Government of Karnataka **Sub: Electronics (40)** **II PU Syllabus (Annual Plan of Work)** **For 2021-22** **Theory (70 Marks) + Practical (30 Marks)**			
1		**TERM – I [Amplifiers and Digital Electronics]** **Duration of the course: Between 15-07-21 to 15-09-21**	
		Term – I Theory	
	2	Bipolar Junction Transistor (BJT) Biasing	3 Hr
	2.1	Biasing : Introduction – Need for biasing. DC load line – end points of the load line from basic circuit in CE mode with two sources i.e. V_{BB} and V_{CC}. Equations for base current, collector current, V_{BE}, and V_{CE}. Significance and graph. Selection of operating point on DC load line. Mention the types of biasing – Fixed bias (base bias), Collector to base feedback bias, Emitter feedback bias and Voltage divider bias (universal bias). Voltage divider bias: Circuit diagram, explanation, expressions for the end points of DC load line and for the coordinates of Q-point from approximate analysis. Importance of voltage divider bias, its advantages Leakage currents (mention only, no equation) and thermal runaway. Mention stability factor S, heat sink, (No problems on this section (2.1)).	
	3	Transistor Amplifiers	14 Hr
	3.1	Introduction to Amplifiers: Concept of amplification and faithful amplification – Biasing of EB junction and the CB junction for faithful amplification. Classification of amplifiers based on different criterion: Based on position of the operating point, operating frequencies, bandwidth, number of stages, types of coupling and their application areas (qualitative treatment only).	2 Hrs
	3.2	Amplifier parameters: Voltage gain, current gain, power gain, input and output impedances, bandwidth, half power frequencies. Expressions for power gain in dB and voltage gain in dB. Need for measurement of gain in dB.	1 Hr
	3.3	Single stage CE, CB and CC amplifiers: Circuit diagram using voltage divider bias, working, input, output waveforms, frequency response – factors affecting the gain at low, midrange and high frequencies, 3dB bandwidth, applications. Comparative study of CE, CB and CC amplifiers (qualitative study): Comparison with respect to – input impedance, output impedance, phase relation between input and	3 Hrs

		output voltages, voltage gain, current gain, frequency bandwidth and applications.	
	3.4	DC equivalent circuit: Steps for drawing DC equivalent circuit. DC equivalent circuit of single stage CE amplifier with potential divider bias. AC equivalent circuit of a single stage CE amplifier (potential divider bias) with r_e' model of transistor— steps involved in drawing ac equivalent circuit. Derivation of the expressions (neglecting the internal resistance of ac source) for current gain, voltage gain, input impedance, output impedance and power gain. Problems.	3 Hr
	3.5	Power amplifiers: Introduction, classification, differences between voltage amplifier and power amplifier.	2 Hr
	3.6	Multistage amplifiers: Need of multistage amplifier, gain of multistage amplifier, types of coupling with block diagrams. Two stage RC coupled CE amplifier – Circuit diagram, working and frequency response. Qualitative study of gain at low, mid and high frequencies, advantages disadvantages and applications. Direct-coupled CE amplifier – Circuit diagram, working and frequency response – qualitative study, advantages, disadvantages and applications. (No problems from section 3.6)	3 Hr
	10	Digital Electronics	16 Hr
	10.1	Exclusive OR (XOR) and Exclusive NOR (XNOR) gates – Logic symbols, Boolean expression for the outputs, truth tables, realization using basic logic gates and timing diagrams. Universal property of NAND and NOR gates: Realisation of NOT, OR, AND, XOR and XNOR gates, Boolean expression for the output of each gate. Pin diagrams of IC 7400 and IC 7402.	2 Hr
	10.2	Digital Codes: Introduction, need for Digital codes,– BCD codes (mention only), 8421 code (examples and applications), Self complimenting codes – Excess 3 code and 2421 code (examples and applications of each), Gray code (examples and applications), Binary to gray and gray to binary conversions using XOR gates (with logic circuits). Problems.	2 Hr
	10.3	Arithmetic Logic Circuits: Half Adder and Half subtractor – Logic symbols, realisation using X-OR gate and basic gates, explanation – Boolean expressions for the outputs, truth tables. Realisation of Half Adder using NAND gates – Boolean expressions for SUM and	4 Hr

