

**III Year – I SEMESTER**

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**ELECTRICAL MEASUREMENTS****Preamble:**

This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

**Learning Objectives:**

- To study the principle of operation and working of different types of instruments. Measurement of voltage and current.
- To study the working principle of operation of different types of instruments for measurement of power and energy.
- To understand the principle of operation and working of dc and ac potentiometers.
- To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
- To study the principle of operation and working of various types of magnetic measuring instruments.
- To study the applications of CRO for measurement of frequency, phase difference and hysteresis loop using Lissajous patterns.

**UNIT-I:****Measuring Instruments**

Classification – Deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type, dynamometer and electrostatic instruments – Expression for the deflecting torque and control torque – Errors and compensations– Extension of range using shunts and series resistance – CT and PT: Ratio and phase angle errors – Design considerations.

**UNIT –II:****Measurement of Power and Energy**

Single phase and three phase dynamometer wattmeter – LPF and UPF – Expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems – Type of P.F. Meters – Single phase and three phase dynamometer and moving iron type Single phase induction type energy meter – Driving and braking.

torques – errors and compensations –Testing by phantom loading using R.S.S. meter– Three phase energy meter – Tri vector meter – Maximum demand meters– Electrical resonance type frequency meter and Weston type synchroscope.

**UNIT – III:****Potentiometers**

Principle and operation of D.C. Crompton's potentiometer – Standardization – Measurement of unknown resistance – Current – Voltage – AC Potentiometers: polar and coordinate types –Standardization – Applications.

**UNIT – IV:****Measurements of Parameters**

Method of measuring low, medium and high resistance – Sensitivity of Wheat stone's bridge – Carey Foster's bridge– Kelvin's double bridge for measuring low resistance– Loss of charge method for measurement of high resistance – Megger– Measurement of earth resistance – Measurement of inductance – Quality Factor – Maxwell's bridge–Hay's bridge – Anderson's bridge–Measurement of capacitance and loss angle – Desautybridge – Schering Bridge–Wagner's earthing device–Wien's bridge.

**UNIT – V:****Magnetic Measurements**

Ballistic galvanometer – Equation of motion – Flux meter – Constructional details–Determination of B–H Loop methods of reversals six point method – AC testing – Iron loss of bar samples– Core loss measurements by bridges and potentiometers.

**UNIT – VI:****Digital Meters**

Digital Voltmeter–Successive approximation – Measurement of phase difference – Frequency – Hysteresis loop using lissajious patterns in CRO –

Ramp and integrating type–Digital frequency meter–Digital multimeter–Digital Tachometer.

**Learning Outcomes:**

- Able to choose right type of instrument for measurement of voltage and current for ac and dc.
- Able to choose right type of instrument for measurement of power and energy – able to calibrate energy meter by suitable method
- Able to calibrate ammeter and potentiometer.
- Able to select suitable bridge for measurement of electrical parameters
- Able to use the ballistic galvanometer and flux meter for magnetic measuring instruments
- Able to measure frequency and phase difference between signals using CRO. Able to use digital instruments in electrical measurements.

**Text Books:**

1. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C.Widdis, fifth Edition, Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput, S.Chand

**Reference Books:**

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications.
2. Electrical Measurements – by Buckingham and Price, Prentice – Hall
3. Electrical Measurements by Forest K. Harris. John Wiley and Sons
4. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, Publishers.
5. Electrical and Electronic Measurements –by G.K.Banerjee, PHI Learning Private Ltd., New Delhi–2012.

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**POWER SYSTEMS–II****Preamble:**

This course is an extension of power systems–I course. It deals with basic theory of transmission lines modeling and their performance analysis. Transient in power system, improvement of power factor and voltage control are discussed in detail. It is important for the student to understand the mechanical design aspects of transmission lines, cables, insulators. These aspects are also covered in detail in this course.

