1. David K. Cheng; "Analysis of Linear System", Narosa Publishing Co.
2. Donald E. Scott, "Introduction to circuit Analysis" Mc. Graw Hill .
3. B. P. Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
4. I. J. Nagrath, S.N. Saran, R. Ranjan and S. Kumar, "Signals and Systems", Tata Mc.Graw Hill, 2001.
5. M E Van-Valkenberg; " Network Analysis", Prentice Hall of India.

EEE-351: ELECTRICAL WORKSHOP

L T P
0 0 2

Note: Minimum ten experiments are to be performed from the following list:

1. To study the working and Control of two lamps in series and in parallel
2. To perform the stair case working and it's testing.
3. To study the working principle and wiring of fluorescent lamp.
4. To study and wiring of distribution board including power plug using isolator, MCB, ELCB.
5. To study and estimate a typical, BHK house wiring.
6. Familiarization, soldering, testing and observing the wave forms on CRO of a HW and FW uncontrolled rectifier (using diodes) with capacitor filter.
7. Visit your college substation and familiarize the supply system, Transformer, HT Panel and Distribution etc.
8. To study construction, working and application of workshop tools. Also study the Electrical and Electronics Symbols.
9. To study the wires, cables and their gauges, Domestic Electrical Accessories.
10. Mini Project on PCB.
11. To study fault, Remedies in Domestic Installation and Indian Electricity Rules.
12. To study the different types of earthing system and measure the earth resistance.

EEE-352: ELECTRICAL MEASUREMENTS LAB

L T P
0 0 2

Note: Minimum ten experiments are to be performed from the following list:

1. Calibration of AC voltmeter and AC ammeter.
2. Measurement of inductance by Maxwell's Bridge.
3. Measurement of inductance by Hay's Bridge.
4. Measurement of inductance by Anderson's Bridge.
5. Measurement of capacitance by Owen's Bridge.

6. Measurement of capacitance by De Sauty Bridge.
7. Measurement of capacitance by Schering Bridge.
8. Measurement of low resistance by using Kelvin's Double bridge.
9. Measurement of phase difference and frequency of AC signal using CRO.
10. Measurement of Power using CT & PT.
11. Measurement of iron loss in a ring by using Maxwell's Bridge.
12. To measure high resistance by using loss of charge method.

EEE-353: SIMULATION LAB - I

L T P
0 0 2

Note: Minimum ten experiments are to be performed from the following list:

1. Introduction to MATLAB and its basic commands
2. Determine the root of a polynomial
3. Determination of polynomial using method for least square curve fitting
4. Solution of differential equation using 4th order Runge - Kutta method
5. Determination of time response of an RLC circuit
6. Single line Modeling of DC motor
7. Step, Ramp and impulse response of transfer function
8. Generation of single and three phase sinusoidal waveform
9. PWM based waveform generation
10. Single phase uncontrolled half wave rectifier using R and RL load
11. Single phase uncontrolled full wave rectifier using R and RL load
12. Three phase uncontrolled full wave rectifier using R and RL load

Institute may add any two software based experiments [Develop Computer Program in 'C' language or use MATLAB or Electrical Domain Simulation Software: "Virtual HIL Device" (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list.

EEEC-359: ELECTRONICS LAB

L T P
0 0 2

ANALOG ELECTRONICS:

Note: Select at least any five out of the following:

1. To Plot V-I characteristics of junction diode and zener diode.
2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge rectifiers.
3. To Plot input / output characteristics for common base transistor.
4. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.
5. To determine voltage gain, current gain, input impedance and output impedance of common emitter amplifier.
6. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C coupled common emitter amplifier.
7. To design R-C Phase shift / Wein Bridge oscillator and verify experimentally the frequency of oscillation.
8. To study transistor as a switch and determine load voltage and load current when the transistor is ON.

