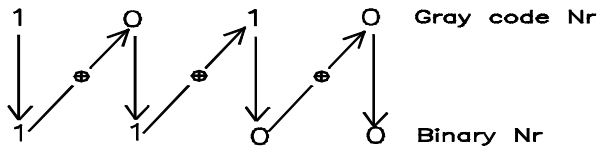
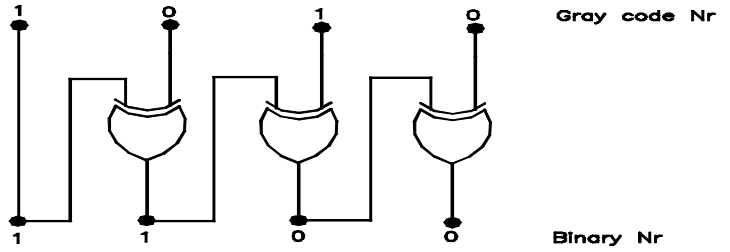
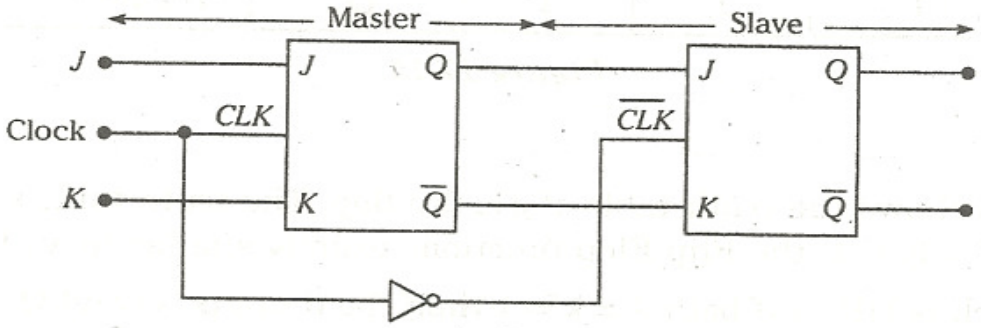
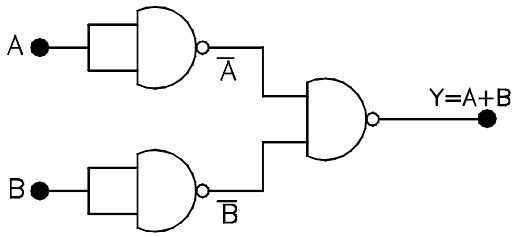
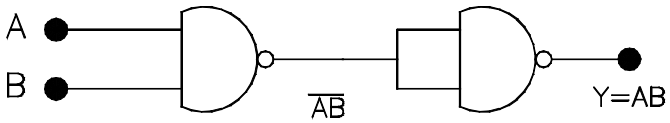
GOVERNMENT OF KARNATAKA
KARNATAKA STATE PRE-UNIVERSITY EDUCATION EXAMINATION BOARD
II YEAR PUC EXAMINATION – MARCH-2012
SCHEME OF VALUATION

Subject Code: 40 Subject: **ELECTRONICS**

Qn. No.	**PART - A**	Marks Allotted
01.	Which is the largest of three transistor currents?	1
Ans	Emitter current OR I_E.	1
02.	Name the transistor amplifier that has current gain less than unity?	1
Ans	Common base amplifier OR CB amplifier.	1
03.	What kind of negative feedback increases input impedance and decreases output impedance?	1
Ans	Voltage series feedback.	1
04.	When does a comparator give zero output?	1
Ans	When both the inputs are at equal voltage.	1
05.	Why are oscillators damped in a tank circuit?	1
Ans	Due to loss of energy in tank circuit.	1
06.	Define single hop distance.	1
Ans	The distance from the transmitting antenna measured along the earth surface where the first hop takes place is called single hop distance.	1
07.	What is the value of modulation index if a carrier wave of amplitude 6V is amplitude modulated by audio signal of amplitude 4V?	1
Ans	$m_a = V_m/V_c = 4/6 = 0.66$	1
08.	Write the Boolean expression for two input XNOR gate.	1
Ans	$Y = \overline{A \oplus B}$ OR $Y = \bar{A}\bar{B} + AB$	1
09.	Convert $(123)_{10}$ into excess-3 code.	1
Ans	Decimal Nr = 1 2 3 +3 +3 +3 Excess-3 code = 0100 0101 0110	1
10.	Expand PSTN.	1
Ans	Public Switched Telephone Network	1
	PART - B	
11.	Obtain the relation between α and β.	2
Ans	We have $I_E = I_C + I_B$ ..... (1) Divide equation(1) by I_C We get $I_E/I_C = I_C/I_C + I_B/I_C$	1
	$1/\alpha = 1 + 1/\beta$ Therefore $\alpha = \beta/(1 + \beta)$	1
12.	A transistor is connected in CE mode. When collector to emitter voltage increases from 2V to 5V the collector current increases from 5 mA to 5.5 mA. Calculate the dynamic output resistance.	2

