Government of Karnataka **Sub: Electronics (40)** **I PU Syllabus (Annual Lesson Plan)** **For 2021-22** **Theory (70 Marks) + Practical (30 Marks)**			
1		**TERM – I** **Duration of the course: Between 16-08-21 to 15-09-21**	
	Ch No	**Term – I Theory**	
	1	INTRODUCTION TO ELECTRONICS Electronics and its scope: **Development of** vacuum tube devices, semiconductor devices, integrated circuits, microprocessors and microcontrollers. **Applications of electronics** – entertainment, communication, defense, industrial medical. **Impact of electronics on quality of life**	4 Hr
	2A	PRINCIPLES OF ELECTRICITY, NETWORK THEOREMS AND AC PRINCIPLES	13 Hr
		Charge, Potential difference, DC and AC: **Charge**-positive and negative charges, properties of charges, S.I Unit of charge, Charge of an Electron, Number of electrons in one Coulomb of charge, Electric Current-definition (charge/sec), its unit and direction of current - conventional current and the electronic current. Potential difference and its unit related to electric circuit, Direct current (DC) and Alternating Current (AC)-representation and examples of DC and AC sources. **Ohm's law**-statement and limitations, application to circuits. Resistance and its unit, Electric Power-definition, unit of power, electric energy-definition and Power dissipation in resistors - Power formulae and Energy formula. (P = VI, $P = \frac{V^2}{R}$ P = I^2R and kWh). **Combinations of resistors**-series, parallel-derivations of the expressions, series – parallel - circuits and problems. Open and short circuit – Problems. Kirchhoff's current law and Kirchhoff's voltage law, current and voltage division, problems up to two loops on Kirchhoff's laws.	11 Hr 2 Hr
		Term – I Practical	
	1	Colour coding of resistors 4 band and 5 bands.	2 Hr
	2	Verification of Ohm's law.	2 Hr
	3	Verification of Kirchhoff's current law and Kirchhoff's voltage law.	2 Hr

2		**Activity: Assignment 1 for Term I** (theory) to be submitted before 20-09-21	
3		**I Unit Test between 13-09-21 to 15-09-21 for Term I (theory)**	
4		**TERM – II** **Duration of the course: Between 16-09-21 to 30-11-21**	
		Term - II Theory	
	2B	PRINCIPLES OF ELECTRICITY, NETWORK THEOREMS AND AC PRINCIPLES	8 Hr
		D.C Sources and Network theorems (for DC circuits): Introduction to secondary DC sources like dry cells and other type of batteries, internal resistance of sources, Voltage sources: Definitions, Conversion of voltage source to current source and vice versa. **Network theorems**: Thevenin's theorem, statements, respective equivalent circuits for dc networks. Super position theorem, statement, analysis with two voltage sources, Maximum power transfer theorem- statement (no derivation) all theorems with respect to DC circuit. Problems on each theorem. **A.C principles:** Expression for the instantaneous voltage $v = V_m \sin(\omega t)$ (no derivation), definitions of frequency, time period, peak value, r.m.s value, effective value and average value with reference to sinusoidal waveform. Different types of non sinusoidal waveforms square, triangular and saw tooth- mention only.	5 Hr 3 Hr
	4A	**PASSIVE ELECTRONIC COMPONENTS**	10 Hr
		Comparison of passive and active components - Passive and active components, their examples. **Resistors:** resistance of conductor and its unit, specification of resistors, temperature coefficient of resistor, specific resistance, types of resistor **–** fixed and variable, fixed resistors - carbon composition, metal film and SMD resistor, constructional aspects in brief and applications of resistors. **Wire wound resistor:** Construction, applications. **Variable resistors:** Potentiometer – carbon composition type – construction and uses, Preset. Importance of power rating in resistors. **Color coding of resistors (4 bands and 5 bands),** tolerance, and problems.	4 Hr
		Capacitors:	6 Hr
		Definition of Capacitance and its unit – Principle of capacitor, factors affecting the capacitance of capacitor, parallel plate capacitor (mention $C = \varepsilon_o A/d$ and $C = \varepsilon_o \varepsilon_r A/d$- no derivation), energy stored in a capacitor $E = \frac{1}{2}CV^2$ (no derivation), dielectric and	

