Syllabus for the post of TGT - Work Experience

The questions will be testing the depth of understanding and application of the concepts at the level of Diploma.

(1) Circuit Fundamentals

Zero Reference Level - Chassis Ground - Ohm's Law - Formula Variations of Ohm's Law - Graphical Representation of Ohm's Law - Linear Resistor - Non-linear Resistor - Cells in Series and Parallel - Conventional Problems

(2) Resistive Circuits

Series Circuit - Characteristics of a Series Circuit - The Case of Zero IR Drop - Polarity of IR Drops - Total Power - Series Aiding and Series Opposing Voltages - Proportional Voltage Formula in a Series Circuit Series Voltage Dividers - 'Opens in a Series Circuit - 'Shorts' in e Series Circuit - Parallel Circuits - Laws of Parallel Circuits Special Case of Equal Resistances in all Branches - Special Case of Only Two Branches Any Branch Resistance - Proportional Current Formula - 'Opens' in a Parallel Circuit - 'Shorts' in a Parallel Circuit - Series-Parallel Circuits Analyzing Series Parallel Circuits - 'Opens' in Series-Parallel Circuits 'Shorts' in SeriesParallel Circuits - Voltage Division in a Complex Series-Parallel Circuit - Conventional Problems

(3) Kirchhoff's Laws

General - Kirchhoffs Current Law Kirchhoffs Voltage Law - Determination of Algebraic Sign - Assumed Direction of Current Flow - Conventional Problems.

(4) Network Theorems

General - Superposition Theorem - Ideal Constant-Voltage Source - Ideal Constant-current Source - Thevenin's Theorem - How to Thevenize a Circuit? - Norton's Theorem - How to Nortonise a Given Circuit - Maximum Power Transfer Theorem - Conventional Problems

(5) Passive Circuit Elements

General - Resistors - Resistor Types - Wire-wound Resistors - Carbon Composition Resistors - Carbon Film Resistors - Cermet Film Resistors .Metal Film Resistors - Power Rating - Value Tolerance - Variable Resistors - Potentiometers and Rheostats - Fusible Resistors - Resistor Colour Code - Resistance Colour Bands - Resistors under Ten Ohm - Resistor Troubles - Checking Resistors with an Ohmmeter - Inductor - Comparison of Different Cores - Inductance of an Inductor - Another Definition of Inductance - Mutual Inductance - Coefficient of Coupling - Variable Inductors - Inductors in Series or Parallel without M - Series Combination with N - Stray Inductance - Energy Inductance - Energy Stored in a Magnetic Field - DC Resistance of a Coil - Troubles in Coils - Reactance Offered by a Coil - Impedance Offered by a Coil - Q-Factor of a Coil - Capacitors - Capacitor Connected to a Battery –Capacitance-Factors Controlling Capacitance '- Types of Capacitors - Fixed Capacitors - Variable Capacitors - Voltage Rating of Capacitors - Stray Circuit Capacitance Leakage Resistance - Capacitors in Series - Two Capacitors in Series Capacitor's in Parallel - Two Capacitors in Parallel - Energy stored in e Capacitor - Troubles in Capacitors - Checking Capacitors with Ohmmeter - Charging of a Capacitor - Capacitor Connected Across an AC Source Capacitive Reactance

(6) Energy Sources

Primary and Secondary Cells - Cell and Battery - Voltage and Current of a Cells - Cell life - Different Types of Dry Cells - Carbon Zinc Cell Alkaline Cell - Manganese Alkaline Cell – NickelCadmium Cell - Mercury Cell - Silver Oxide Cell - Lead Cells - Battery Rating - Testing Dry Cells - Photoelectric Devices - Photovoltaic Cell - Solar Cell Conventional Problems

(7) Magnetism and Electromagnetism

Magnetic Materials- Ferrites - Types of Magnets - Demagnetizing or Degaussing -Magnetic Shielding - Magnetic Terms and Units - Ohm's Law for Magnetic Circuit - Transformer - Transformer Working - Transformer Impedance - Can a Transformer Operate on DC ? - RF Shielding - Autotransformer - Impedance Matching - Conventional Problems.