Qn. No.	ELECTRONICS	Marks Allotted
12.	$r_0 = \Delta V_{CE}/\Delta I_C$	1
Ans	$= (5 - 2)/(5.5 - 5) \times 10^{-3} = 3/ 0.5 \times 10^{-3} = 6000\ \Omega$ OR $6\ k\Omega$	1
13.	An amplifier has a voltage gain of 150. Express the gain in decibels.	2
Ans	Gain in dB = $20 \log_{10} A$	1
	$= 20 \log_{10} 150$	
	$= 43.52$	1
14.	What are the characteristics of CC amplifier?	2
Ans	➢ High/very high input impedance ➢ Low output impedance ➢ Voltage gain < 1 (or unity) ➢ High current gain ➢ O/p signal is in phase with input signal Any two of the above, each carry 1 mark	2
15.	Distinguish between Open loop gain and closed loop gain?	2
Ans	Open loop gain - Gain without feedback	1
	Closed loop gain - Gain with feedback	1
16.	Mention any four characteristics of ideal Op-Amp.	2
Ans	➢ The open loop voltage gain is infinity ($Av = \infty$). ➢ The input impedance is infinity ($Zi = \infty$). ➢ The output impedance is zero ($Z_0 = 0$). ➢ The bandwidth is infinite ($BW = \infty$). ➢ The common mode rejection ratio is infinity ($CMRR = \infty$). ➢ The slew rate is infinity ($SR = \infty$). ➢ Perfect balance i.e., the output voltage is zero when both the inputs are equal. ➢ Characteristics do not drift with temperature. Any four of the above, each carry 1/2 mark	2
17.	State Barkhausen criteria for sustained oscillations.	2
Ans	➢ The loop gain $A_V\beta$ should be unity <u>OR</u> $\lvert A_V\beta \rvert = 1$ <u>OR</u> $1 + A_V\beta = 0$.	1
	➢ The overall phase shift of the feedback circuit and the amplifier must be 0 or integral multiple of 2π.	1
18.	What are ground waves and sky waves?	2
Ans	<u>Ground Waves:</u> These are the radio waves travels along the earth surface.	1
	<u>Sky waves:</u> These are the radio waves, sent towards the sky, they get reflected back to earth from the ionosphere.	1
19.	A 10 kHz audio signal is used to frequency modulate a 100 MHz carrier causing carrier deviation of 75 kHz. Determine modulation index	2
Ans	$m_f = \delta/f_m$	1
	$= (75 \times 10^3)/(10 \times 10^3) = 7.5$	1
20.	Using X-OR gate, convert the gray code 1010 into binary code. Draw the logic diagram.	2
Ans		1

Qn. No.	ELECTRONICS	Marks Allotted
20. Ans		1
21.	Draw the block diagram of JK Master-slave flip-flop.	2
Ans	 JK Master Slave flip-flop	2
22.	Construct OR and AND gates using NAND gates.	2
Ans	 OR gate using NAND gates	1
	 AND gate using NAND gates	1
	PART - C	
23.	Using the following data, calculate the theoretical and experimental values of voltage gain for an Op-Amp inverting amplifier. Input voltage = 0.75 volts.	4