		CARRY. DIFFERENCE and BORROW Full Adder: Logic symbol, explanation – SUM and CARRY outputs, Boolean expressions, truth table. Realisation of Full Adder using – i) two Half Adders and OR gate. ii) two X-OR gate two AND gates and an OR gate. iii) three input X-OR gate and basic gates, Boolean expressions for SUM and CARRY outputs for all circuits	
	10.4 10.5	Simplification of Boolean expressions: Conversion of Boolean expression to SOP form. Conversion of Boolean expression to POS form (mention only). Karnaugh's map (K-map): Introduction, plotting K-map for two, three and four variables. Plotting the K-maps for the expressions of SOP form for four variables, pairs, quads, octets, don't care conditions-obtaining the simplified expressions. Realising the simplified expressions using – (i) only basic gates. and (ii) only NAND gates. Problems. Sequential logic circuits: Introduction, importance of clock in digital circuits. Qualitative study of level triggering and edge triggering – positive edge triggering & negative edge triggering. Flip Flops: Introduction, Basic NAND latch, logic circuit, working and truth table. Unclocked RS Flip Flop: Logic symbol, circuit using NAND gates only, working and truth table. Clocked RS Flip Flop: Logic symbol, circuits using NAND gates only, working, truth table. D Flip Flop: Logic symbol, RS Flip Flop as D Flip Flop – working, truth table JK Flip Flop: Logic symbol, realisation of JK Flip Flop using NAND gates, working, truth table, and race around condition.	4 Hr 4 Hr
		Term – I Practical [Digital Electronics]	
	1 2 3 4 5	Realization of AND, OR, NOT and XOR gates using IC 7400. Realization of AND, OR, NOT and XNOR gates using IC 7402. Half adder and half subtractor using IC 7400. Clocked RS flip flop using IC 7400. Verification of truth table of JK flip-flop using IC 7476 and conversion of JK FF into T FF.	2 Hr 2 Hr 2 Hr 2 Hr 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 [Analog Electronics]** **Duration of the course: Between 16-09-21 to 30-11-21**	
		Term - II Theory	
	1	Field Effect Transistor (FET)	4 Hr
		Field Effect Transistor (FET) Introduction, types, Junction field effect transistor (JFET) construction, working and characteristics. Definition of drain resistance r_d, transconductance g_m, amplification factor μ. Derivation of $\mu = g_m r_d$. Comparison of BJT and JFET, problems. (No expression $g_m = g_{mo}(1-V_{GS}/V_P)$)	
	4	Feedback in Amplifiers	5 Hr
	4.1	Introduction to feedback – Need for feedback in amplifiers, block diagram illustrating the principle of feedback in amplifiers – feedback ratio, open loop gain, closed loop gain.	1 Hr
	4.2	Positive and negative feedback- explanation, advantages, disadvantages and applications.	1 Hr
	4.3	Block diagrams showing negative feedback -transfer functions, comparison of input and output impedances.	1 Hr
	4.4	Voltage series negative feedback – Derivation of the expressions for voltage gain, input and output impedances. Frequency response of negative feedback amplifier, expressions for bandwidth and cutoff frequencies, problems.	2 Hr
	5	Operational amplifier (Op-Amp)	13 Hr
	5.1	Differential amplifier (mention four modes with circuit diagrams)	1 Hr
	5.2	Operational Amplifier (op-amp) – Block diagram, circuit symbol, characteristics of ideal op-amp (open loop gain, input and output impedances, bandwidth, CMRR, slew rate, input and output offset voltages). Mono op-amp ICs (mention only).	2 Hr
	5.3	Application of Op-Amp with negative feedback: Inverting Amplifier – Circuit diagram, explanation and derivation of the expression for voltage gain, Concept of virtual ground and virtual short. Non-inverting Amplifier– Circuit diagram, working and derivation of the expression for voltage gain Buffer Amplifier – Circuit diagram, working and derivation of the expression for voltage gain, its applications. Problems.	3 Hr
	5.4	Summing amplifier: Three input inverting summing amp – Circuit diagram, working	2 Hr