(8) A.C. Fundamentals ;

Introduction - Types of Alternating Waveforms - The Basic AC Generator -Some Definitions - Characteristics of a Sine Wave - Audio an ,Radio Frequencies - Different Values of Sinusoidal Voltage and Current - Phase of an AC - Phase Difference - Vector Representation of an Alternating Quantity - AC Through Pure Resistance Only • AC Through Pure Inductance Only - AC Through Pure Capacitance Only - Non-sinusoidal Waveforms - Harmonics -Conventional Problems

(9) Series A.C. Circuits

R-L Circuit - Q Factor of a Coil - Skin Effect - IR•C Circuit - Coupling Capacitor - R-L-C Circuit - Resonance in an R-L-C Circuit - Resonance Curve - Main Characteristics of Series Resonance - Bandwidth of a Tuned Circuit - Sharpness of Resonance - Tuning - Tuning Ratio - RaGio Tuning Dial- Parallel Resonance -Convectional Problem

(10) Time Constant

Rise and Fall of Current In pure Resistance - Time :Constant at an R-L Circuit • Circuit Conditions - Inductive Kick - Time Constant of an RC circuit - Charging and Discharging of a Capacitor Decreasing Time Constant - Flasher -: Puke Response of an RC Circuit - Effect of Large and Short Time Constants - Square voltage Wave Applied to Short A. RC Circuit - Square Voltage Wave Applied to Long A,'E.0 circuit - Conventional Problems

(11) Timing Circuits and Filters

What-is. a Tuning Circuit ? - Tuned Circuit - Operating Characteristics of a Tuning Circuit - Resonance - Actual Series Resonance - Is it Series or Parallel Resonance ? - Tuned Transformers - Double Tuned Transformers - Parallel Circuit - Coupled Circuits – Simple Coupled Circuits - Coefficient of Coupling - Filters Filter Definitions - Types of Filter Circuits - Low-pass Filter – High pass Filter - Bandpass Filter – Band stop Filter - Multisection Filter Circuits - Uses of Fitters - Conventional Problems

(12) Solid State Physics

Definition of Matter - Crystalline Solids - Unit Cell - arms of Matter - Atom and Molecule - Atomic Structure - Atomic Number (Z) Atomic mass Number (A) - Electron Orbits or shells - Electron Distribution of Different Atoms Electron Sub orbits or Subshells - Valence Electrons Orbital Energy. - Normal, Excited and IonizedAtom. - Orbital Energies in hyrogen Atom - Energy Levels in an Isolated At W- Energy Bands in Solids - Bonds in Solids - Valence and Conduction Bands - Conduction in Solids - Hole Formation and its Movement Conductors, Semiconductors and Insulators - Types of Semiconductors - Intrinsic Semiconductors Extrinsic Semiconductors - Majority and Minority Charge Carriers - Mobile Charge Carriers and Immobile Torts - Drift Current in Good Conductors Drift Current in Intrinsic Semiconductors - Intrinsic Conduction -Conventional Problems

(13) The P-N Junction

The P-N Junction - Formation of Depletion Layer Junction or Barrier Voltage (V B) - Effect of Temperature on Barrier Voltage - Forward Biased P-N Junction - Forward VII Characteristics -Reverse Biased P-N Junction - ReMerse Saturation Current (Is or 1_0) - Reverse V/ I Characteristic Combined Forward and Reverse VII Characteristics - Junction Breakdown - Junction Capacitance

(14) P-N Junction Diode

P-N Junction Diode - Diode Ratings or Specifications - Diode Testing The Ideal Diode -The Real Diode - Diode Circuits with DC and A Voltage Sources - Diode Fabrication- Grown Junction - Alloy Junction Diffused Junction Epitaxial Junction - Point ContactJunction - Clippers and Campers - Clippers - Some Clipping Circuits - Clampers
Summary of Clamping Circuits - Conventional Problems Questions.