**Learning Objectives:**

- To compute inductance and capacitance of transmission lines and to understand the concepts of GMD, GMR.
- To study short and medium length transmission lines, their models and performance computation.
- To study the performance and modeling of long transmission lines.
- To study the transient on transmission lines.
- To study the factors affecting the performance of transmission lines and power factor improvement methods.
- To discuss sag and tension computation of transmission lines as well as to study the over head insulators.

**UNIT–I:****Transmission Line Parameters**

Types of conductors – Calculation of resistance for solid conductors – Calculation of inductance for single phase and three phase– Single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition– Numerical Problems–Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and three phase–Single and double circuit lines–Numerical Problems.

**UNIT–II:****Performance of Short and Medium Length Transmission Lines**

Classification of Transmission Lines – Short, medium, long line and their model representations –Nominal-T–Nominal-Pie and A, B, C, D Constants

for symmetrical and Asymmetrical Networks– Numerical Problems– Mathematical Solutions to estimate regulation and efficiency of all types of lines – Numerical Problems.

### **UNIT–III:**

#### **Performance of Long Transmission Lines**

Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants–Interpretation of the Long Line Equations – Incident, Reflected and Refracted Waves –Surge Impedance and SIL of Long Lines–Wave Length and Velocity of Propagation of Waves – Representation of Long Lines – Equivalent-T and Equivalent Pie network models (Numerical Problems).

### **UNIT – IV:**

#### **Power System Transients**

Types of System Transients – Travelling or Propagation of Surges – Attenuation–Distortion – Reflection and Refraction Coefficients – Termination of lines with different types of conditions – Open Circuited Line–Short Circuited Line – T-Junction– Lumped Reactive Junctions (Numerical Problems).

### **UNIT–V:**

#### **Various Factors Governing the Performance of Transmission line**

Skin and Proximity effects – Description and effect on Resistance of Solid Conductors –Ferranti effect – Charging Current – Effect on Regulation of the Transmission Line–Shunt Compensation –Corona – Description of the phenomenon–Factors affecting corona–Critical voltages and power loss – Radio Interference –Power factor improvement methods.

### **UNIT–VI:**

#### **Sag and Tension Calculations and Overhead Line Insulators**

Sag and Tension calculations with equal and unequal heights of towers– Effect of Wind and Ice on weight of Conductor–Numerical Problems – Stringing chart and sag template and its applications–Types of Insulators – String efficiency and Methods for improvement–Numerical Problems – Voltage distribution–Calculation of string efficiency–Capacitance grading and Static Shielding.

#### **Learning Outcomes:**

- Able to understand parameters of various types of transmission lines for using calculation and behavior during different operating conditions.

- Able to understand the insight into specific transmission lines short and medium type which would have application in medium and high voltage power transmission systems.
- Student will be able to understand the surge propagation, reflection and refraction in transmission lines. such output will be useful in protecting transmission line insulators and designing level of insulation coordination at various high voltages.
- Will be able to utilize it for understanding the surge behaviour of transmission line for protection of connects equipments, viz. power transformer and system connected shunt reactors.
- Will be able to understand various phenomenon related to charged line transmitting different level of power.
- Will be able to understand physical and geometrical parameters of transmission line for safe and efficient performance during operating condition of voltage and power.

**Text Books:**

1. Electrical power systems – by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1998.
2. Modern Power System Analysis by I.J. Nagarith and D.P.Kothari, Tata Mc Graw Hill, 2<sup>nd</sup> Edition.
3. Electrical Power Systems by P.S.R. Murthy, B.S. Publications.

**Reference Books:**

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4<sup>th</sup> edition
2. Power System Analysis and Design by B.R. Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S. Bhatnagar A .Chakrabarthy, DhanpatRai& Co Pvt. Ltd.

