B. E. II YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) 2015

III SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
Ma	201 A :	Applied Engineering Mathematics –I (EEE)	1	3	2	-	3	50
EEE	202 A :	Network Theory (EEE)	1	3	2	1	3	50
EEE	203 A :	Electronic Devices & Circuits (EEE)	1	3	2	1	3	50
EEE	204 A :	Direct Current Machines (EEE)	1	3	2	1	3	50
EEE	205 A :	Digital Electronics –I (EEE)	1	3	2	1	3	50
EEE	206 A :	Measurement and Instruments – I (EEE)	1	3	2	1	3	50
		Total (A)	6	18	12	5	-	300
B. **Practicals & Sessionals**								
EEE	211 B :	Network Laboratory	-	-	-	2	-	50
EEE	212 B:	Electronic Circuits Lab.	-	-	-	2	-	50
EEE	213 B :	D. C. Machine Lab.	-	-	-	2	-	50
EEE	214 B :	Digital Electronic Lab – I	-	-	-	2	-	50
EEE	215 B :	Measurement Lab.	-	-	-	2	-	50
EEE	216 B :	Computer Programming	1	2	-	2	-	50
		Total (B)	1	2	-	12	-	300
		Total of III Semester	7	20	12	17	-	600

B. E. II YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) - 2015

IV SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
Ma	251 A	: Applied Engineering Mathematics –II (EEE)	1	3	2	-	3	50
EEE	252 A	: Electronic Circuits (EEE)	1	3	2	1	3	50
EEE	253 A	: Industrial Electronics (EEE)	1	4	2	1	3	50
EEE	254 A	: Digital Electronic– II (EEE)	1	3	2	1	3	50
EEE	255 A	: Measurement & Instruments – II (EEE)	1	4	2	1	3	50
EEE	256 A	: Electrical Circuit Theory (EEE)	1	4	2	1	3	50
		Total (A)	6	21	12	5	-	300
B. **Practicals & Sessionals**								
EEE	261 B	: Electronic Circuit Lab.	-	-	-	2	-	50
EEE	262 B	: Industrial Electronic Lab.	-	-	-	2	-	50
EEE	263 B	: Digital Electronic Lab. - II	-	-	-	2	-	50
EEE	264 B	: Measurement & Instruments Lab.	-	-	-	2	-	50
EEE	265 B	: Electrical Circuit Lab.	-	-	-	2	-	50
EEE	266 B	: Computer Programming Lab.	1	3	-	2	-	50
		Total (B)	1	3	-	12	-	300
		Total of IV Semester	7	24	12	17	-	600
Joint award for III & IV Semester (Marks not counted for award of division)								
FE	237 EEE	Co – curricular activities	½	2				100

B. E. III YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) -2016

V SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
EEE	301 A	: Control System (EEE)	1	3	2	1	3	50
EEE	302 A	: Alternating Current Machine - I (EEE)	1	3	2	1	3	50
EEE	303 A	: Electrical Power Transmission & Distribution (EEE)	1	3	2	1	3	50
EEE	304 A	: Analog Communication Engg(EEE)	1	3	2	1	3	50
EEE	305 A	: Radiation & Wave Propogation (EEE)	1	3	2	1	3	50
EEE	306 A	: Computer Organisation (EEE)	1	3	2	1	3	50
Total (A)			6	18	12	6	-	300
B. **Practicals & Sessionals**								
EEE	316 B	: Control Systems Lab.- I	-	-	-	2	-	50
EEE	317 B	: A C Machine Lab.	½	1	-	2	-	50
EEE	318 B	: Power Systems Lab.	-	-	-	2	-	50
EEE	319 B	: Analog Communication Lab.	-	-	-	2	-	50
EEE	320 B	: Radiation & Wave Propogation Lab.	-	-	-	2	-	50
EEE	321 B	: Electronics workshop	½	1	-	2	-	50
Total (B)			1	2	-	12	-	300
Total of V Semester			7	20	12	18	-	600

B. E. III YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) -2016

VI SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
EEE	351 A	: Alternating Current Machine - II (EEE)	1	3	2	1	3	50
EEE	352 A	: Modern Control Systems (EEE)	1	3	2	1	3	50
EEE	353 A	: Electrical Power Switch Gear & Protection Transmission & Distribution (EEE)	1	4	3	1	3	75
EEE	354 A	: Digital Communication System (EEE)	1	4	3	1	3	75
EEE	355 A	: Microprocessor & Microcomputer (EEE)	1	3	2	1	3	50
EEE	356 A	: Radiation & Wave Propogation –II (EEE)	1	3	2	1	3	50
		Total (A)	6	20	14	6	-	350
B. **Practicals & Sessionals**								
EEE	367 B	: A/C Machine Lab. II	-	-	-	2	-	50
EEE	368 B	: Control System Lab II	-	-	-	2	-	50
EEE	369 B	: Digital Communication Lab.	-	-	-	2	-	50
EEE	370 B	: Microprocessor Lab.	-	-	-	2	-	50
EEE	371 B	: Radiation & Wave Propogation Lab.	-	-	-	2	-	50
		Total (B)	-	-	-	10	-	250
		Total of VI Semester	6	20	14	16	-	600
Joint award for V & VI Semester (Marks not counted for award of division)								
FE	337 EEE	Co – curricular activities	½	2				100

B. E. IV YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) - 2017

VII SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
EEE	401 A :	Power Electronic (EEE)	1	3	3	1	3	50
EEE	402 A :	Control System Design (EEE)	1	3	3	1	3	50
EEE	403 A :	Advance Communication System (EEE)	1	3	3	1	3	50
EEE	404 A :	Advance Computer Technology (EEE)	1	3	3	1	3	50
EEE	405 A :	Engineering Management and Economics (EEE)	1	3	3	-	3	50
EEE		Elective –I	1	3	3	1	3	50
		Total (A)	6	18	18	5	-	300
B. **Practicals & Sessionals**								
EEE	421 B :	Power Electronic Lab.	-	-	-	2	-	50
EEE	422 B :	Control System Lab	-	-	-	2	-	50
EEE	423 B :	Advance Communication System Lab.	-	-	-	2	-	50
EEE	426 B :	Project	½	-	-	2	-	-
		Total (B)	½	-	-	8	-	150
		Total of VII Semester	6½	18	18	13	-	450