(15) Special Diodes

Zener Diode - Voltage Regulation Zener Diode as Peak Clipper - Meter Protection – Tunneling Effect - Tunnel Diode - Tunnel Diode Oscillator Varactor - PIN Diode - Schottky Diode - Step Recovery Diode Thermistors -Conventional Problems

(16) Optoelectronic Devices

Light Emitting Diode (LED) - Photoemissive Devices - Photomultiplier Tube - Photovoltaic Devices - Bulk Type Photoconductive Cells - Photodiodes -P-N Junction Photodiode - PIN Photodiode -
Avalanche Photodiode

(17) DC Power Supplies

Introduction - Unregulated Power Supply - Regulated Power Supply Steady and Pulsating DC Voltages - Rectifiers Half-wave Rectifier Full-wave Rectifier - Full-wave Bridge Rectifier - Filters - Series Inductor Filter - Shunt Capacitor Filter - Effect of Increasing Filter Capacitance - LC Filter - The CLC or Pi Filter - Bleeder Resistor - Voltage Regulation Zener Diode Shunt Regulator - Transistor, Series Voltage Regulator - Controlled Transistor Series Regulator - Transistor Shunt Voltage Regulator Transistor Current Regulator - Voltage Dividers - Complete Power Supply - Voltage Multipliers - Half-wave Voltage Doubler - Full-wave Voltage Doubler - Voltage Tripler and Quadrupler Circuits - Troubleshooting Power Supplies - Controlled Rectification - Output Waveforms for Different Firing Angles - Output Voltage and Current Values in Controlled Rectifiers Average Values for FW Controlled Rectifier - Silicon Controlled Rectifier (SCR) - Pulse Control of SCR - 90° Phas- Control of SCR - 180^{0} Phase Contr,gi of SCR - SCR Controlled Circuit - U3T Controlled Circuit Conventional Problems

(18) The Basic Transistor

The Bipolar Junction Transistor - Transistor Biasing -Important Biasing Rule - Transistor Currents - Summing Up - Transistor Circuit Configurations - CB Configuration - CE Configuration -Relations between a and 13 - CC Configuration - Relations between Transistor Currents - Leakage Currents in a Transistor - Thermal Runaway - Conventional Problems

(19) Transistor Characteristics and Approximations

Transistor Static Characteristics - Common Base Test Circuit - Common Base Static - Characteristics - Common Emitter Test Circuit - Common Emitter Static Characteristics - Common Collector Static Characteristics - Different Ways of Drawing 'Transistor Circuits - Common Base Formulas Common Emitter Formulas - Common Collector Formulas - The Beta Rule - Importance of V_{ce}- Cut-off and Saturation Points - Normal DC Voltage Transistor Indications - Transistor Fault Location - Solving Universal Stabilization Circuit - Notation for Voltages and Currents - Increase / Decrease Notation - Applying AC to a DC Biased Transistor - Transistor *AC/DC*
Analysis -Conventional problems

(20) Load Lines and DC Bias Circuits

DC Load Line - Q-point and Maximum Undistorted Output - Need for Biasing a Transistor - Factors Affecting Bias Variations - Stability; Factor - Beta Sensitivity - Stability Factor for CB and OF Circuits - Different Methods for Transistor BiaSing - Base Bias - Base Bias with Emitter Feedback - Bate Bias with Collector Feedback - Base Bias with Collector and Emitter Feedbacks - Voltage Divider Bias - Load Line and Output Characteristics - AC Lmid Line - Conventional Problems'