		examples, role of dielectric in capacitor.	
		Types of Capacitors – fixed and variable. **Fixed capacitors:** Ceramic, Polystyrene, SMD capacitor and Electrolytic capacitor - construction and applications. variable capacitors like ganged capacitor and trimmer - their applications Importance of voltage rating in capacitors. **Capacitive networks** - derivation of expressions for effective capacitance of capacitors connected in series or in parallel, trouble shooting in capacitors - open short, leakage.	
	6A	**SEMICONDUCTORS, DIODES AND APPLICATIONS OF DIODES**	17 Hr
		Semiconductor theory: **Band theory of solids** - valence band, conduction band and the forbidden energy gap, Classification of solids as conductors, semiconductors and insulators on the basis of their conductivity and on the basis of energy band diagrams, examples for each. **Types of semiconductors** - Intrinsic and Extrinsic. **Intrinsic semiconductors:** Definition, lattice structure (two dimensional), concept of holes and electrons (their generation and flow in the bands), effect of temperature, thermal generation and recombination of electrons and holes. **Extrinsic semiconductors:** Definition, doping, doping elements -trivalent and pentavalent, meaning of donor and acceptor impurities. Types of Extrinsic Semiconductors: n type and p type, their formation, in each case study of lattice structure (two dimensional).	4 Hr
		pn junction: **Formation of pn junction**, diffusion of charge carriers, depletion region - formation of depletion region, barrier width and barrier potential, semiconductor diode. **Forward biased pn junction:** Diagram, Effect on width of the depletion region, resistance and current flow. **Reverse biased pn junction:** Diagram, Effect on width of the depletion region, resistance and concept of leakage current (in germanium and silicon), junction capacitance (during reverse bias) and its variation with applied reverse bias voltage, brief note on breakdown mechanisms.	4 Hr
		Junction Diode Circuit symbol, Diode equation $\left[I = I_o(e^{\frac{V}{\eta V_T}} - 1) \right]$ - Numerical problems need not be discussed. Ideal and practical diodes, Equivalent circuit of a practical diode (barrier	4 Hr

		potential in series with R_f).	
		V-I static characteristics - Circuits to study the forward bias and reverse bias characteristics, characteristic curves, knee voltage, forward bias resistance from characteristic curve. Study of various terms related to diode like PIV and power rating (qualitative), diode approximations, Comparison of Germanium and Silicon diodes. **Wave shaping circuits** – clippers – series positive clippers, series negative clippers, clampers - positive clampers, negative clampers.	
		Rectification – Need for rectification, (Mention the concept of mutual inductance and turns ratio in the transformer) Principles, Half wave rectifier, Full wave rectifier (centre tapped and bridge type): Circuit, working of rectifiers considering transformers at the input, input and output wave forms for the rectifiers. Expression for Load regulation – mention only. Expressions (no derivations) for average output voltage V_{av}, average output current $I_{av,}$ V_{rms} and I_{rms}. Efficiency 'η' (expression – no derivation), Ripple and Ripple factor Υ (expression- no derivation) for each case, comparison of rectifiers. Concept of negative voltage rectifiers. **Problems on Half wave rectifier and Bridge rectifier only**.	5 Hr
		Term II Practical	
	4	Verification of Thevenin's theorem	2 Hr
	5	Measurement using Oscilloscope a. V_p, V_{p-p}, V_{rms}, time period, frequency for a sinusoidal wave and b. V_p, time period, frequency for square wave.	2 Hr
	6	Forward characteristics of Semiconductor diode, determination of forward dynamic resistance.	2 Hr
	7	To study diode positive clipper and positive clamper circuit.	2 Hr
	8	Half wave rectifier - Verification for output dc voltage ($V_{dc} = V_m/\pi$), display of input and output waveforms on C.R.O.	2 Hr
	9	Bridge rectifier a. Verification for output dc voltage ($V_{dc} = 2V_m/\pi$), display of input and output waveforms on C.R.O. separately (use single channel at a time) b. Shunt capacitance filter; display of filtered output waveforms on C.R.O.	2 Hr
5		**Activity: Assignment 2 for Term II** (theory) to be submitted before 5-12-21	
6		**Mid Term Exam between 20-11-21 to 30-11-21 (for Term I and Term II)**	