B. E. VIII YEAR (ELECTRONICS & ELECTRICALS ENGINEERING) -2017

VIII SEMESTER EXAMINATION

Branch Code	Subject Code	Subject	Units	Credits	L	T/p	Exam H.	Marks
A. **Written Paper**								
EEE	451 A :	Digital Signal Processing (EEE)	1	3	3	1	3	50
EEE	452 A :	Computer Communication & Data Network (EEE)	1	3	2	1	3	50
EEE	453 A :	Power System Operation & Control (EEE)	1	3	3	1	3	50
EEE	454 A :	Electric Machine Design (EEE)	1	3	3	1	3	50
EEE	455 A :	Microwave Engineering (EEE)	1	3	3	1	3	50
EEE		Elective –II	1	3	3	1	3	50
		Total (A)	6	18	16	6	-	300
B. **Practicals & Sessionals**								
EEE	471 B :	Digital Signal Processing Lab.	-	-	-	2	-	50
EEE	472 B :	Microwave Lab	-	-	-	2	-	50
EEE	473 B :	Advance Power System Lab	-	-	-	2	-	50
EEE	474 B :	Electric Machine Design Lab	-	-	-	2	-	50
EEE	426 B :	Project	1	6	-	2	-	150
		Total (B)	1	6	-	10	-	350
EEE	476 C :	Practical Training	1	3	-	-	-	75
EEE	477 C :	Educational Tour	½	1	-	-	-	25
Total of VIII Semester			8½	28	16	16	-	750

Joint Award of VII and VIII Semester (Marks not counted for award of Division)

FE 437 EEE	: Co- curricular activities		½	2				100

SECOND B E. EXAMINATION
THIRD SEMESTER
Ma 201 A Applied Engineering Mathematics - I (EEE)

2L 3 Hours, 50 Marks

Differential Equations: Simultaneous differential equations, Total differential equation, Partial differential equation of the first order (Langrange's and Charpit's methods), Linear partial differential equations with constant coefficients.

Partial differential equations of the second order; classification, Monge's methods. Solution of Wave, Heat One dimensions and Laplace equations (two dimensional) by separation of variables method.

Complex Analysis: Analytic functions, complex integration, Cauchy's integral theorem, Cauchy's integral formula. Taylor's and Laurent's theorems. Singularities of an analytic function, Pole; Residue, Cauchy residue theorem. Use of calculus residues to evaluate integrals of the types $\int_{-\infty}^{+\infty} f(x)dx$ and $\int_{0}^{2\pi} f(x)dx.$ Conformal and bilinear transformations.

Vector Calculus: Definitions of Gradient, divergence and curl. Various identities involving them. Green, Gauss and Stoke's theorems(statement and verification only).

Calculus of Variation: Classical problems, Euler-Langrange equations, Isoperimetric problem.

Statistics: Concept of probability, Binomial, Poisson and normal distributions. Coefficient of correlation and lines of regression.

EEE 202 A Network Theory (EEE)

2L, IT 3 Hours, 50 Marks

Network Equations: Topology incidence, cut-set end tie-set matrices. Mesh and nodal analysis of networks with independent and dependent sources. Duality, Transient and steady state solutions of D.C. and A.C. networks.

Network Theorems: Superposition, Thevenin, Norton, Reciprocity. Maximum power transfer. Millman and Tellegen's Theorems and their applications to D.C. and A.C. circuits

Resonance: Resonance in series and parallel- circuits. Q-Factor, bandwidth and selectivity.

Non-sinusoidal Periodic Waveforms: Fourier series- trigonometric and exponential forms. Response of network to non-sinusoidal periodic waveforms.

Two Port Networks: Different two port parameters and their inter-relations and characteristic functions, interconnection of two port networks, Brune's test. Network configurations. Symmetrical and asymmetrical two port communication networks. Iterative, Image and characteristic impedances, Propagation, attenuation, phase and Image transfer constants. Balanced, unbalanced and reciprocal networks; T.L. lattice and bridged T network

Network Functions: Generalized concept of complex frequency, Impedance and admittance functions. Exponential excitation and system functions. Driving point and transfer functions. Pole zero configuration of system functions.

EEE 203 A Electronics Devices & Circuits (EEE)

2L, 1T 3 Hours, 50 Marks

Introduction to Solid State Devices: Space charge region and junction capacitance. Minority carrier injection, carrier storage and transient response. Impact ionization and avalanche break-down.

Analytical theory of junction diodes. BJT, JFET, MOSFET, UJT, diffused transistors, avalanche transistors. Degenerate semi-conductors and theory of tunneling, Theory of tunnel diodes, zener diodes, varactor diodes, photo diodes, LEDs, photo-transistors, photo FETs and LASER. Introduction to Laser. Elementary theory of composite junction. Ohmic junctions and hetro junctions.

Biasing: Biasing and stabilization techniques of BJT, JFET, MOSFET for use as amplifiers in various configurations. Small signal models for BJT, JFET and MOSFET in discrete and integrated form. Frequency dependence characterization and equivalent circuits. Miller effect.

Untuned small signal BJT amplifiers: Analysis and design of Single stage and multistage. RC coupled and transformer coupled amplifiers. Frequency response, bandwidth, gain and factors affecting them. Various two transistor integrated circuit amplifier stages. Introduction of d.c. amplifiers, differential amplifiers, Cascode and Darlington circuits. Follower circuits and boot-strapping.

EEE 204 A Direct Current Machines (EEE)

2L, IT 3 Hours, 50 Marks

Armature Winding: Fundamental winding terms, classification of windings, simple lap and wave winding, chorded and multiplex winding, dummy coils and equalizing connections, calculations.
Armature Reaction : Armature and field M.M.F.s, cross and demagnetizing effect of armature reaction and their calculations, effect of brush shift, effect of saturation compensating windings.
Commutation : Meaning of commutation, action of commutator, types of commutation, effect of armature reaction, leakage flux, position of brushes, contact resistance, cause of bad commutation, methods of improving commutation.
Generators : EMF equation, types of field excitations, characteristics and parallel running of shunt and compound generators.

Motors : Back EMF, torque equation, characteristics of series, shunt and compound motors, starters and their designs, speed control by field, armature and voltage control, Ward Leonard Method.
Efficiency and testing : Losses and efficiency, condition for maximum efficiency, Estimation of losses by Swinburne's and Hopkinson's tests, separations of losses, Retardation test.
Cross – Field Machines : Constructional features, Rosenberg generator and amplidyne.