		and derivation of the expression for the output voltage, adder. Difference amplifier: Circuit diagram, working and derivation of the expression for the output voltage, subtractor, Problems	
	5.5	Integrator and differentiator: Basic circuits, working and derivations for output voltage, output wave forms for sine wave & square wave. (No Problems).	2 Hr
	5.6	Active filters: first order high pass and low pass filters – Circuit diagrams, working and and frequency response, expression for cutoff frequency in each case. Problems.	2 Hr
	5.7	Comparator– Circuit diagram, working output wave form and (mention any one application)	1 Hr
	6	Oscillators	8 Hr
	6.1	Introduction – Electronic oscillators, sinusoidal and non sinusoidal oscillators. Sinusoidal oscillations – damped and un-damped oscillations. Basic principle of an oscillator – positive feedback, review of the expression for voltage gain of a positive feedback amplifier (infinite gain). Block diagram– Barkhausen's criteria, startup of oscillations and start up condition.	2 Hr
	6.2	Classification of sinusoidal oscillators: LC, RC and Crystal oscillators (mention the types of these). Damped oscillations in a tank circuit, losses. Hartley and Colpitts oscillators – Circuits using transistor, working, Barkhausen Condition and expression for the frequency of oscillations in each case. Advantage, disadvantages, applications, Problem	2 Hr
	6.3	RC oscillators: Noise voltages as startup, principle of phase shift in RC circuits Phase shift oscillator – phase shift network, principle, circuit using Op-amp, working, Barkhausen conditions, expression for the frequency of oscillations, problems. Wein bridge oscillator – principle of lead-lag network, oscillator circuit using Op-Amp, working, Barkhausen conditions, expression for the frequency of oscillations, problems. Advantages of RC oscillators over LC oscillators, any two advantages of Wein bridge oscillator over Phase shift oscillator, applications of RC oscillators.	2 Hr
	6.4	Crystal oscillator – Principle, equivalent circuit of a crystal. Colpitts oscillator circuit with inductance replaced by crystal, working, Barkhausen conditions, advantages of crystal oscillator over other types of oscillators and applications.	2 Hr

		Term II Practical [FET and Op-Amp]	
	6	Characteristics of common source n-channel JFET – determination of its parameters.	2 Hr
	7	Op-amp inverting and non-inverting amplifier.	2 Hr
	8	Op-amp adder and subtractor – for two DC input signals.	2 Hr
	9	First order low-pass filter using op-amp – to study frequency response and determine its cut-off frequency.	2 Hr
	10	First order high-pass filter using op-amp – to study frequency response and determine its cut-off frequency.	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 [Communication]** **Duration of the course: Between 01-12-21 to 30-01-22**	
		Term – III Theory	
	7	Wireless Communications	4 Hr
	7.1	Introduction to communication system, basic block diagram– function of each block, definitions of noise, signal to noise ratio and noise figure.	1 Hr
	7.2	Propagation of radio waves: Introduction-various paths of propagation. Ground waves, ground reflected waves, space waves, sky waves – Qualitative study of each.	1 Hr
	7.3	Ionosphere: Role of ionosphere in the process of long distance communication, different layers of ionosphere, thickness, constitution and operating frequency range.	1 Hr
	7.4	Sky waves: Mention the reflection mechanism with diagrammatic representation, definitions of the terms-critical frequency, critical angle, skip distance, skip zone, single hop and multiple hop, idea of signal fading.	1 Hr
	8	Modulation and Demodulation	17 Hr
	8.1	Modulation-definition, need, types of analog modulation, definition of each.	1 Hr
	8.2	Amplitude modulation (AM): Definition, explanation using waveform representation. Modulation index: Definition, expressions, percentage modulation, representation of AM wave for different values of modulation index, importance, limitations.	2 Hr

		Problems.	
	8.3	Derivation for the instantaneous voltage of an AM signal - frequency spectrum, Power relations in AM signal: derivations for the interrelations between carrier power, side-band power and total power. Power dissipated in a load in terms of current. Problems.	3 Hr
	8.4	AM transmitter – block diagram, function of each stage, applications of AM transmission.	2 Hr
	8.5	Frequency modulation (FM): Definition, representation of FM waveform. Definition of the terms frequency deviation, carrier swing, modulation index, percentage modulation, deviation ratio. Mention instantaneous voltage equation of FM signal (No derivation, Only problems).	3 Hr
	8.6	Demodulation: Definition, need. AM detection – principles of detection, linear diode detector-circuit, principle of working and waveforms.	2 Hr
	8.7	AM Superheterodyne Radio Receiver– Principle, block diagram, function of each stage with waveform, qualitative study of AGC, FM Superheterodyne Radio Receiver– Principle, block diagram, function of each stage with waveform. Characteristics of Radio receiver: Qualitative study of sensitivity, selectivity, signal to noise ratio, fidelity and stability.	3 Hr
	8.8	Antenna: Definition, mention types of antenna - helical, Yagi, loop, horn and micro strip antennas.	1 Hr
	13	Modern Communication Systems	6 Hr
	13.1	Cellular mobile Phone Network: Introduction, Network operation: Frequency reuse, call hand off, cell splitting, types of communication systems (GSM & CDMA mention only)	2 Hr
	13.2	Internet (No architecture), Wi-Fi , Bluetooth and Optical fiber communications – principle, block diagrams and explanation. Satellite Communication System – basic block diagram, function of each block, applications.	2 Hr