(21) Transistor Equivalent Circuits and Mode

General DC Equivalent Circuit - AC Equivalent Circuit -equivalent Circuit of a CB Amplifier -Effect of Source Resistance RS on Voltage Gain - Equivalent circuit of a CE Amplifier – Effect of Source Resistance RS - Equivalent Circuit of a CC Amplifier -Low-frequency Model or Representation - Genera; - T-Model - Formulas for T-Equivalent of a CB Circuit - Equivalent of a CB Circuit - T-Equivalent of a CE Circuit What are h-parameters ? - The h-parameter Formulas for Notation for Transistors - The h-parameters of an Ideal Transistor -, The h-parameters of an Ideal CB Transistor - The h-parameters of an Idal CE, Transistor - Approximate Hybrid Equivalent Circuits Typical Values of Transistor h-parameters - Hybrid Formulas for Transistor Amplifier - Approximate Hybrid Formulas -Conventional Problems

(22) Single- Stage Transistor Amplifiers

Classification of Amplifiers – Common Base (CB) Amplifier – Various Glans of a CB Amplifier- Characteristics of a CB Amplifier – Characteristics of a CE Amplifier – Common Collector (CC) Amplifier – Various Gains of a CC Amplifier – Characteristics of a CC Amplifier – Uses – Comparison of Amplifier Configurations –Amplifier Classification Based on Biasing Condition – Graphic Representation Class A Amplifiers – Power Distribution in a class A Amplifier – Power Rectangle – Power Efficiency Maximum AC Power in Load – Transformer-coupled, Class A Amplifier Class B Amplifier- Power Relations for Class B Operation – Maximum Values- Class –B Push –Pull Amplifier- Crossover Distortion – Power Efficiency of Push-Pull Amplifiers – Complementary Symmetry Push-Pull Class-B Amplifier – Class C Amplifier- Tuned Amplifier – Distortion in Amplifier – Non-linear Distortion- Intermodulation Distortion- Frequency Distortion – Phase or Delay Distortion – Noise

(23) Multistage Amplifiers

General '--- Amplifier Coupling- RC-Coupled Two stage Amplifier – Advantages of RC Coupling } Impedance-Coupled Two –stage Amplifier- Advantages of Impedance Coupling – Transformer – coupled Two Stage Amplifier – Advantages of Transformer Cupling – Frequency Response – Applications – Direct- coupled Two- stage Amplifier Using Similar Transistors – Direct-coupled Amplifier Using Complementary Symmetry of Two Transistors – Darlington Pair –Advantages of Darlington Pair – Comparison between Darlington Pair and Emitter Follower – Special Features of a Differential Amplifier – Common Model Input – Differential Amplifier – Conventional problems

(24) Decibels and Frequency Response

The Decibel System - Other Expressions for Power Gain - Voltage and Current Levels - Characteristics of the Decibel System - Value of I dB Zero Decibel Reference Level - Variations In Amplifier Gain with Frequency - Changes in Voltage and Power Levels - Causes of Gain Variation.: Miller Effect - Cut-off Frequencies of Cascaded Amplifiers - Transistor Cut-off Frequencies - Alpha Cut-off Frequency - Beta Cut-off :Frequency - The f_t of a Transistor - Relation Between f_a,$f_b$and f_t Gain-Bandwidth Product - Conventional Problems

(25) Feedback Amplifier

Feedback Amplifiers – Principal of Feedback Amplifiers – Advantages of Negative Feedback – Gain Stability – Decreased Distortion- Increased Bandwidth – Forms of Negative Feedback – Shunt- derived Series-fed Voltage Feedback – Current –Series Feedback Amplifier – Voltage-shunt Negative Feedback Amplifier – Current –shunt Negative Feedback Amplifier –Conventional Problems.