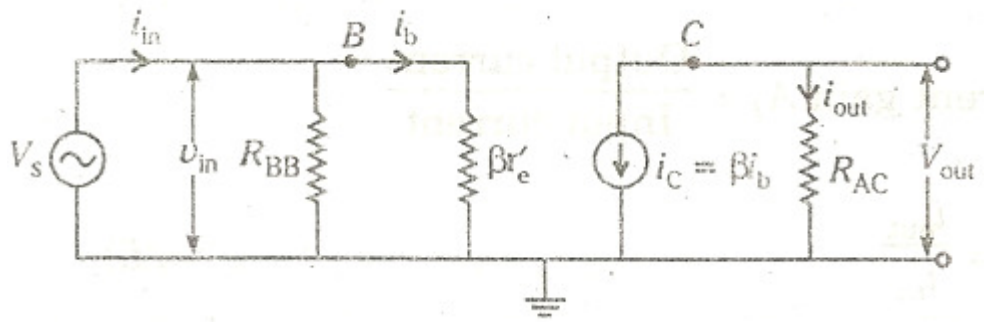
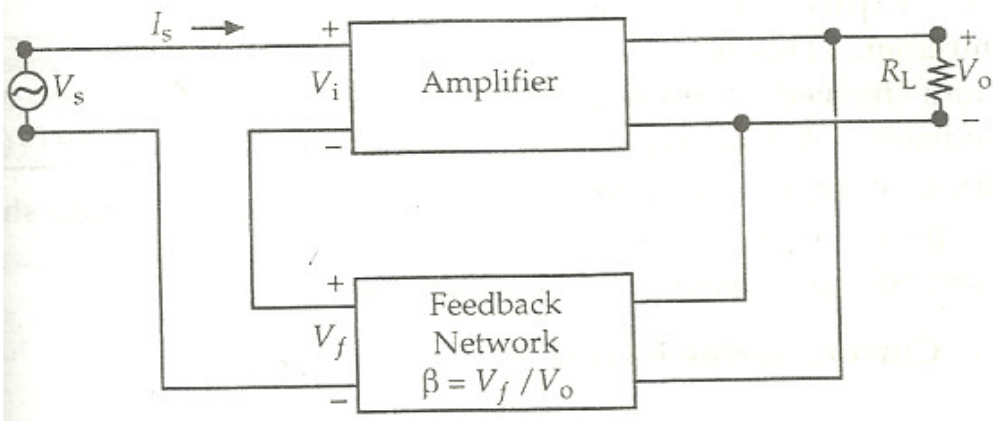
Trial No.	R_i in kΩ	R_f in kΩ	V_0 in volts	Voltage gain	
				Theoretical	Practical
1	2.2	8.2	-2.72		
2	4.7	10	-1.6		

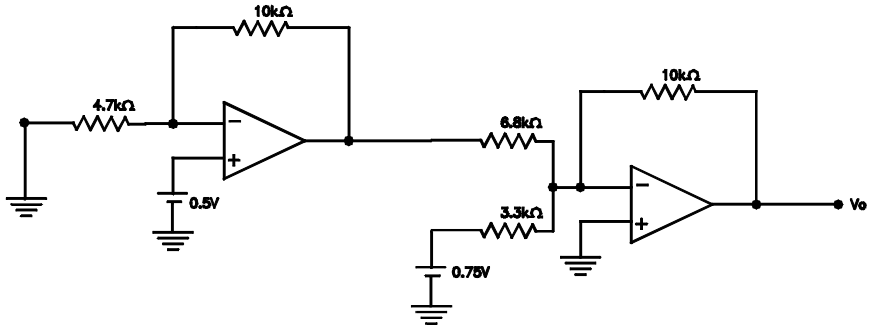
Qn. No.	ELECTRONICS	Marks Allotted
23. Ans	Theoretical voltage gain : $A_{VT} = - R_f/R_i$ Practical voltage gain : $A_{VP} = V_0/V_i$ Trial No.1 $A_{VT} = - 8.2k/2.2k = - 3.72$ $A_{VP} = - 2.72/0.75 = - 3.62$ Trial No.2 $A_{VT} = - 10k/4.7k = - 2.13$ $A_{VP} = - 1.6/0.75 = - 2.13$	1 1 1 1
	OR	
23.	The following readings were recorded in a CE amplifier experiment. Calculate the voltage gain. Input voltage = 50 mV.	