ANALOG IC & DIGITAL ELECTRONICS:

Note: Select at least any five out of the following:

9. To study application of Operational Amplifier as summer integrator and voltage comparator.
10. To study operation of Op-Amp based astable and mono-stable multi vibrators.
11. To study operation IC 555 based astable and mono-stable multi vibrators.
12. To study operation of (a) multiplexer using IC 74150 (b) demultiplexer using IC 74138.
13. To study operation of Adder / Subtractor using 4 bit / 8 bit IC 7483.
14. To study operation of (a) J K Master – slave flip – flop using IC 7476 (b) Modulo N counter using programmable counter IC74190.
15. To verify experimentally output of A/D and D/A converters.
16. To study regulation of unregulated power supply using IC 7805/7812 voltage regulator and measure the load and line regulations

EEC-402: ELECTROMAGNETIC FIELD THEORY

L T P
3 1 0

Unit – I

Coordinate Systems and Transformation:

Basics of Vectors: Addition, subtraction and multiplications; Cartesian, Cylindrical, Spherical transformation.

Vector calculus: Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.

Unit – II

Electrostatic fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law- Maxwell's equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson's and Laplace's equations., Methods of Images.

Unit – III

Magneto statics: Magneto-static fields, Biot - Savart's Law, Ampere's circuit law, Maxwell's equation, Application of ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential.

Unit – IV

Magnetic forces: Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy.

Unit – V

Waves and Applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, Displacement current, Maxwell's equation in final form Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics Plane wave in free space. Plain waves in good conductors, Power and the pointing vector, Reflection of a plain wave in a normal incidence. Transmission Lines and Smith Chart.

Text Book:

1. M.N.O. Sadiku, "Elements of Electromagnetic", Oxford University Press.

Reference Book:

2. W.H.Hayt and J.A.Buck, "Engineering Electromagnetic", McGraw- Hill Education.

EEE-401: POWER PLANT ENGINEERING

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UNIT-I

Hydro-electric power plants – selection of site, elements of power plant, classification, water turbines, governor action, hydro-electric generator, plant layout, pumped storage plants.

UNIT-II

Thermal Steam power plants – selection of site, elements and operational circuits of the power plant, turbo-alternators, plant layout, steam turbines, controls and auxiliaries.

UNIT-III

Nuclear power plants – selection of site, nuclear reaction – fission process and chain reaction, constituents of power plant and layout, nuclear reactor – working, classification, control, shielding and waste disposal.

UNIT-IV

Renewable power plants – Solar power generation – Photo-voltaic and solar thermal generation – solar concentrators, Wind power generation – types of wind mills, wind generators, tidal, biomass, geothermal and magneto-hydro dynamic power generation, micro-hydel power plants, fuel cells and diesel and gas power plants.

UNIT-V

Combined operation of power plants – plant selection, choice of size and number of generator units, interconnected systems, real and reactive power exchange among interconnected systems. Power plant economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants, Economic Load Sharing.

Text Books:

1. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A text book on Power Systems Engg.', DhanpatRai and Sons, New Delhi, 2nd revised edition, 2010.
2. J.B.Gupta, 'A course in Power Systems', S.K. Kataria and sons, reprint 2010-2011.

Reference Books:

1. Wadhwa, C.L., 'Generation Distribution and Utilization of Electrical Energy', New Age International publishers, 3rd edition, 2010.
2. Deshpande M.V, 'Elements of Electrical Power systems Design', Pitman, New Delhi, PHI Learning Private Limited, 1st edition, 2009.

EEE-402: ELECTRICAL MACHINES - I

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UNIT-I

Principles of Electro-mechanical Energy Conversion: Introduction, Review of magnetic system, Energy in Magnetic system, Force and torque in magnetic field system, Energy balance equation, Energy conversion via electrical field, Energy in a singly excited system, Determination of the Force and Torque from energy and co-energy, concept of Doubly excited system, Generation of EMF in Machines, Torque in machine with cylindrical air gap.

UNIT-II

DC Machines: Construction, Classification and circuit model of DC Machines, Armature winding (Concentrated and Distributed), Winding Factor, EMF and torque equations, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators, Series and Parallel operation of the DC Generator, Applications.

UNIT-III

DC Machines (Contd.): Performance characteristics of DC motors, Starting of DC motors; 3 point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward

Leonard method); Efficiency and Testing of DC machines (Hopkinson's and Swinburne's Test), Applications.