(26) Field Effect Transistor

What is a FET? Junction FET (JEFT) – Static Characteristics of a JFET – JFET Drain Characteristic with V GS = 0 –JFET Characteristic with External Bias – Transfer Characteristic – Small Signal JFET Parameters DC Biasing of a JFET –DC Load Line – Common Source JFET

Amplifier - JEFF on an IC Chip - Advantages of FETs - MOSFET or IGFET DE MOSFET - Schematic Symbols for a DE MOSFET - Static Characteristics of a DE MOSFET - Enhancement only N-channel MOSFET Tr?risfer Characteristic - FETs as Switches - FET Applications - MOS-FET Handling

(27) Breakdown Devices

What are Breakdown Devices ? Uni junction Transistor - UJT Relaxation Oscillator - Silicon Controlled Rectifier - C10° Phase Control - Theft Alarm - Triac -Diac - Silicon Controlled Switch (SCS)

(28) Sinusoidal Oscillators

What is an Oscillator? - Comparison between an Amplifier and an Oscillator - Classification of Oscillators - Damped an Undamped Oscillations - The Oscillatory Circuit - Frequency of Oscillatory Current - Frequency Stability of an Oscillator - Essentials of a Feedback LC Oscillator - Tuned Base Oscillator - Tuned Collector Oscillator - Tuned Drain Oscillator (FET) - Hartley Oscillator - FET Hartley Oscillator - Colpitts Oscillator - Clapp Oscillator – FETColpitts Oscillator - Crystals - Crystal Controlled Oscillator - Transistor Pierce Crystal Oscillator - FET Pierce Oscillator - Phase Shift Principle - Phase Shift Oscillator - Wien Bridge Oscillator

(29) Noninusoidal Oscillators

Nonsinusoidal Waveforms 't-Classification of Nonsinusoidal Oscillators Pulse Definitions - Basic Requirements of a Sawtoo0 Generator -U3T Sawtooth Generator – Muiti vibrators (MV) – Uses of Multi vibrators - Astable Multi vibrator – Mono stable Multi vibrator (MMV) –Bi stable Multi vibrator (BMV) - Schmitt Trigger -Transistor Blocking Oscillator

(30) Modulation and DeModulation

Introduction - What is a Carrier Wave? - Radio Frequency Spectrum Sound - Need for Modulation - Radio Broadcasting - Modulation Methods of Modulation - Amplitude Modulation - Per cent Modulation Upper and Lower Side Frequencies - Upper and Lower Sidebands - Mathematical Analysis of a Modulated Carrier Wave - Power Relations in an AM Wave - Forms of Amplitude Modulation - Generation of SSB - Methods of Amplitude Modulation - Block Diagram of an AM Transmitter - Modulating Amplifier Circuit - Frequency Modulation - Frequency Deviation and Carrier Swing - Modulation Index'-Deviation Ratio - Per cent Modulation - FM Sidebands ;- Modulation index and Number of Sidebands - Mathematical Expression for FM Wave - Demodulation or Detection - Essentials of AM Detection - Diode Detector for AM Signals - Transistor Detectors for AM Signals - FM Detection - Quadrature Detector - Frequency Conversion - Super heterodyne AM Receiver - FM Receiver - Comparison between AM and FM - The Four Fields of FM - Conventional Problems

(31) Integrated Circuits

Introduction - What is an Integrated Circuit? - Advantages of ICs - Drawbacks of ICs - Scale of Integration - Classification of ICs by Structure Comparison between Different ICs -Classification of ICs by Function Linear Integrated Circuits (UCs) - Digital Integrated Circuits - IC Terminology - How Monolithic ICs are Made? - le Symbols - Fabrication of IC Components - Complete Monolithic Integrated Circuits - Popular Applications of ICs MOS Integrated Circuits - What is an OP-AMP? OP-AMP Symbol - Polarity Conventions - Ideal Operational Amplifier - Virtual Ground and Summing Point - Why Vi is Reduced to almost Zero? - OP-AMP Applications - Linear Amplifier - Unity Follower - Adder or Summer - Subtractor - Integrator - Differentiator - Comparator

(32) Number Systems

Number of Systems -The Decimal Number System - Binary System Binary to Decimal Conversion - Binary Fractions - Double-D add Method - Decimal to Binary Conversion - Shifting the Place Point - Binary Operations - Binary Addition - Binary Subtraction - Complement of a Number - 1 is Complemental Subtraction - 2's Complemental Subtraction - Binary Multiplication - 8i4ry Division - Shifting a Number to Left or Right - Representation of Binary Numbers as Electrical Signals - Octal Number System - Octal to Decimal Conversion – Decimal to Octal Conversion – Binary to Octal Conversion – Octal to Binary Conversion – Advantages of Octal Number System, Hexadecimal Number System – How to Count beyond F in Hex Number System? --- Binary to Hexadecimal conversion – Hexadecimal to Binary Conversion – Conventional Problems.