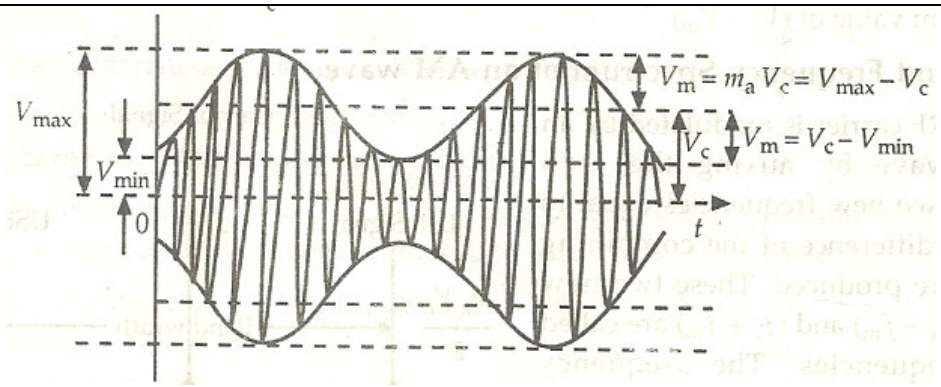
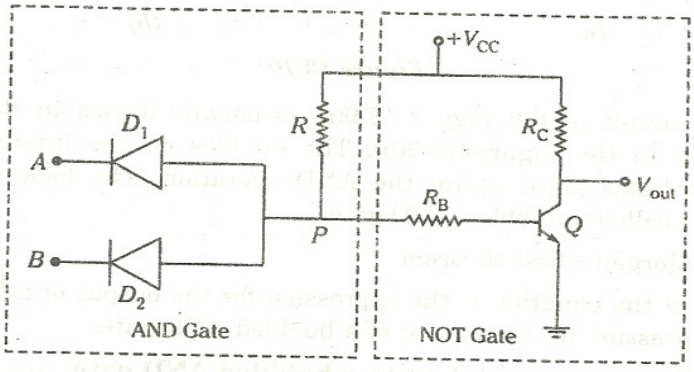
Frequency in Hz	200	500	1k	5k to 100k	500k	700k
Output voltage in volts	2	2.5	4.5	5	4.2	3.5
Voltage gain						

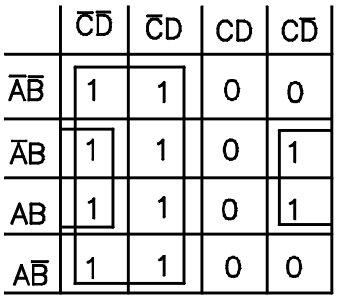
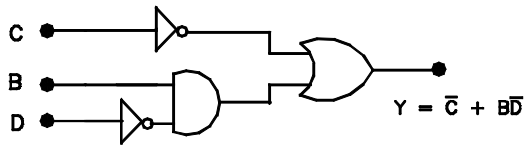
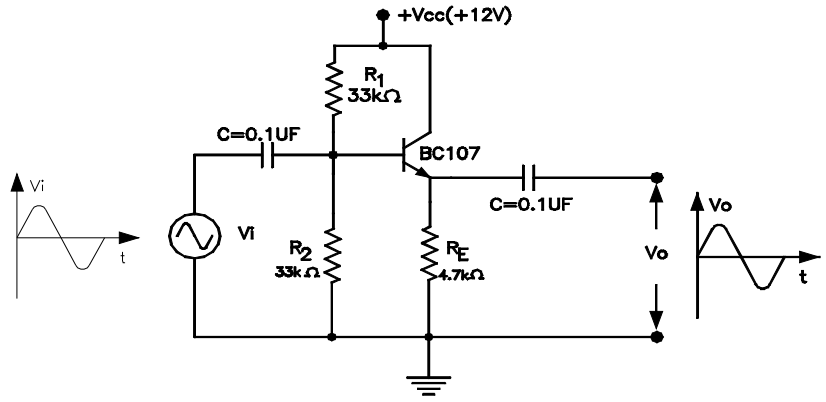
4