**III Year – I SEMESTER****T P C**  
**3+1 0 3****ELECTRICAL MACHINES – III****Preamble:**

This course essentially covers ac machines. It covers topics related to principle of operation, constructional features and starting of single phase induction motors and three phase synchronous motors. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

**Learning Objectives:**

- To study the application of “Double revolving field” theory for single – phase induction motor and appreciate the function and application of a.c series motor.
- To discuss e.m.f generation principle of synchronous generator and armature reaction effect.
- To study the effect of load at different power factors, methods of predetermination of regulation for non– salient and salient pole generators.
- To study the parallel operation and the concepts of transfer of real and reactive powers.
- To understand the operation and performance of synchronous motor.
- To study the power circle diagrams and methods of starting of synchronous motor.

**UNIT – I:****Single Phase Motors**

Single phase induction motors – Constructional features and the problem of starting–Double revolving field theory–AC Series motor–Compensation.

**UNIT-II:****Synchronous generator construction and operation**

Constructional features of non–salient and salient pole type – Armature windings –Distributed and concentrated windings – Distribution– Pitch and winding factors –E.M.F equation–Improvements of waveform and armature reaction– Numerical problems.

**UNIT – III:****Voltage regulation of synchronous generator**

Voltage regulation by synchronous impedance method– MMF method and Potier triangle method–Phasor diagrams– Two reaction analysis of salient pole machines and phasor diagram– Numerical problems.

**UNIT –IV:****Parallel operation of synchronous generators**

Parallel operation with infinite bus and other alternators – Synchronizing power – Load sharing –Transfer of real and reactive power– Numerical problems.

**UNIT–V:****Synchronous motor – operation**

Synchronous Motor principle and theory of operation– Phasor diagram – Starting torque–Variation of current and power factor with excitation – Synchronous condenser – Mathematical analysis for power developed– Numerical problems.

**UNIT – VI:****Synchronous motor performance and starting**

Excitation and power circles – Hunting and its suppression – Methods of starting – Synchronous induction motor.

**Learning outcomes:**

At the end of the course the student should be able to

- Analyze the performance of single phase induction and ac series motors.
- Explain the structure of synchronous machines and design the windings.
- Develop solutions for regulation of both non salient pole and salient pole synchronous generators.
- Explain the role of synchronous generators operation when connected to an infinite bus or when operating in parallel.
- Analyze the performance of synchronous motor for development of torque and power factor correction.
- Explain hunting phenomenon and methods of starting of synchronous motor.



**Text Books:**

1. Electrical Machines – by P.S. Bhimbra, Khanna Publishers.
2. The Performance and Design of AC Machines – by M.G.Say, ELBS and Ptiman & Sons.

**Reference Books:**

1. Electric Machinery – by A.E. Fitzgerald, C. Kingsley and S.Umans- by Mc Graw–Hill Companies, 5<sup>th</sup> edition, 1990.
2. Theory of Alternating Current Machinery by Langsdorf, Tata Mc Graw–Hill, 2<sup>nd</sup> edition.
3. Analysis of Electric Machinery and Drive systems – by Paul C. Krause, Oleg Wasynczuk and Scott D.Sudhoff, wiley publications, 2<sup>nd</sup> edition Publishers.

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**POWER ELECTRONICS****Preamble:**

The usage of power electronics in day to day life has increased in recent years. It is important for student to understand the fundamental principles behind all these converters. This course covers characteristics of semi conductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters. The importance of using pulse width modulated techniques to obtain high quality power supply (dc/ac converter) is also discussed in detail in this course.

**Learning Objectives:**

- To study the characteristics of various power semiconductor derive and analyze the operation of diode bridge rectifier.
- To design firing circuits for SCR. Analyze the operation of AC voltage controller and half-wave phase controlled rectifiers.
- To understand the operation of single phase full-wave converters and analyze harmonics in the input current.
- To study the operation of three phase full-wave converters and dual converter.
- To analyze the operation of single phase cyclo converters and high frequency dc-dc converters.
- To understand the working of inverters and application of PWM techniques for voltage control and harmonic mitigation.