EEE 205 A Digital Electronics- I (EEE)

2L, IT 3 Hours, 50 Marks

Device Characteristics: Steady state and transient switching characteristics of diodes, BJTs, FETs, UJTs. Wave shaping circuits. Integrating and differentiating circuits, effects of time constant, relation of tilt time to time constants. Clipper and clamper circuits using diodes and transistors. Saturated and unsaturated transistor switches. Speed-up capacitors. Inverter circuits. Performance of pulse transformer and lumped distributed parameter electromagnetic delay lines.
Relaxation Oscillators: Theory, operation and performance of astable, monostable and bistable multivibrators. Different triggering circuits. Theory of Schmitt trigger. Comparison of performance of various circuits configurations of multivibrators and their fields of applications. Tunnel diode. UJT relaxation oscillator. Theory of astable and monostable blocking oscillators and their triggering methods.
Sweep Circuits: Free running and triggered modes. Theory and common circuits of voltage and current time base generators.
Sampling Gates: Theory, operation and applications of unidirectional and bi-directional sampling gates using diodes and transistors.

EEE 206 A Measurements & Instruments - I (EEE)

2L, IT 3 Hours, 50 Marks

Galvanometer : D" Arsonaval. Vibration and Ballistic Galvanometer. Dynamic equation of motion and its solution for various conditions. Relative damping, logarithmic decrement and galvanometer sensitivities.

Principle of operation, constructional details, torque equation, scale shapes, uses and errors in moving coil, moving iron, electro dynamic and induction instruments for the measurement of voltage, current and power. Single-phase and polyphase induction type energy meters. Energy meter adjustment and testing.
Measurement of Reisistance : Three and four terminal resistances, Kelvin's double bridge. Price's guard wire and loss of charge methods.
A. C. Bridge : Four and A.C. bridges for the measurement of inductance and capacitance, screening, Wagner earth.

Ma 211 A Special Mathematics (C,ChE,,CSE,E,EC,ECC,EEE,M,Mi&PI)

(Common for Diploma passed candidates of all branches)

2L 3 Hours, 50 Marks

Differential Calculus: Asymptotes, curvature. Envelopes, evolutes, Concavity, Convexity and singular points, curve tracing

Integral Calculus: Rectification and quadrate, Volumes and surfaces of Solids of revolution. Mean values of functions, differentiation under sign of integration

Differential Equations: Differential Equations of first order and first degree. Equations of the first order but not of the first degree. Linear differential equations with constant coefficients. Homogeneous Linear differential equations, second order differential equations with variable coefficients

FOURTH SEMESTER

Ma 251 A Applied Engineering Mathematics - II (EEE)

2L 3 Hours, 50 Marks

Integral transforms: Laplace transform, various theorems. Inverse Laplace transform, Applications to solutions of ordinary and simultaneous differential equations. Infinite Fourier transform, various theorems and application to solution of first order partial differential equation.

Special Functions; Solutions of Bessel and Legendre's differential equations, Bessel function and Legendre polynimial of first kind. Their generating functions, recurrence relations, orthogonality, Rodrigue's formulae, and other properties. Solution of Hypergeometric differential equation, Gauss hypergeometric function, its integral representation. Gauss summation theorem, their transformations.

Numerical Methods: Newton-Gregory formula, Langrange's method, Gauss backward, Gauss forward, Stirling's methods for interpolation. Newton-Gregory, Stirling methods for numerical differentiation. Trapezoidal and Simpsons 1/3 and 3/8 rule for numerical integration. Numerical solution of ordinary differential equations of first and second order by Euler, Taylor, Milne's, Runge-Kutta methods. Bisection, Reguli-faisi, secant, Newton-Raphson methods for solution of algebraic and transcendental equations. Matrix representation of simultaneous equations. Gauss elimination, Jordan, Jacobi, Gauss-Siedal methods for simultaneous linear algebraic equations.

EEE 252 A Electronic Circuits (EEE)

2L, IT 3 Hours, 50 Marks

Untuned large signal amplifiers: Methods of analysis of large signal FET, BJT and IC amplifiers. Analysis of distortion and cross modulation. Classification of power amplifiers. Analysis and design of single ended, parallel and push-pull Class A, AB and B power amplifiers. Complementary, symmetry and quasi-complementary circuits, Driver and out-put stages, with and without out-put transformers for power amplifiers. Output circuit efficiency calculations for various classes and configuration of amplifiers. Power out-put. Thermal considerations. Derating curves.

Power Supply Circuit: Design factors and applications of various power supply filters and voltage multiplying rectifier circuits.

Regulated Power Supplies: Regulator circuits using voltage regulating tubes, solid state devices and monolithic ICS. Adjustable constant voltage power supplies. Adjustable constant current power supplies. Higher output power supplies with solid state pre-regulations. Protection circuits for power supplies. Rating and specifications.

EEE 253 A Industrial Electronics (EEE)

2L, 1T 3 Hours, 50 Marks

Power electronics devices: Characteristics and operation of SCR, PUT, SUS, SBS, SCS, TRIAC, DIAC, IGBT, GTO, MCA and light activated thyristors. Ratings and rating extension by series/parallel operation.
Electronic Power Control: Electronic methods of power control. SCR firing methods, Phase control techniques. Line commutation and different types of commutation. One, two and four quadrant converters. Bridge inverters, series and parallel inverters. Cyclo converters
Electrical Drives: Performance characteristics of series, shunt and compound d.c. motors. Motor starters. Characteristics of single and three phase induction motors, Universal motor, Amplidyne and selsyns.
AC and DC Motor Speed Control: Philosophy of speed control, open and closed control and single and three phase AC, DC and universal motors using thyristors. PWM inverter technique and introduction to variable frequency drive
Misc. Industrial Applications: Photo relays and their applications, X-ray tubes. Particle accelerators. Principle of Electron Microscope, Uninterruptible supplies. Switched mode power supplies
Programmable Logic Controllers (PLC): Advantages of PLC, CPU configurations, Digital and analog inputs and outputs, ladder circuits and process flow diagram. Console and operator panel.