7		**TERM – III** **Duration of the course: Between 01-12-21 to 30-01-22**	
		Term – III Theory	
	4B	**PASSIVE ELECTRONIC COMPONENTS**	12 Hr
		Inductors: Review of laws of electromagnetic Induction **Definitions of self, mutual inductances and unit of Inductance.** **Inductor -** factors determining the inductance of inductor $\left(L = \frac{\mu N^2 A}{\ell}\right)$ **Energy stored in an inductor** i.e., $E = \frac{1}{2} LI^2$ (no derivation), **Fixed Inductors:** Air core, iron core, ferrite core - construction and applications. Expressions for series and parallel combination of inductors neglecting the mutual inductance (no derivations).	5 Hr
		Transformers: Principle (mutual induction), Turns ratio, voltage ratio and current ratio - relation between them, step up and step down transformers, Centre tapping in transformers, problems**,** applications of transformers, Efficiency in transformers	5 Hr
		Transducers: Definition of transducer, pressure transducers - microphone and loud speaker – construction, working and applications,	2 Hr
	6B	**SEMICONDUCTORS, DIODES AND APPLICATIONS OF DIODES**	9 Hr
		Filters: Need for filters, series inductor filter, shunt capacitor filter and Inductive input L type filter, - circuit diagram, working and waveforms for each type, bleeder resistance	2 Hr
		Zener diode: schematic symbol, Zener and avalanche breakdown, V-I characteristics of Zener diode, its application in voltage regulation-study of line and load regulation, Calculation of minimum load resistance required for regulation - problems with constant input and variable input voltage.	2 Hr
		Design of practical regulated power supplies – Design of a rectifier for a given DC voltage, Fixed positive regulated power supply using 7812, Fixed negative regulated power supply using 7912 and Adjustable regulated power supply using LM317.	5 Hr

		Specifications of DC regulated power supply. Special Diodes Light Emitting Diode (LED) - symbol, construction - type of materials used, working in brief and applications. Seven segment display: LED display - pin configuration showing the different segments-a, b, c, d, e, f, g and dp. Display of digits 0 to 9.	
	8A	INTRODUCTION TO DIGITAL ELECTRONICS	13 Hr
		Introduction, importance of Digital Electronics, representation of digital and Binary signals, Positive and Negative logic. Number systems – Need for the study of various number systems, Decimal number system, and Binary number system – advantage, bit, nibble, byte, memory representation using Bytes, hexadecimal number systems, conversion from one system to another. Binary addition, subtraction, multiplication and division, 1's complement, 2's complement, 1's complement and 2's complement method for subtraction of binary numbers (subtraction of a binary number of smaller value from a number of larger value), sign magnitude binary number. **Boolean Algebra:** Introduction to Boolean Algebra, Basic Boolean operators (OR, AND and NOT operators), Basic Laws and theorems of Boolean Algebra, De Morgan's theorems and their verification, Boolean identities, Simplification of Boolean expressions,	13 Hr
		Term – III Practical	
	10	Characteristics of Zener diode.	2 Hr
	11	Zener diode as a voltage regulator a. Line regulator. b. Load regulator.	2 Hr
	12	Fixed Regulators: To construct fixed regulators using discrete components. a. +12V (using7812) regulator b. -12V (using7912) regulator	2 Hr
	13	Adjustable Regulator: To construct adjustable positive regulator (1.25V-14V) usingLM317and discrete components.	2 Hr
8		**II Unit Test between 28-01-22 to 31-01-22 (for Term III)**	