**UNIT-I:****Power Semi Conductor Devices**

Thyristors–Silicon controlled rectifiers (SCR's) –Characteristics of power MOSFET and power IGBT– Basic theory of operation of SCR–Static characteristics– Turn on and turn off methods–Dynamic characteristics of SCR– Snubber circuit design–Numerical problems–Diode bridge rectifier with R-load and capacitive filter–Output voltage and input current waveforms.

**UNIT-II:****Phase Controlled Converters – Single Phase**

Firing circuits for SCR– Line commutation principle– Single phase AC voltage controller with R and RL load–Half wave converters with R, RL and RLE loads– Derivation of average load voltage and current–Effect of freewheeling diode for RL load.

**UNIT-III:****Single Phase Bridge Converter and Harmonic Analysis Fully controlled converters**

Operation with R, RL and RLE loads–Derivation of average voltage and current – Effect of source Inductance.

**Semi Converters (Half Controlled):**

Operation with R, RL and RLE loads – Harmonic analysis for input current waveform in a system with a large load inductance –Calculation of input power factor.

**UNIT-IV:****Three Phase AC–DC Bridge Converters**

Full converter with R and RL loads–Semi converter (Half Controlled) with R and RL loads– Derivation of load voltage–Line commutated Inverter operation–Dual converters with non–circulating and circulating currents.

**UNIT – V:****AC–AC and DC–DC Converters**

Single phase Bridge type cyclo converter with R and RL load (Principle of operation) –High frequency DC–DC converters: Buck Converter operation–Time ratio control and current limit control strategies–Voltage and current waveforms–Derivation of output voltage–Boost converter operation–Voltage and current waveforms–Derivation of output voltage – Buck-Boost converter operation –Voltage and current waveforms.

**UNIT – VI:****DC–AC Inverters****Inverters**

Single phase inverters–Unipolar and bipolar switching–Three phase Inverters ( $120^\circ$  and  $180^\circ$  modes of operation) –PWM techniques– Sine triangular PWM technique– amplitude and frequency modulation Indices –Harmonic analysis.

**Learning Outcomes:**

Student should be able to

- Explain the characteristics of various power semiconductor derive and analyze the operation of diode bridge rectifier.
- Design firing circuits for SCR. Analyze the operation of AC voltage controller and half-wave phase controlled rectifiers.
- Explain the operation of single phase full-wave converters and analyze harmonics in the input current.
- Explain the operation of three phase full-wave converters and dual converter.
- Analyze the operation of single phase cyclo converters and high frequency dc-dc converters.
- Explain the working of inverters and application of PWM techniques for voltage control and harmonic mitigation.

**Text Books:**

1. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
2. Power Electronics: converters, applications & design -by Nedmohan, Tore M. Undeland, Robbins by Wiley India Pvt. Ltd.
3. Power Converter Circuits -by William Shepherd, Li zhang, CRC Taylor & Francis Group.

**Reference Books:**

1. Elements of Power Electronics–Philip T.Krein.oxford.
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics handbook by Muhammad H. Rashid, Elsevier.

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### LINEAR & Digital IC APPLICATIONS

#### Preamble:

All Electronic devices developed in circuit Concepts. Thus all analog circuits developed on circuit Concept basis. But the advancement of Technology in Fabrication Field gain prominence and all discrete components are fabricated using I.C Technology. On a Single chip millions of transistors are fabricated using Very Large Scale IC. In This context Operational Amplifiers which is an analog device plays an important role for Analog IC Design.

Operational Amplifiers performs Algebraic operations, Logarithmic Operations, Trigonometric Operations etc. Therefore these Operational Amplifiers design goes into System design instead of circuit design. So Linear IC applications plays vital role in the electronic field Starting from home appliances to Super computers.