EEE 254 A Digital Electronics - II (EEE)

2L,1T 3 Hours, 50 Marks

Counters and Registers: Binary and decade ripple counters. One bit counters. Up, down and up-down, synchronous counters. Programmable counters. Divide-by N counters. Storage registers, shift-right, shift-left and bi-directional shift registers. Serial input, serial output, parallel input, parallel output, parallel-in-serial out, serial in parallel out and Universal shift registers and synchronous parallel loading of shift registers. Static and dynamic MOS shift registers. Ring and Johnson counters
Arithmetic Circuits: Digital Comparators, half, and full adders; parallel and serial binary adders, half and full binary subtractors. BCD adders and subtracters. Binary multipliers and divider circuits
Miscellaneous Sub-systems: Encoders, decoders and code converters. Parity checking circuits. Multiplexers and demultiplexers. Digital to analog and analog to digital converters.
Semi-conductor memories: Random and sequential access memories. RAM, ROM, PROM, EPROM.EEPROM, EAPROM, EPLA, GALs. MOS and CMOS memories

EEE 255 A Measurements & Instruments - II (EEE)

2L, 1T, 2P 3 Hours, 50 Marks

Potentiometer : Theory of operation, constructional details and use of a.c. potentiometer.
Instrument Transformers : Theory and constructional details of current and potential transformers, Ratio and phase angle errors and methods of minimizing them. Classification and rating, absolute and comparison methods of testing, uses.

Magnetic Measurement : Determination of B-H curve and hysteresis loop of ring and bar specimens, Measurement and separation of iron loss, Epstein Lioyd Fisher Squares.
Electrical Instruments : Transistor voltmeters TVM digital voltmeters Ramp type and integrating type, wave analysers – Resonant & Heterodyne type. Measurement of the time, phase and frequency using digital counters.
Theory of Errors : Accuracy and precision systematic and random errors, limits of error, probable error and standard deviation Gaussian error curves, combination of errors.

EEE – 256 A Electricals Circuit theory (EEE)

2L, 1T, 2P 3 Hours, 50 Marks

Time Domain Analysis : Transient and steady state solution of differential equations of RLC networks. Effect of initial conditions and time constants, damped and undemped oscillations.
Non- Sinusoidal Waveforms : Fourier series expansion of periodic functions, summertry conditions, Exponential form of Fourier series Equivalent voltage, current and power, analysis of simple circuits with non sinusoidal excitation, concept of power factor.
Fourier Integral and Continuous Spectra : Fourier integral and analysis of a recurring pulse, properties of the Fourier transform, Convolution, Analysis of circuits using Fourier Transform.
Polyphase Circuits : Analysis of three phase three wire and three phase four wire balanced and unbalanced circuits with symmetrical supply, Individual phase power factor and overall power factor, Blondel's theorem, Measurement of active and reactive power in three phase balanced and unbalanced systems.

Ma 261 A Special Mathematics (C,ChE,,CSE,E,EC,ECC,EEE,M,Mi&PI)

(Common for Diploma passed candidates of all branches)

Statics: Composition and resolution of coplanar forces Moments. Equilibrium of coplanar forces acting at a point, Equilibrium of three forces acting on a rigid body. Resultant and equilibrium of coplanar forces acting on a rigid body friction. Common catenary.
Dynamics: Composition and resolution of velocities and accelerations. Relative velocity. Rectilinear motion, linear constant acceleration. Vertical motion under gravity. Rectilinear motion under variable law offers and also in resisting medium. Kinematics of uniplaner motion

III BE Examination V Semester

EEE 301 A Control system (EEE)

2L, IT 3 Hours, 50 Marks

Mathematical models: Representation of simple physical open – loop and closed up loop system: electrical analog block diagrams, block diagram reduction techniques; Signal flow diagram; Masson's gain formula.

Control Systems components: Error detectors, potentiometers synchros; servo amplifiers d.c. and a.c. motors.

Time Domain Analysis: Characteristics equations, response to step, ramp and parabolic inputs, Transient response specifications, effects of derivative and integral control, steady errors and error coefficients, generalized error series.

Frequency domain analysis: Bode and polar plots, frequency domain specification, Correlation between transient response and frequency response.

Stability Analysis : Routh Hurwitz and Nyquist criteria of stability gain and phase margins constant M and N circles; Nichols; charts and its applications.

Root- Iocus Techniques: Nature of Root – Locus diagrams, rules of construction, root – locus analysis of control systems.

EEE 302 A Alternating Current machine- I (EEE)

2L, 1T 3 Hours, 50 Marks

Transformers: Types of cross, windings and insulation, transformer oil cooling methods, bushes and accessories. Equivalent circuit, phasor diagrams, regulation; open circuit, polarity and back – to – back tests. Efficiency. Condition for maximum efficiency and all day efficiency. Separation of losses, standard connections for three – phase operation, magnetizing current and harmonics, tertiary winding, parallel operation. Scot connection. Autotransformer, off – load and on – load tap changers.

Three phase induction motors: Constructional features, Torque production, slip equivalent circuit, phasor diagram, circle diagram, No- load and blocked rotor tests, Calculation of performance. Torque slip characteristics speed control, starting and braking. Induction generator, induction regulators single and three phase.

Single Phase Induction Motors: Double revolving field theory, Methods of starting, equivalent circuit, calculation of performance.

EEE 303 A Electrical Power Transmission & Distribution (EEE)

2L, 1T 3 Hours, 50 Marks

Supply systems: Feeders distributors and service main. Systems of transmission. Elementary idea of high voltage d.c. Transmission. Effect of systems voltage on size of conductor, transmission voltage . Calculation for a.c. single phase and three phase feeders and distributors.

Insulators : Pin shackle, suspension and strain insulators voltage distribution over an insulators string. Grading and methods of improving string efficiency pollution flashover Bushing and station insulators.

Mechanical Features of overhead Lines: Different types of conductor materials with special reference to their mechanical properties. Line support, cross – arms and stays. Spacing and arrangements of conductors. Conductor vibration and its prevention, sag – tension calculations for various conditions. Sag templets Conductor and stringing.

Parameters of Transmission Lines: Resistance, inductance and capacitance of overhead lines. Effect of earth, Lines transposition. Geometric mean radius and distance. Inductance and capacitance of double circuit lines on the same tower, skin and proximity effects. Bundled conductors.
Performance of Transmissions Lines: Resistance inductance of short, medium and long lines. Generalized ABCD line Constants, Ferranti effect. Interference with communication circuits.
Corona: Electric stress between parallel conductors. Disruptive critical voltage and visual critical calculation for three phase overhead line, corona power loss effect of corona. Underground Cables; Conductor, insulation, sheathing and armouring material. Types of cables Insulation resistance and capacitance calculation. Reduction of maximum stresses, causes of break down. Oil filled and gas filled cables. Thermal ratings of cables, Localization of cable faults by bridge and search coil methods.