(33) Logic Gates

Definition - Positive and Negative Logic - The OR Gate - Equivalent Relay Circuit of an OR Gate - Diode OR Gate - Transistor OR Gate OR Gate Symbolizes Logic Addition - Three Input OR Gate - Exclusive OR Gate - The AND Gate - Equivalent Relay Circuit of an AND Gate. Diode AND Gate — Transistor AND Circuit - AND Gate SymbolizesLogic Multiplication - The NOT Gate - Equivalent Circuits for a NOT Gate The NOT Operation ' Bubbled Gates The NOR Gate - NOR Gate is a Universal Gate - The NAND Gate - NAND sate is a Universal Gate The XNOR Gate - Logic Gates at a Glance - Adders and Subtractors Half Adder - Full Adder - Parallel Binary Adder -Half Subtractor - Full Subtractor - Conventional Problems

(34) Boolean Algebra

Introduction - Unique Feature of Boolean Algebra - Lay of Boolean Algebra - Equivalent Switching Circuits - De Morgans Theorems - Duals - Conventional Problems

(35) Logic Families

Main Logic Families Saturated and Non-saturated Logic Circuits - Characteristics of Logic Families - RTL Circuit - DTL Circuit -- '- TTL Circuits -TTL Subfamilies -ECL Circuit —I2L_ Circuit - MOS Family - PMOS Circuit - NMOS, Circuit - CMOS Circuit

(36) Transducer

What is a Transducer? - Classification of Transducers • Classification based on Electrical Principle Involved - Resistive Position Transducer - Resistive Pressure Transducer —-;-Inductive pressure Transducer - - Capacitive Pressure Transducer - Self-generating Inductive Transducers - Linear Variable Differential Transformer (.VDT) - Piezoelectric Transducer - Strain Gauge Temperature Transducers - Resistance Temperature Detectors - Thermistor - Thermocouples - Ultrasonic Temperature Transducers - photoelectric Transducers - Various Types of Microphones - Carbon Microphone Ribbon Microphone - Moving-Coil (Me) Microphone - Crystal Microphone - Ceramic Microphone - Capacitor Microphone - The Electret Microphone The Loudspeaker

(37) Electronic Instruments

Introduction - Analog and Digital Instruments - Function of Instruments - Electronic versus Electrical Instruments - Essentials of an Electronic Instrument - Measurement Standards - The Basic Meter Movement - Characteristics of Moving Coil Meter Movement - Variations of Basic Meter Movement - Converting Basic Meter to DC Ammeter – Multi range Meter - Measurement of Current - Converting Basic Meter to DC Voltmeter Multi range DC Voltmeter - Loading Effect of a Voltmeter - Ohmmeter The Multimeter - Rectifier Ty e AC Meter Electronic Voltmeters - The Direct Current VTVM - Comparison of VOM and VTVM - Direct Current PET VM - Electronic Voltmeter for Alternating Currents - The Digital Voltmeter (DVM) -Cathode Ray Oscilloscope (CRO) - Cathode Ray Tube (CRT) - Deflection Sensitivity f a CRT - Normal Operation of a CRO Triggered and Non-triggered Scopes - Dual Trace CRO - Dual Beam CRO - Storage Oscilloscope - Sampling CRO - Digital Readout CRO - Lissajous Figures - Frequency Determination with Lissajous Figures - Applications of a CRO