#### Learning Objectives:

After completion of this course, the reader should be able to

- Draw a block diagram representing a typical op-amp with various definitions.
- Draw and explain the open-loop configuration and feedback configuration and can determine Voltage gain, the input resistance, the output resistance.
- Differentiate between Ideal and Non-Ideal Op-Amp, Determination of closed loop voltage gain, the input resistance, the output resistance for Non-Ideal Op-Amp Circuits.
- Perform various mathematical Operations, Trigonometric & Logarithmic Operations, and Instrumentation Amplifier with relevant Circuits.
- Design waveform generators (Astable, Monostable, Schmitt Trigger) using Single Op-Amp.
- Study of 555 timer & its applications using Astable and Monostable Operations.
- Can design various types of Active Filters such as LPF, HPF, BPF, BRF, NBPF, Notch Filter, ALL pass filters.
- Study the operation & applications of PLA.
- Explain the operation of A/D and D/A Converters.

**UNIT-I:****Introduction To Operational Amplifier**

Block diagram of Typical Op-Amp With Various Stages– BJT Differential Amplifier With  $R_E$  DC Analysis– AC Analysis –BJT differential amplifier with constant current source – Analysis Different input/output configurations dual input balanced output–Dual input unbalanced output–Signal input balanced output–Signal input unbalanced output–AC analysis with r-parameters –Current repeater circuits–Current mirror circuits–Analysis–Level translator – Cascade differential amplifier– FET differential amplifier.

**UNIT-II:****OP-AMP Parameter**

Input offset voltage – Input off-set current–Input bias current–Differential input resistance–Common mode rejection ratio–Slew ratio–PSRR–Large signal voltage gain–Output voltage swing transients response–definitions and explanations. Measurement of bias current–Measurement of offset currents–Measurement of offset voltage –Measurement of slew rate – Output offset voltage balancing circuits–Bias current compensations circuit–Dual power suppliers with shunt capacitance filter–Fix voltages Regulators 78XX–79XX series and as current sources– Dual power supply using 78XX and 79XX series.

**UNIT-III****Ideal Operational Amplifier Theory and Basic Circuits**

Ideal operational amplifier properties–Ideal assumptions–Basic circuits such as non inverting type comparator–Inverting type comparator–Voltage follower– Inverting amplifier–Non–inverting amplifier–Summing amplifier–Non–inverting summing amplifier–sub-tractor– Differentiator–Integrator–Scale changer–Instrumentation amplifier– V to I and I to V converters–Log and Anti–log amplifiers–Zero crossing detector–Schmitt-trigger peak detector– Half-wave and full-wave rectifiers– Precision diode– Non-ideal operational amplifier non–inverting amplifier– inverting amplifier– closed-loop gain–Input and output resistance equivalent circuits.

**UNIT-IV:**

**Wave form generator in angular waveform generator using op-amps and PLL** Design of Astable multivibrator –Monostable multivibrator using signal op-amp–Trigging waveform generator 555 timer:Introduction–Pindigram–Functional diagram for 8pin DIP–Design of Astable and monostable multi– Astable applicatio–Monostable applications– PLL: Introduction,basic blockdiagram– Functions of each block–566 VCO– 565 PLL block diagram –Function of each block–Applications of PLL–Frequency

multiplier role of each pin frequency translation– AM–FM and FSK demodulators.

## **UNIT–V:**

### **Active filters**

Introduction– Merits and demerits of active filters–Over passive filters– First order low pass Butter–Worth filter –Design and frequency response–Second order LPF design and frequency response – First order HPF design and frequency response– Second order HPF design and frequency response–Higher-order filters– BPF wide band–pass and narrow band–pass filter–Wide band reject filter–Notch filter–All-pass filter.

## **UNIT–VI:**

### **D to A and A to D Convertors**

Digital to Analog Convertors(D to A) – Introduction–Specifications–Basic DAC techniques– Weighted resistor DAC– R–2R ladder DAC–Inverted R–2R –Output expression for each type.

### **Analog to Digital Convertors**

Introduction–Specifications–Parallel comparator type–Counter type–Dual slope–Successive approximation type ADCs– Merits and demerits of each type, Comparison of different types.