EEE 304 A Analog Communication Engineering (EEE)

2L, 1T 3 Hours 50 Marks.

Amplitude Modulation : Analysis of standard AM waves and signal power distribution. Different circuits for amplitude modulation and their comparison. Methods of generating DSBSC, SSB and VSB – AM and their characteristics. Envelope and coherent demodulation methods for standard AM. DSBSC, SSB signals. Design considerations of AM modulators and demodulators. Frequency Division Multiplexing.
Angle modulation : Theory of frequency and phase modulations. Spectrum and BW of FM and PM signals. Direct and indirect methods of generating narrow – band and wide band FM. Discriminators and PLL demodulators for FM and PM. Pre-emphasis and de – emphasis. Idea of noise suppression properties of FM and PM systems.

EEE 305 A Radiation & Wave Propagation (EEE)

2L, 1T 3 Hours, 50 Marks

Transmission Lines : Type of transmission lines, General transmission line equations. Line constants and equivalent circuits. Infinite line, Lines with reflections. SWR Lines dissipationless lines. Cable circuits and composite lines.
Coaxial cables: Transmission lines at audio and radio frequencies. Losses in transmission lines. Transmission equalizers. Characteristics of quarter wave, half wave and other lengths. Smith chart and its applications. Transmission line applications. Stub matching.
Radio Wave Propagation : Mechanism of radio wave propagation. Reflection, refraction interference and diffraction of radio waves. Theory of ground wave, space wave and sky wave propagation. Effect of conductivity, dielectric constant, curvature and surface imperfections of earth on wave propagation, Duct propagation and tropospheric scattering. Characteristics of ionosphere and its effects on wave propagation, Critical frequency, skipzone and maximum usable frequency. Multiple hop transmission, oblique and vertical incidence transmission. Effect of earth's magnetic field, solar activity and meteorological conditions on wave propagations.

EEE 306 A Computer organization (EEE)

2L, 1T 3 Hours, 50 Marks

Elements of Computer Organization

Evolution of Computers : Generations of Computers, modeling of Computers at Gates, Registers and Processors level.

CPU Architecture : Fixed and floating point arithmetic and ALU organization. Instruction format, types, sequencing and interpretation. Instruction fetch and execute cycles. Addressing techniques. Hardwired and Micro – programmed control.

Secondary Memories : Magnetic memories core, tape, disk and floppy disc, introduction to magnetic bubble and CCD memories.

I/O Devices : Principle and construction of Keyboard, Mouse, digitizer, joystick, optical scanner, Resistive membrane touch screen, Tele-typewriter, CRT Terminals, TFT monitors, Line Dot Matrix, Daisy Wheel, Ink Jet and Laser printers.

Communication of I/O with CPU and memory : Speed mismatch of I/O v/s memory and CPU. Communication methods for I/O to CPU and Memory : Polling, interrupt, DMA and I/O channel.

BE III Examination VI Semester

EEE 351 A Alternating Current Machines - II (EEE)

2L, 1T 3 Hours, 50 Marks

Synchronous Machines: Constructional features armature winding and winding factors. Cooling of alternators. Theory of cyclindrical rotor machine. Saturation effect, phasor diagram. Regulation by Synchronous impedance, MMF, AIEE and A.S.A. methods and their relative comparison. Theory of salient pole machines, Blondel's two – reaction theory. Doherty – Nickel modification, phasor diagram. Direct and quadrature axis reactances transient, sub – transient and sequence reactances and their determination, parallel operation of alternators Synchronizing operation on infinite bus, synchronizing power, power angle characteristics, reluctance torque and stability of salient pole and cylindrical rotor machine.

Synchronous Motors: Starting, performance and phasor diagram, Calculation of torque and stiffness coefficient, V- curve and power circle diagram, Hunting and damping Synchronous induction Motor;

EEE 352 A Modern Control Systems (EEE)

2L, 1T 3 Hours, 50 Marks

State Variable Characterization: System representation in state variable form, phase variables, comonical variables, physical variable: Matrix representation of state equations.

Relationship between state equation and transfer function: Characteristic equation, eigen values and eigen vectors, stranfomration of phase variables, state transition matrix, its significance and methods of determination. Stability analysis using Liapunov's Methods.

Sampled Data Systems: Importance of sampling in control systems; mathematical analysis of the sampling process in frequency domain. Reconstruction of sampled signals using Hold circuits.

Z – Transform : Transfer function in terms of the z – transform, inverse z – transform, state variable representation of sampled data systems; phase variable physical variable and canonical variable forms; solution of discrete state equation; state transition matrix state diagrams, stability analysis using bilinear transformation.

EEE 353 A Electrical Power switch Gear and Protection Transmission & Distribution (EEE)

3L, 1T 3 Hours, 75 Marks

Power Station Layout : Single and sectionalized busbar system, Duplicate busbar system and tie- bar reactors, switches, insulators and fuses.

Power system faults: Tapes of faults, concept of per unit quantities, Analysis of symmetrical faults. Calculation of current limiting reactors there construction Location and uses.

Symmetrical components of unsymmetrical phasor; sequence impedance and sequence networks, solution of unsymmetrical fault problem in power systems. Measurement of sequence components of current and voltage.

Circuit Breakers: Principles of arc interruption, low and high resistance interruptions. Theories of arc interruption, recovery rate theory and energy balance theory. Inductive and capacitive current interruption, current chopping, resistance switching. Recovery voltage, re-striking voltage and rate of re-striking voltage and factors affecting them. Types of circuit breakers. Various types of oil and air blast circuit breakers, vacuum ad SF circuit breakers. High speed reclosing Rating of circuit breakers and determination of breaking current, making current and recovery voltage. Testing of circuit breakers.

System Protection; Relays Basic requirement of protective relaying, primary and back –up protection.

Types of electromagnetic relays, their construction and operating characteristics.

Line Protection: Differential pilot wire systems. Time graded directional over current and earth fault protection. Elements of distance protection and power line carrier protection.

Bus Protection : Frame Leakage and circulating current protection.

Generator Protection : Field failure, field earth fault, over current, phase unbalance and insulation protection : Differential and restricted earth fault schemes. Protection against prime mover failure.