UNIT-IV

Single Phase Transformer: Construction, EMF Equation, Equivalent Circuit, Phasor diagram, Efficiency and voltage regulation, All day efficiency. Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test, Auto Transformer- Single phase and three phase autotransformers, Volt-amp relation Copper saving in autotransformer Efficiency, Merits & demerits and applications.

UNIT-V

Three Phase Transformers: Construction, Three phase transformer, Phasor groups and their connections, Open delta connection, Three phase to 2 phase, 6 phase or 12 phase connections and their applications, Parallel operation of single phase and three phase transformers and load sharing, Three winding transformers, Excitation phenomenon and harmonics in transformers.

Text Books:

1. I.J. Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad, "Electrical Machines", PHI
3. P.S. Bimbhra, "Electrical Machinery", Khanna Publisher
4. A.E. Fitzgerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

1. H. Cotton, "Electrical Technology", CBS Publication .
2. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
3. P.S. Bimbhra, "Generalized Theory".

EEE-405: NETWORK ANALYSIS AND SYNTHESIS

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UNIT-I

Graph Theory: Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

UNIT-II

Network Theorems (Applications to dependent & independent sources): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

UNIT-III

Transient Circuit Analysis: Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

UNIT-IV

Network Functions: Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions.

Two Port Networks: Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections of two port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.

UNIT-V

(a) Network Synthesis- Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters- Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. C.L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill.
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill .
3. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T.S.K.V. Iyer, "Circuit Theory", Tata McGraw Hill.
5. Samarjit Ghosh, "Network Theory: Analysis & Synthesis" Prentice Hall India.

EEE-451: SIMULATION LAB - II

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Note: Minimum ten experiments are to be performed from the following list:

1. Design of three phase inverter using R and RL Load
2. Design of DC to DC converter using R and RL Load
3. Simulate the response of DC machine using three phase rectifier
4. Simulate the response of DC machine using PID controller
5. Simulate the response of Induction machine using three phase inverter
6. Simulate the response of synchronous machine using three phase inverter
7. Introduction to fuzzy system toolbox
8. Speed control of DC machine using fuzzy system
9. Introduction to neural network toolbox
10. Load forecasting of power system using neural network
11. Introduction to Genetic Algorithm
12. Least square curve fitting using Genetic Algorithm

Institute may add any two software based experiments [Develop Computer Program in 'C' language or use MATLAB or Electrical Domain Simulation Software: "Virtual HIL Device" (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list.

EEE-452: ELECTRICAL MACHINES LAB - I

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Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. To obtain magnetization characteristics of a DC shunt generator.
2. To obtain load characteristics of a DC shunt generator and compound generator (a) Cumulatively compounded (b) Differentially compounded.
3. To obtain efficiency of a DC shunt machine using Swinburne's test.
4. To perform Hopkinson's test and determine losses and efficiency of DC machine.
5. To obtain speed-torque characteristics of a DC shunt motor.

6. To obtain speed control of DC shunt motor using (a) armature resistance control (b) field control
7. To obtain speed control of DC separately excited motor using Ward-Leonard.
8. To obtain equivalent circuit, efficiency and voltage regulation of a single phase transformer using O.C. and S.C. tests.
9. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test.
10. To obtain 3-phase to 2-phase conversion by Scott connection.
11. To determine excitation phenomenon (B.H. loop) of single phase transformer using C.R.O.
12. To demonstrate the parallel operation of three phase Transformer and to obtain the load sharing at a particular load.

Institute may add any two software based experiments [Develop Computer Program in 'C' language or use MATLAB or Electrical Domain Simulation Software: "Virtual HIL Device" (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list.

EEE-453: NETWORKS LAB

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Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. Verification of principle of superposition with AC sources.
2. Verification of Thevenin, Norton and Maximum power transfer theorems in AC circuits.
3. Verification of Tellegen's theorem for two networks of the same topology.
4. Determination of transient response of current in RL and RC circuits with step voltage input.
5. Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases.
6. Determination of frequency response of current in RLC circuit with sinusoidal AC input.
7. Determination of z and h parameters (DC only) for a network and computation of Y and ABCD Parameters.
8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.
9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests.
10. Verification of parameter properties in inter-connected two port networks: series, parallel and cascade. Also study loading effect in cascade.
11. Determination of frequency response of a Twin – T notch filter.
12. To determine attenuation characteristics of a low pass / high pass active filters.