### **Learning Outcomes:**

- After completion of this course student can able to differentiate “Analog Circuits & Digital Circuits”.
- The course content gives an insight in to the fundamentals so that one can design the “Linear Circuits” with their own innovative skills.
- Those who are taken this course can specialize in this subject in their Post Graduation. It is a challenging task for the individual to exhibit his logical skills & Analytical ability.
- They can design their own circuits which may be useful for current industry needs.

### **Text Books:**

1. OP–AMPS and liner integrator circuits by Ramakanth A Gayakwad (PHI).
2. Linear Integrated Circuits by D.Roy chowdary, New age international.

3. Op-amp and linear integrated circuits by sanjay sharma, S.K.Kataria & son's New Delhi.

**Reference Books:**

1. Micro Electronics– Mclliman Mc Graw Hill.
2. Analog Electronics– L.K.Maheswari, PHI.
3. Linear Integrated circuits by S.Salivahan, TMH.



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**ELECTRICAL MACHINES – II LAB****Learning objectives:**

- To predetermine the efficiency and regulation of transformers and assess their performance.
- To predetermine the regulation of three-phase alternator by various methods, find  $X_d / X_q$  ratio of alternator and assess the performance of three-phase synchronous motor.
- To perform various tests on Induction motor for assessing its performance.

**The following experiments are required to be conducted as compulsory experiments:**

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on single phase transformers
3. Scott connection of transformers
4. No-load & Blocked rotor tests on three phase Induction motor
5. Regulation of a three-phase alternator by synchronous impedance & M.M.F. Methods.
6. V and Inverted V curves of a three-phase synchronous motor.
7. Equivalent Circuit of a single phase induction motor
8. Determination of  $X_d$  and  $X_q$  of a salient pole synchronous machine

**In addition to the above eight experiments, at least any two of the following experiments are required to be conducted from the following list:**

1. Parallel operation of Single phase Transformers
2. Separation of core losses of a single phase transformer
3. Brake test on three phase Induction Motor
4. Regulation of three-phase alternator by Potier triangle method.
5. Efficiency of a three-phase alternator

6. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers.
7. Measurement of sequence impedance of a three-phase alternator.

**Learning outcomes:**

- Able to predetermine the efficiency and regulation of transformers and assess their performance.
- Able to predetermine the regulation of three-phase alternator by various methods, find  $X_d / X_q$  ratio of alternator and assess the performance of three-phase synchronous motor.
- Able to perform various tests on Induction motor for assessing its performance.

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**CONTROL SYSTEMS LAB****Learning Objectives:**

- To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors, stepper motor and potentiometer.
- To understand time and frequency responses of control system with and without controllers and compensators.

**Any 10 of the following experiments are to be conducted:**

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – characteristics of stepper motor
4. Effect of feedback on DC servo motor
5. Effect of P, PD, PI, PID Controller on a second order systems
6. Lag and lead compensation – Magnitude and phase plot
7. DC position control system
8. Transfer function of DC motor
9. Temperature controller using PID
10. Characteristics of magnetic amplifiers
11. Characteristics of AC servo motor
12. Characteristics of DC servo motor
13. Potentiometer as an error detector

**Learning Outcomes**

- Able to analyze the performance and working Magnetic amplifier, D.C. servo motors, A.C. Servo motors and synchronous motors.
- Able to design P,PI,PD and PID controllers
- Able to design lag, lead and lag-lead compensators
- Able to control the temperature using PID controller
- Able to determine the transfer function of D.C.motor
- Able to control the position of D.C servo motor performance

**III Year – I SEMESTER****T P C**  
**3+1 0 2****INTELLECTUAL PROPERTY RIGHTS AND PATENTS****UNIT I**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics - Types of Intellectual Property - Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement - Regulatory – Over use or Misuse of Intellectual Property Rights - Compliance and Liability Issues.

**UNIT II**

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

**UNIT III**

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

**UNIT IV**

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

**UNIT V**

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement –

Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law.

## **UNIT VI**

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy - International aspects of Computer and Online Crime.

### **REFERENCE BOOKS:**

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
2. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.