	13.3	RADAR Communication System: Introduction, principle, basic block diagram, function of each block, application	2 Hr
		Term – III Practical [Amplifiers and Oscillators]	
	11	CE amplifier – to study the frequency response and determine its bandwidth.	2 Hr
	12	CB amplifier – to study the frequency response and determine its bandwidth.	2 Hr
	13	Colpitts oscillator using BJT.	2 Hr
	14	Wein bridge oscillator using op-amp.	2 Hr
	15	Phase shift oscillator using op-amp.	2 Hr
		Activity: Assignment 3 for Term III (theory) to be submitted before 5-02-22	
8		**II Unit Test between 28-01-22 to 31-01-22 (for Term III)**	
9		**TERM – IV [Applied Electronics]** **Duration of the course: Between 01-02-22 to 31-03-22**	
		Term – IV Theory	
	9	Power Electronics and its applications	10 Hr
	9.1	Power Electronics : Power semiconductor devices, Power diode-construction, Power transistor, Silicon controlled rectifier (SCR), TRIAC, Power Metal Oxide Field Effect Transistor (MOSFET), Insulated Gate Bipolar Transistor(IGBT) - operations, V-I characteristics for each device. Problems.	6 Hr
	9.2	Applications of Power Electronics :Power converters, single phase AC to DC controlled rectifier, single phase fully controlled half wave rectifier and full wave rectifier using RC triggering circuit with R load, AC to AC converter (AC voltage controller), single phase full wave AC voltage controller using TRIAC, DC to DC chopper using MOSFET, DC to AC inverter using IGBTs, Problems.	4 Hr
	11	Microcontroller	10 Hr
	11.1	Microcontroller: Introduction, block diagram of microprocessor, 8051 block diagram, comparison between microprocessor & microcontroller and pin out diagram of 8051. Addressing modes: Introduction, types, register addressing mode, immediate addressing mode, direct addressing mode, indirect addressing mode. Instructions set – data transfer instructions, arithmetic instructions,	7 Hr
	11.2	Assembly language programming (ALP) – addition, subtraction, multiplication, division – of two 8-bit numbers.	3 Hr

	12	C – Programming	10 Hr
	12.1	C Introduction - Features, format of C processor, the #include and #define directives, mention <stdio.h>, <conio.h>, <math.h>, writing C programs, C program fundamentals: Character set, key words, identifiers, data types, constants and variables, statements, expressions, operators, precedence and associativity of operators, type conversion, managing input and output, C programs.	6 Hr
	12.2	Selective control statements–if statement, if-else statement, if-else-if statement, switch-case statement. Iterative control statements – while loop, do-while loop, for loop statement, break statement, continue statement, C programs (No quadratic equation)	4 Hr
		Term – IV Practical [Applied Electronics]	
	16	SCR Characteristics – for two values of I_G	2 Hr
	17	Full Wave rectifier using SCR – by RC triggering method	2 Hr
	18	ALP for addition of two 8 bit numbers (execution for a given program)	2 Hr
	19	ALP for multiplication of two 8 bit numbers (execution for a given program)	2 Hr
	20	C program to accept three integers and print the largest amongst them (execution for the given program)	2 Hr
	21	C program to find i) sum of n integers and ii) sum and average of four given numbers (execution for the given program) **Note: Any 10 experiments must be performed (Among four Terms)**	2 Hr
10		**Preparatory Exam between 24-03-22 to 30-03-22 (for Full syllabus)**	
11		**Annual Exam to be held in the 1st week of April 2022 (for Full syllabus)**	

****