Institute may add any two software based experiments [Develop Computer Program in 'C' language or use MATLAB or Electrical Domain Simulation Software: "Virtual HIL Device" (Free, Unlimited Users, Full Version) from Typhoon HIL GmbH or Equivalent software] in the above list.

EEE-454: ELECTRICAL INSTRUMENTATION LAB

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Note: Minimum ten experiments are to be performed from the following list.

1. Measurement of displacement using LVDT.
2. Measurement of load using strain gauge based load cell.
3. Measurement of water level using strain gauge based water level transducer
4. Measurement of temperature by RTD.

5. Design and Test a signal conditioning circuit for any transducer.
6. Simulate and analyze the frequency domain measurement of electrical signals using spectrum analyzer.
7. Study of PID controllers in flow measurement.
8. Measurement of flow rate by anemometer.
9. Measurement of solar energy using sensor.
10. Implementation of Color Sensor for differentiating frequencies.
11. Determine rotational speed and angle of a motor shaft using Encoder.
12. Range finding and object detection using detection sensor.
13. Measurement using various sensors and analyzing the output using Lab-VIEW software.
14. Design a circuit for noise reduction in measurement system.

SCIENCE BASED OPEN ELECTIVES

EOE-030/EOE-040: MANUFACTURING PROCESS

Unit- I Engineering Materials

Materials and Civilization, their socio economic impact. Engineering Materials their classification and applications.

Metals & Alloys: Properties and Applications

Mechanical Properties of Materials: Strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, malleability, toughness, hardness, resilience, hardness, machine ability, formability, weld ability. Elementary ideas of fracture fatigue & creep.

Steels and Cast Irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications. Wrought iron. Cast iron. Alloy steels: stainless steel, tool steel.

Alloys of Non Ferrous Metals: Common uses of various non-ferrous metals (Copper, Zinc, Tin, Magnesium, Lead, Aluminum etc.) & alloys and its composition such as Cu-alloys: Brass, Bronze, Alalloys.

Unit-II Basic Metal Forming & Casting Processes.

Forming Processes: Basic metal forming operations & uses of such as: Forging, Rolling, Wire & Tube - drawing/making and Extrusion, and their uses.

Press-work: Die & Punch assembly, cutting and forming, its applications. Hot-working versus cold - working.

Casting: Pattern: Materials, types and allowances. Type and composition of Molding sands and their desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola Furnace. Die-casting and its uses.

Unit-III Machining and Welding Operations and their Applications

Machining: Basic principles of Lathe-machine and operations performed on it. Basic description of machines and operations of Shaper-Planer, Drilling, Milling & Grinding.

Welding: Introduction, classification of welding processes. Gas-welding, types of flames and their applications. Electric-Arc welding. Resistance welding. Soldering & Brazing processes and their uses.

Unit-IV Misc. Topics/ Processes

Heat Treatment Processes: Introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching, tempering and case-hardening.

Manufacturing Establishment: Plant location. Plant layout–its types. Types of Production. Production versus Productivity.

Non-Metallic Materials: Common types & uses of Wood, Cement-concrete, Ceramics, Rubber, Plastics and Composite-materials.

Misc. Processes: Introduction to Galvanizing and Electroplating.

Reference Books:

1. "Processes and Materials of Manufacture", Lindberg, PHI.
2. "Manufacturing Engineering And Technology", Kalpakjian and Schmid, Pearson.
3. "Manufacturing Processes", Kalpakjian and Schmid, Pearson.
4. "Manufacturing Processes", H. N .Gupta, R. C. Gupta, Arun Mital, New Age.

EOE-031/EOE-041: INTRODUCTION TO SOFT COMPUTING

Unit- I

Neural Networks-I (Introduction & Architecture)

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multiplayer feed forward networks recurrent networks. Various learning techniques; Perception and convergence rule.

Auto-associative and hetro-associative memory.

Unit- II

Neural Networks-II (Back propogation networks)

Architecture: perceptron model, solution, single layer artificial neural network, multiplayer perception model; back propogation learning methods, effect of learning rule co-efficient back propagation algorithm, factors affecting back propagation training, applications.