Transformer Protection: Over current, earth fault frame leakage and differential protection. Buchholz relay. Differential scheme for the protection of generator transformer units.

EEE 354 A Digital Communication System (EEE)

3L, 1T 3 Hours, 75 Marks

Random Signals: Power and energy signals. Introduction to probabilistic and statistical description of discrete and continuous communication processes. Marginal, conditional and joint probability density and density and distribution functions. Stationarity and ergodicity. Auto correlation and Cross correlation functions, Energy spectral density and Power spectral density. Simple linear system analysis under random excitation in time and frequency domains.

Digital Communication : Comparison of analog and digital communication systems. Essentials of PCM linear delta and adaptive delta modulation. Study of components of complete digital communication system. Multiplexing, Introduction to bit, word and frame synchronization to matched filter detection.

Noise : Various noise sources in amplifier and communication systems, Comparison of various electronic devices for noise performance, Signal to noise ratio and noise figure. Equivalent noise bandwidth. Noise temperature, Effect of cascading, statistical properties of noise Representation of white and band pass noise in communication systems.

System Performance: Noise – performance of analog CW and pulse modulation systems using coherent and non – coherent .

Baseband PCM and delta modulation systems, performance in terms of probability of error and S/N ratio. Probability of error performance of band pass ASK, FSK BPSK, and simple QAM systems.

EEE 355 A Microprocessor & Microcomputer (EEE)

2L, 1T 3 Hours, 50 Marks

Microprocessor Architecture: Architecture of 8 – bit 8085, Z80, 6800 microprocessors; their instruction sets and addressing modes. Assembly language programming of Intel's 8085 Microprocessor. Introduction to assemblers.
Microprocessor Interfacing : Interfacing of address; data and control buses Memory and I/O devices, Interrupt and DMA for 8085 microprocessor.
Introduction of Micro controllers : Architecture and instruction set of MCS – 51 series of micro controllers. Application of Micro controllers.
16 and 32 – bit Microprocessors: CPU architecture addressing modes and feature of 16 and 32 bit microprocessor – 8086. Salient features of 80286, 80386, 80486 and Pentium series microprocessors.
Bus standards: Introduction to multi bus VME, RS – 232-C, IEEE 488, PCI, USB, RS 422 and 485.

EEE 356 A Radiation & Wave Propagation –II (EEE)

2L, 1T 3 Hours, 50 Marks

Radiation : Retarded potentials and concept of electromagnetic radiation. Alternating current element and power radiated, radiation resistance. Radiation from dipole and monopole antennas.
Antennas: Quarter wave and half wave antennas. Application of network theorems to antennas. Resonant and non-resonant antennas. Radiation resistance, J. Impedance, mutual impedance and directional characteristics of antennas. Antennas patterns. Effective length and effective area of antennas , Antennas gain efficiency, beam width and polarization. Antenna temperature. Loaded antennas. Colinear, broad-side, end fire and combination arrays and computation of their radiation patterns. Multiplication of radiation patterns. Binomials array, Yagi, Rhombic, log periodic antennas and Baluns, Receiving antennas. Antenna systems for diversity reception. Elements of design considerations for medium wave and short wave antennas.

BE IV Examination VII Semester

EEE 401A: Power Electronics (EEE)

3L, 1T 3 Hours, 50 Marks

Converters: Two transistors model, characteristics of SCR, Single phase and polyphase uncontrolled and controlled rectifiers, Dual Converters.

AC voltage regulators: On off and phase angle control, single – phase bi- directional controller for neutral connected and neutral not connected resistive load.

DC. Chopper: Thyristor turn – off methods in dc circuits (various classed), single quadrat two quadrant and four quadrant choppers, steps up choppers, Thyristor commutation in choppers, voltage current and load communication, multiphase choppers.

Inverters: Voltage Source inverters: Single phase half bridge and full bridge inverter with auxiliary commutation and with complementary commutation, three phase inverter with 120° and 180° mode.

Current source Investors: Single phase and capacitor commutated, CSI with resistive load, Single phase and three phase auto sequential commutated inverter, single phase Thyristor series inverter, parallel or push –pull inverters.

Cycloconverters: step down cycloconverters: Single phase to single phase, three phase to single phase and three phase to three phase cycloconverters, non circulating current and circulating current mode, idea of step up cycloconverters.

EEE 402 A Control System Design (EEE)

3L, 1T 3 Hours, 50 Marks

Introduction to compensation and type of Compensation, phase log, phase lead, phase – lag – lead compensation. Design in frequency domain and time domain realization of compensators using passive components.

Concept of observability & controllability, principle of duality.

Design of Controllers in state – space approach state feedback, output feedback, Concept of pole placement, design of PID Controller, Deadbeat control.

Computer controlled system, basic idea of Direct & distributed control systems.

EEE 403 A Advance Communication systems (EEE)

3L, 1T 3 Hours, 50 Marks

Line – of Sight and Troposcatter Communication: Principle of working and essential features of microwave LOS and troposcatter communication Propagation study and performance requirements. Diversity techniques.

Satellite communications: Basic considerations. Up – link and down link parameters. Orbit and frequency selection. Transmission losses, noise and interference. Elements of multiple access techniques. Frequency reuse techniques. Functional description of earth stations.

Optical Communications: Ray propagation in optical fibers. Types of fibers. Losses and dispersion in fibers. Transmitter and receiver subsystem for optical communications. Laser and LED sources. Optical amplifier. Cable joints couplers and connectors. Splicing techniques. Modulation techniques. PIN and avalanche photo diode detectors. Characteristics of analog and digital transmission in optical communication systems. Noise considerations.

EEE – 404 A Advance Computer Technology (EEE)

3L, 1T 3 Hours, 50 Marks

Computer Architecture: Microprogrammed control organization, CPU – memory speed mismatch and solutions, Word- length, caches and buffers. Speeding up instruction cycle, instruction fetch and decode overlaps.
Parallelism in execution : Instruction pipe- line and vector processing concepts. Introduction to Array processors.
Memory Organisation : Memory hierarchy. Associative memory, cache memory, paging and segmentation.
Advanced Systems: Organization of parallel processing, multiprocessing multiprogramming, distributed processing and time sharing systems.
Software : Introductory theory of Compilers, Interpreters and operating systems.