9		**TERM – IV** **Duration of the course: Between 01-02-22 to 31-03-22**	
		Term – IV Theory	
	7	BIPOLAR JUNCTION TRANSISTOR Transistor working-npn (in active mode), Symbols, currents I_B, I_C and I_E, Three basic configurations of transistor – CE, CB and CC. DC current gains α and β and the relationship between them. Input and output characteristics of a transistor in CE configuration. Meaning of cutoff, saturation, and active regions.	7 Hr
	8B	INTRODUCTION TO DIGITAL ELECTRONICS	5 Hr
		Basic Logic gates: OR gate and AND gate: Logic symbol, truth table and realization using diodes, NOT gate - using transistor, logic symbol and truth table**.** (Positive logic is to be dealt in all cases). Construction of logic circuits for logic expressions. DTL - NAND, DTL - NOR gates – working and truth table. **Pulse (clock) generator using 555** - Astable multivibrator - frequency and duty cycle.	
	5	**APPLICATION OF D.C AND A.C TO PASSIVE COMPONENTS**	14 Hr
		D.C applied to Passive components:	2 Hr
		Transient phenomenon, transient period, Charging and discharging of a capacitor in RC circuit - expressions (mention only-no derivations), definition of Time constant, graphical representations for charging and discharging of a capacitor. Growth and decay of current in RL circuit - expressions (no derivations), definition for Time constant, graphical representations for growth and decay of current. Problems on RC and RL circuits.	
		A.C applied to Passive components:	12 Hr
		Concept of phase and phase difference. **AC applied to resistive circuit:** Phasor representation of voltage and current waveforms. **AC applied to capacitive circuit:** Circuit diagram, Expression for instantaneous current and voltage for a sinusoidal input voltage, Phasor representation of voltage and current, definition of phase, phase difference - Lead and lag concepts. **AC applied to inductive circuit:** Circuit diagram, Expression for instantaneous current and voltage for a sinusoidal input voltage**, Phasor representation of voltage and**	

		current, definition of phase, phase difference - Lead and lag concepts. Resistance, reactance and impedance. Capacitive reactance and inductive reactance-definitions and expressions. **Power in AC circuit:** Power factor, active and reactive power. **Series RLC circuits:** Impedance, impedance equation (mention only), variation of impedance with respect to frequency**.** **Series Resonance** - Condition for resonance, Resonant frequency, Half power frequencies, BW, Quality factor in terms of f_r and BW. **Frequency and phase response of RC circuits:** Brief note on filters and its application. Low pass and high pass filters – frequency response and phase response graph and Cutoff frequency, problems.	
	3	MEASURING INSTRUMENTS Electronic Instruments: Voltmeter (AC/DC), ammeter (AC/DC) and Ohm meter – photograph of each one, symbol and uses of each, with diagrams study front panel details of a typical multimeter and a dual channel oscilloscope, use of oscilloscope for measurement of voltage (AC/DC), time period and frequency, precautions while using electronic instruments. Medical electronic Instruments: **Electrocardiography** (ECG), ***sphygmomanometer*** (blood pressure instrument), glucometer, ultrasound scan, pulse oximeter, clinical digital thermometer – use of each one.	4 Hr
	9	**PRACTICAL ELECTRONIC COMPONENTS, THEIR SPECIFICATIONS AND PCB** **[Note: photographs, important specifications, part numbers (wherever possible) of each component to be mentioned]** Resistors–CFR, MFR. Capacitors–ceramic, electrolytic, Inductors–air core, Transformers–ferrite core Diodes rectifying diodes, diode bridge module, switching diodes, Zener diode, LEDs, seven segment display, Transistors–npn and pnp transistors Regulators-Fixedregulator:78XXseries,79XXseries, **PCB Design and development**	4 Hr

		Term – IV Practical	
	14	OR gate and NOR gate using discrete components - Verification of truth table using voltage measurements.	2 Hr
	15	AND gate and NAND gate using discrete components - Verification of truth table using voltage measurements.	2 Hr
	16	Astable Multivibrator using IC 555. Verify for frequency and duty cycle.	2 Hr
	17	Transistor Characteristics in CE mode: (a) Input characteristics (b) output characteristics	2 Hr
	18	Series resonance circuit–determination of resonant frequency, Bandwidth and Q factor	2 Hr
	19	Frequency response of RC Low pass filter-determination of cut off frequency.	2 Hr
	20	Frequency response of RC High pass filter-determination of cut off frequency.	2 Hr
		Note: Any 10 experiments must be performed (Among four Terms)	
10		**Annual Exam between 24-03-22 to 30-03-22 (for Full syllabus)**	

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