Unit- III

Fuzzy Logic-I (Introduction)

Basic concepts of fuzzy logic. Fuzzy sets and Crisp sets Fuzzy set theory and operations Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit- IV

Fuzzy Logic-II (Fuzzy Membership, Rules)

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications & Defuzzifications, Fuzzy Controller, Industrial applications.

Unit- V

Genetic Algorithm (GA)

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Books:

1. S. Rajsekaran & G A. Vijayalakshmi Pal, "Neural Networks Fuzzy Logic and Genetic Algorithm Synthesis and Applications" Prentice Hall of India.
2. N.P. Pady, "Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:

3. Siman Hykin, "Neural Networks' Trentice Hall of India.
4. Timothy J Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
5. Kumar Satish, "Neural Networks" Tata Me Graw Hill.

EOE-032/EOE-042: NANO SCIENCE

UNIT-I

Introduction: Definition of Nano-Science and Nano Technology, Applications of Nano-Technology.

Quantum Theory for Nano Science: Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Potential box (Traped particle in 3D: Nanodot).

Physics of Solid State Structures: Size dependence of properties, crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.

Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT-II

Quantum Nanostructure: Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantum dot laser superconductivity.

Properties of Individual Nano Particles: Metal nano clusters; Magic numbers; Theoretical modeling of nanoparticles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulk to nanostructure, semiconducting nanoparticles, Optical Properties, Photofragmentation, Coulombic Explosion. Rare Gas & Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.

UNIT-III

Growth Techniques of Nanomaterials: Litho and Nonlithographic techniques, RF Plasma, Chemical methods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical Vapour Deposition, Pulsed Laser Deposition.

UNIT-IV

Methods of Measuring Properties: Structure: X-ray Diffraction Technique, Particle size determination, surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy(TEM). Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

UNIT-V

Carbon Nano Materials: Bucky Ball and Carbon Nano- Tubes: Nano structures of carbon (fullerene), Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. Nano Diamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:

1. C.P. Poole Jr F.J. Owens, "Introduction to Nanotechnology".
2. C.Kittel "Introduction to S.S. Physics"-(7th Edn.) Wiley 1996.
3. H.S. Nalwa "Handbook of Nanostructured Materials & Nanotechnology" vol. 5. Academic Press 2000.

EOE-033/EOE-043: LASER SYSTEMS AND APPLICATIONS

UNIT-I

Basic Principle of Modern Physics: Black body radiation, Atomic structure, Spectral series of hydrogen atom, Polarization, Absorption and fluorescence of X-ray, Energy distribution in electrons, Probability of distribution of free electrons, Free electron in metals, Energy level in free electrons, Application of Schrodinger equation in potential well, potential step, tunneling effect.

UNIT-II

Elements and Techniques of Laser: Concept of coherence, Temporal and Spatial coherence, Coherence length and time, Brightness and Intensity, Directionality and Monochromaticity. Absorption, Spontaneous and Stimulated Emission process and Einstein's coefficients. Population inversion, Pumping and pumping schemes, laser gain, Optical cavities and its types.

UNIT-III

Principle of Laser & General Lasers: Main components of Laser, Principle of Laser action, Introduction to general lasers and their types. Three & four level Lasers, Continuous Wave Lasers, Pulsed Lasers, Q-switch lasers.

UNIT-IV

Types of Laser Systems:

Solid state Lasers: Neodymium laser, Nd-Yag laser, Nd-Glass laser and Alexandrite laser.

Liquid Lasers: Dye laser, Tuning in Dye laser, Model-Locked Ring Dye laser.

Gas Laser: Ionic lasers, Argon ion laser, Krypton ion laser, He-Cadmium laser, Copper vapour laser, Carbon dioxide laser and Excimers laser.

Semiconductor Laser: Characteristics of semiconductor lasers, Semiconductor diode lasers, Heterojunction lasers, Homojunction lasers, Quantum well lasers.

UNIT-V

Laser Applications:

Material Processing: Material processing with lasers, Interaction mechanism, Material processing mechanism, Drilling, Cutting and Welding process with laser. Laser hardening.