EEE 405 A Engineering management and Economics (EEE)

3L 3 Hours, 50 Marks

Principle and Techniques of Management: Management function. Theories of management and their application to Indian condition. Responsibility, authority, leadership, motivation, co-ordination and co-operation, change agent, Importance of organization charts and their application to Electronic Industries.
Financial Management : Objectives, functions and importance of financial management, Book – keeping, journals and ledgers, Balance sheet, profit and loss accounts, fund flows and financial ratios. Sources of finance and Financial Institutions. Interest and depreciation. Salvage value.
Marketing Management : Concept of Marketing and its various components.
Stores and Purchase Management : Function of store and Purchase management. Economic order quantity. A-B-C analysis. Inventory control and management. Purchase procedure in Government , Public and Private undertakings, Floating of tenders and Contracts.
Forms of Business : Proprietorship, partnership, joint stock companies joint sectors and co-operative movements.
Cost Accountancy : Various types of costs, profit/ volume ratio, Break even analysis and marginal costing.
Production planning and control : Job Batch and mass production, production efficiency, productivity. Site selection. Production planning Routing, scheduling and follow up. Elements of time and motion study. Quality control and quality assurance.
Nature and Scope of Economics: Basic concept of managerial economics. Supply and demand, free competition, monopoly and oligopoly.

BE IV Examination VIII Semester

EEE 451 A Digital Signal Processing (EEE)

3L, 1T 3 Hours, 50 Marks

Digital Signal Processing : Advantage of digital filters and processing. Fundamentals of discrete time systems. Fourier transform of sequences. Discrete – time filter structures. Z – Transform system representation solution of linear constant co- efficient difference equations. Digital filters design by transformation from analog filters. Simple realization of IIR and FIR filters DFT and FFT.

EEE 452 A Computer Communication and Data Networks (EEE)

2L, 1T 3 Hours, 50 Marks

Computer communication: Layered Architecture of computer communication networks. DNA, SNA and ISO- OSI models. Properties of LANs, MANs, and WANs. Physical level, data link and transport protocols. Multiple access protocol organization. Routing techniques flow and congestion control in packet switched networks. Window scheme. Network interconnection – bridges and routers. Dead Lock avoidance. Elements of queuing analysis. Introduction to network security.

Data Networks: Structure and functions of network protocols. Data link control procedures. Operation of HDLC, SDLC, BISY NC, X.25 and x.21 Protocols Elements of Polling ALOHA, Reservation ALOHA, CSMA and token ring. Characteristic features of LANs.

Basics of Internet: Evolution; dialup, XDSL, ADSL, cable modem and other access methods. IP address and domain name system, TCP/IP, Internet applications and www.

EEE 453 A Power systems operation and control (EEE)

3L, 1T 3 Hours, 50 Marks

Power system operation: Advantage and disadvantage of power system interconnection, control of current and power interconnection.

Automatic Generation Control: Elements of Loud frequency, control two area control, flat frequency, flat tie line bias controls, capability chart, sending end and receiving end power circle diagrams. Maximum power limits.

Power System stability : Meaning of power system stability, stability limits, infinite bus, power angle curve, steady state and transient stability, Inertia constant, swing equation (Solution not to be done) equal area criteria of stability, factors affecting stability methods of improving stability.

Power System Electronics : Input – output curves, incremental rate curves, effect of operating conditions, for minimum input in single and multi-fed systems. Transmission loss formula.

HVDC Transmission: Introduction to HVDC transmission, type of DC links, advantages and limitations of HVDC transmission, converter station equipments.

Voltage Surges: Causes of high voltage surges. Typical voltage surge wave from. Surge velocity surge impedance. Wave reflection and refraction. Over voltage protection. Use of overhead earth wire and lighting arrestors. Elements of insulation co-ordination.

EEE 454 A Electrical Machine Design (EEE)

3L, 1T 3 Hours, 50 Marks

General : Factors and limitations in design, output coefficient and other factors, emf equation; classification of magnetic circuit, materials and allowable flux densities. Calculation of magnetic circuits, magnetizing current design of coils for given ampere-turns, field forms.
Armature winding: General features of armature windings, single layer, double layer winding, integral and fractional slot winding factors, Harmonies and eddy current losses in conductors.
Heating, cooling and ventilation: Heat dissipation, heat flow, heating and cooling curves, heating cooling cycles, estimation of maximum temperature rise, cooling media, quantity of cooling media, types of enclosures, Ratings, Heat dissipation from transformers.
Design of Transformers : General consideration output equation; output equation, emf per turn , Choice of flux density and current density, Main dimensions and conductor size, window, yoke and overall dimensions.
Design of induction motors: General considerations. Output equation, choice of specific electric and magnetic loadings, efficiency, power factors, selection of frame size, selection of number of stator slots, squirrel cage rotor bars.
Design of Synchronous Machines: General considerations, Output equation choice of specific electric and magnetic loadings election of frame size, selection of number of slots and air gap length.

EEE 455 A Microwave Engineering (EEE)

3L, 1T 3 Hours, 50 Marks

Wave Guides : Theory of wave propagation in rectangular wave guides, cut off frequency. Dominant and higher modes. Generation of different modes and suppression of unwanted modes. Field distribution. SWR and impedance relations in wave guides. Coupling between coaxial lines and wave guides. Wave guide stub-matching.
Resonators: Theory and application of cavity resonators. Coupling to cavity, Q of cavity resonators.
Microwave Components: Attenuators, phase shifters, directional couplers, tees, isolators, circulators, tunings screws, coupling probe, loops, mixers and detectors. Use of scattering parameters.
Microwave Generators and Amplifiers: Theory of velocity modulation. Theory of operation and characteristics of two cavity and multicavity klystron, amplifier and oscillators. Reflex klystron O and M type travelling wave tube and backward wave oscillators – principle of operation . Construction, type and application of Magnetrons.
Microwave Solid State Devices: Special considerations for UHF and microwave transistors and oscillators. Parametric amplifiers. Manley-Rowe relation linearized equations. Parametric up converters. Negative resistance amplifiers. Principle of working and application of impact

diode, hot carrier diode, PIN diode, Gunn diode and LSA diode Quantum mechanical explanation, description and application of MASER amplifiers.

EEE 456 Telematics (EEE)

3L, 1T 3 Hours, 50 Marks

Digital Telephony : Principle of working of SPC digital telephone exchanges. Digital switching, space, time. TS, ST, STS, TST switch blocks. Termination of subscriber lines Signalling systems with digital exchanges. Principle of common channel signalling. Synchronization aspect for digital telephony. Store Program Control for call processing.