Medical Science: Medical lasers, Laser diagnostic, Laser in ophthalmology, laser in glaucoma, Laser for general surgery, Laser in dermatology, laser in dentistry, Laser in medicine.

Optical Communication: Optical source for fiber optical communication, powering and coupling, Transmission, Hologram their characteristics. LIDAR.

Reference Books:

1. K.R. Nambiar, "Laser Principles, Types and Application" New Age International.
2. S.A. Ahmad, "Laser concepts and Applications" New Age International.
3. A.K. Katiyar, C. K. Pandey and Manisha Bajpai, Fundamentals of Laser Systems and Applications.

EOE-034/EOE-044: SPACE SCIENCE

UNIT-I

Introduction: Important Individual Contributions [Pre Telescopic: Ptolemy, Copernicus, Brahe and Kepler. Post Telescopic Era: Galileo, Newton, Hubble, Gauss, Riemann, Einstein and Hawkins]. Various International Organizations involved in the development of space Science (NASA, ESA, ISRO).

UNIT-II

Space Observations: Problems related to Eye and Atmosphere and their Remedies, Distance in Space and Magnitude, Measurement Techniques, Non-Optical Telescopic Techniques used in space observation (Covering entire Electromagnetic Region).

UNIT-III

Solar System: Nebular theory of formation of our Solar System. Sun-its origin and fate, Source of Energy and Solar wind. Brief description of Planets about shape, size, period of rotation about axis and period of revolution, distance of planets from sun. Bode's law, Kepler's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, correction of Kepler's third law. Determination of mass of Earth, Determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets.

UNIT-IV

Stars and Galaxy: Stellar Evaluation and Stellar Remnants, Nucleo-Synthesis and Formation of Elements. Classification of Stars: Harvard classification system, Hertzsprung- Russel Diagram, Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit. Galaxies: Galaxies and their evolution and origin, active galaxies and quasars.

UNIT-V

Cosmology: Hubble Law, Redshift and Expansion of the Universe, Cosmic Microwave, Background Radiations, Matter density in Universe, Cosmological principle, Important Models of Universe (Steady State and Big Bang), Dark Matter and Dark Energy.

Text Books / Reference Books:

1. Baidyanath Basu, T. Chattopadhyay, S.N. Biswas " An Introduction to Astrophysics" PHI 2nd Edition.
2. K. S. Krishnaswami, "Astrophysics: A modern Perspective" New Age International.

EOE-035/EOE-045: POLYMER SCIENCE AND TECHNOLOGY

UNIT-I

Basic Concepts of Polymers: A brief History, what are polymer, how are polymers made, Classification of polymers

UNIT-II

Chemistry of Polymerization: Introduction, Chain polymerization, step growth polymerization. Miscellaneous Polymerization reactions. polymerization Techniques.

UNIT-III

Molecular Weight and Size: Average molecular weight, Number average and weight average molecular weight. Sedimentation and viscosity-average molecular weight. Molecular weight and degree of polymerization. Polydispersity and molecular weight distribution in polymers. Practical significance of polymer molecular weight. Size of polymer molecules.

UNIT-IV

Polymer Degradation: What is polymer degradation, types or degradation, thermal and mechanical degradation, Degradation by ultrasonic waves. photodegradation, degradation by high energy radiation, oxidative degradation, hydrolytic degradation.

UNIT-V

Preparations and Applications: Preparation, properties and technical applications of thermoplastics, thermosetting, elastomer and synthetic fibres. Silicones. Applications of polymers in aerospace, ocean, electronics, medical, agriculture, automobile, Sports and building constructions.

EOE-036/EOE-046: NUCLEAR SCIENCE

UNIT-I

Nucleus and Its Basic Features: Nuclear structure, Nuclear forces and their properties, Nuclear binding energy, Nuclear stability, Nuclear radius and its measurement, Nuclear spin, Nuclear magnetic and Electrical moments.

UNIT-II

Nuclear Models: Single particle model, Liquid drop model and Semi-Emperical mass formula, Nuclear potential and Shell model, Collective model.

UNIT-III

Nuclear Reaction: Nuclear reaction and Laws of conservation, Types of nuclear reaction, Mechanism of nuclear reaction-Q value, Nuclear fission and their explanation by liquid drop model, Nuclear fusion and its applications.

UNIT-IV

Radioactivity: Radioactive disintegration, Decay constant, Half life period and Mean life, Alpha decay, Beta decay, Gamma decay, Interaction of nuclear radiation with matter.

UNIT-V

Accelerators: Mass spectrograph: General principle, Aston's Mass Spectrograph Van de Graph Generator, Cyclotron and Synchrotron.

Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon.

Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture.

Reference Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. S.N. Ghosal, "Nuclear Physics" S. Chand & Co.
3. S. B. Patel, "Nuclear Physics: An Introduction New Age International.
4. H. B. Lal, "Introductory Nuclear Physics" United Book Depot.

5. Wang, "Introductory Nuclear Physics", PHI Learning
6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.

EOE-037/EOE-047: MATERIAL SCIENCE

UNIT-I

Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding.

Crystallography and imperfections: Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques, imperfections, Defects & Dislocations in solids.

UNIT-II

Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT).

Micro Structural Exam: Microscope principle and methods, Preparation of samples and micro structure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Unitary and Binary diagrams, Phase rules, Types of equilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT-III

Ferrous materials: Iron and steel manufacture, furnaces, various types of carbon steels, alloy steels and cast irons, its properties and uses.

Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys: Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various types of Brass, Bronze bearing materials their properties and uses. Aluminum alloys, such as Duralumin, Other advanced materials/alloys.

UNIT-IV

Magnetic properties: Concept of magnetism-Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages.

Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications, diffusion of Solid. Super conductivity and its applications, Messier effect. Type I & II superconductors. High Temp. superconductors.

UNIT-V

Ceramics: Structure, types, properties and applications of ceramics. Mechanical/Electrical behavior and processing of ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behavior and processing of plastics, Future of plastics.

Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.

Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.

Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.

Text / Reference Books:

1. W.D. Callister Jr. "Material Science & Engineering Addition"-Wesly Publishing Co.
2. Van Vlash, "Elements of Material Science & Engineering", John Wiley & Sons

3. V. Raghvan, "Material Science", Prentice Hall of India
4. Narula, "Material Science", Tata Mc.Graw Hill
5. Srivastava, Srinivasan, "Science of Materials Engineering" New Age International.

EOE-038/EOE-048: DISCRETE MATHEMATICS

UNIT-I

Relation: Definition, types of relation, composition of relations, pictorial representation of relation, properties of relation, partial order relation.

Function: Definition and types of functions, composition of functions, recursively defined functions.

Group: Monoid, Semi-group, Abelian Group, Properties of groups, Cyclic Group, Permutation groups, Caley's Theorem, Rings and Fields (definition, examples and standard results)

UNIT-II

Propositional logic: Introduction to logic, logical connectives, truth tables, Tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Notion of proofs: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.

UNIT-III

Combinatorics: Mathematical induction, recursive mathematical definitions, basics of counting, Cardinality and Countability, Pigeonhole principle, permutations, combinations, inclusion-exclusion.

UNIT-IV

Recurrence relations (n^{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function, properties of generating functions (G.F.), Solution of recurrence relation using G.F, solution of combinatorial problem using G.F.

UNIT-V

Graphs: Graph terminology, types of graph, connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree (rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Text/Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
2. J.P.Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science" Mc.Graw Hill, 1975.
3. V. Krishnamurthy, "Combinatorics: Theory and Applications", East-West Press.
4. Seymour Lipschutz, M.Lipson, "Discrete Mathematics" Tata McGraw Hill, 2005.
5. Kolman, Busby Ross, "Discrete Mathematical Structures", Prentice Hall International.

EOE-039/EOE-049: APPLIED LINEAR ALGEBRA

UNIT-I

Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence. Basis and dimensions (each and every fact to be illustrated by suitable examples).

UNIT-II

Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences.

UNIT-III

Singular and non-singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations.

UNIT-IV

Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inequality, Minkowski Inequality, polarization Identity, complete orthonormal set, Bessel's Inequality, Gram-Schmidt's orthogonalization process.

UNIT-V

Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem(without proof), some applications to engineering problems.