Integrated Digital Networks: Data Communication terminology. Introduction to Circuits, message and packet switching concept. Basic aspects of multiplexing, signaling and synchronization in integrated digital networks. Overview of ISDN and BISDN. Concepts of basic rate and primary rate ISDN. Access and facilities provisions. Elements of fast packet switching, frame relay, ATM, SONET and SDH. Introduction to photonic switching.

EEE 457 Mobile Communication Engineering (EEE)

3L, 1T 3 Hours, 50 Marks

Basic technical concepts: Concept of mobile telecommunications. Mobile radio network issues, cell size coding, modulation and diversity Base station subsystems. Access methods. Location strategies for personal communications services. Cell design principles.

Radio Paging System: Types of radio paging system. On site and wide area paging digital codes like POCSAG, elements of radio paging system engineering.

Microcellular radio communication: Fixed and dynamic channel assignment. Cellular systems and power control basic features and system architecture in cordless telephones. Marine and aircraft communication. Overview of mobile terrestrial communication by satellite.

Cellular Radio System: Allocation of spectrum and channels, Concepts of hexagon cells, mobile identification system and registration of mobile, call procedure and measurement of signal strength, GSM and CDMA radio system architecture, roaming, digital speech and channel coding. Efficient use of radio spectrum, multi operator working, cells and frequency reuse.

EEE 458 Medical Electronics (EEE)

3L, 1T 3 Hours, 50 Marks

Introduction to Physiology : Physiological system of the human body. Nerve physiology. Function of nerves and myoneural junction. Cardiac muscle and its contractions. Blood flow system. Arterial pressure Mechanism of respiration, Function of Spinal cord. Generation, Propagation and distribution of action potentials.

Recording of Bio- Electric Events : Kinds of electrodes, amplifiers and display units for recording bioelectric potentials. Principles of ECG, EEG, and EMG. Electrophysiological signals from a micro electrode and salt bridge, Use of field effect – devices as electrometers. Principle of driven shield. Use of photon – coupled amplifiers. Artifacts.

Bio – Medical Measurement : Electronic methods of measuring blood pressure, blood flow, blood pH, skin and systemic body temperature and pulse rate.

Electronic Medical Instrument : Electronic pace makers. Implantable power sources. Defibrillators. Micro power transmitter for telemetering bio – signal. Surgical and therapeutic diathermy units. Physiological stimulators Basic diagnostic X – ray units. Introduction to patient monitoring and intensive care units.

EEE 459 High Voltage Engineering (EEE)

3L, 1T 3 Hours, 50 Marks

Breakdown in gases : Mechanisms of breakdown in gases, various related ionization process. Towns – ends and streamer theories. Paschen's law, Breakdown in Non – uniform fields. Effect of wave shape of impressed voltages on the breakdown of sphere gap and rod gap.

Breakdown in Liquids and Solids: Mechanisms of breakdown in liquids suspended particle, suspended water cavitations and bubble and electronic breakdown theories. Mechanisms of breakdown in solids, intrinsic electromechanical, erosion, surface, thermal and streamer, relation between electronic strength of solids and time intrinsic breakdown strength.

Impluse Generator: Specification of an impulse voltage, wave, standard impulse, reasons for adopting the particular shape, Analysis and control of simple circuit of impulse generator. Multistage impulse generator (Marx Circuit) circuit working, earthing and triping, Techniques to observe wave front on CRO.

Generation of High Voltage: Methods of generation of power frequency high voltage cascade transformers and resonance and methods, generation of high voltage d.c. voltage stabilization. Telsa coil.

Measurement of High Voltage: Potential dividers – resistive capacity and mixed dividers of high voltage. Sphere gap, construction, mounting effect of nearby earthed objects humidity and atmospheric conditions. Effect of irradiation and polarity. Electrostatic voltmeter. Principle and classification, constructional details of an absolute electrostatic voltmeter Oscilloscopes and their application in high voltage measurement.

High Voltage Testing: Measurement of insulation resistance of cables. Wet and dry flashover test of insulators in simulated polluted conditions. Testing of transformers and rotating machines, measurement of breakdown strength of oil. Basic technique of nondestructive testing of insulators measurement of loss angle and partial discharge measurement techniques.

EEE 460A Electric Traction Engineering (EEE)

3L, 1T 3 Hours, 50 Marks

Train movement and performance : Speed – time curve, its analysis and construction. Schedule speed and factors affecting it. Train resistance and is components. Tractive3e efforts calculations. Average acceleration and speed, energy output and consumption.

Power Transmission and Weight Transference: Methods of transmission of power from motor to wheels, Idea about riding qualities of an electric locomotive, Grouping of motors and weight transference. Adhesive weight, Factors affecting slip.

Traction Motors: Performance of (i) d.c. motors (ii) a.c. single phase series motors at low frequencies and at commercial frequency and (iii) polyphase induction motors, under traction service conditions, Specific problems and methods of overcoming them, Special features of construction. Effect of differences in driving wheel diameters and speed time – curves on division of load. Traction motor rating speed factor. Track and overhead equipment.

Power supply of traction : overhead and conductor rail systems. Third rail construction. Bonding of conductor and track – rails. Overhead construction for trolley. Buses and railways, centenary construction.

Temperature effects, current collectors. Outlines of feeding and distributing systems for d.c. low frequency a.c. and commercial frequency a.c. traction Voltage drop control, Electrolytic and inductive coordination. Power leading curves Positions of Sub- stations and load sharing.

Breaking of Electrified Railways : Mechanical versus electric breaking, Theostatic breaking, regenerative breaking, methods and energy saving in the process, magnetic track brakes.

Tractional Control: Study cycle, Methods of traction motor control, series - parallel and other types of controllers, Use of inter locks, Runback prevents Multiple unit control. Master controllers, Reversers, Dead man's handle, use of metadyne and magnavolt diesel – electric and Gas turbo – electric traction: Generator and motor rating and characteristics of diesel – electric loco – motives, Speed acceleration and braking introduction to gas turbo – electric and straight electric traction. Train lighting and Signalling: Dynamo fortrain light, Lighting systems of Indian Railway, Introduction to electric signaling methods manual and automatic.

Systems of Electric Traction : Comparison between various systems, expected trends, Position of single phase commercial frequency Traction. Linear induction motor, possibility for traction purpose.