Ans	Voltage gain: $A_V = V_0/V_i$ At 200 Hz $A_V = 2/50x10^{-03} = 40$ At 500 Hz $A_V = 2.5/50x10^{-03} = 50$ At 1 kHz $A_V = 4.5/50x10^{-03} = 90$ At 5kHz to 100 kHz $A_V = 5/50x10^{-03} = 100$ At 500 kHz $A_V = 4.2/50x10^{-03} = 84$ At 700 kHz $A_V = 3.5/50x10^{-03} = 70$	1 1 1 1
24.	An amplifier has a midband gain of 200. If the lower cut-off frequency and upper cut-off frequency are 500 Hz and 300 kHz, calculate the bandwidth and gain at cut-off frequencies.	4
Ans	Bandwidth = $f_2 - f_1$ $= 300 \times 10^3 - 500 = 299.5$ kHz Gain at cut-off frequency = $A/\sqrt{2}$ $= 200/\sqrt{2} = 141.42$	1 1 1 1
25.	Using re-model, derive the expression for voltage gain and input impedance of CE amplifier	4

Qn. No.	ELECTRONICS	Marks Allotted
25 Ans		1
	Where $R_{BB} = R_1 \| R_2$ and $R_{AC} = R_C \| R_L$	
	re-Model equivalent circuit $\upsilon_i = i_b \beta re^1$ $\upsilon_0 = - i_c(R_C \| R_L)$	1
	Voltage gain: $A_\upsilon = \upsilon_0/\upsilon_i$ $A_\upsilon = - i_c(R_C \| R_L)/i_b \beta re^1 = - (R_C \| R_L)/re^1$ $A_\upsilon = - R_C/ re^1$ - may also be considered	1
	Input impedance: $Z_i = (R_1 \| R_2) \| \beta re^1$	1
26.	With a block diagram, derive the expression for voltage gain of negative feedback amplifier.	4
Ans		1
	Voltage Series negative feedback Amplifier	
	Gain of the amplifier without feedback, $A = V_0/V_i$ ……(1) Gain of the amplifier with feedback, $A_f = V_0/V_s$ ……(2) $V_i = V_s - V_f$ ……(3)	

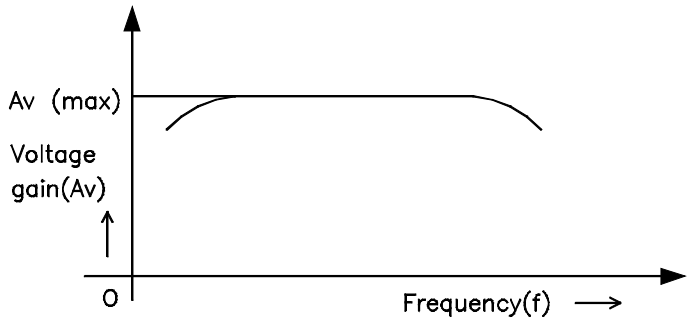
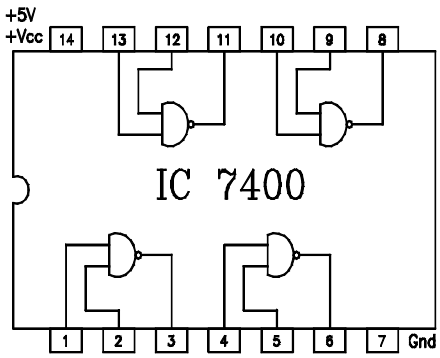
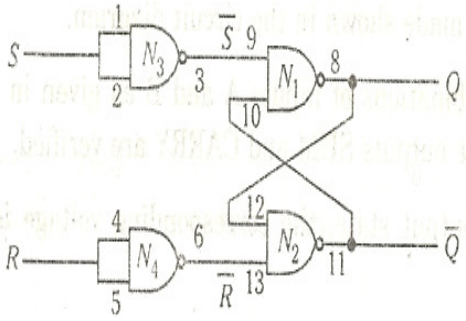
Qn. No.	ELECTRONICS	Marks Allotted
26. Ans	$\beta = V_f/V_0$ .....(4) $V_0 = AV_i$ from eqn (1) $= A(V_s - V_f)$ from eqn (3) $= A(V_s - \beta V_0)$ from eqn (4) $V_0 = AV_s - A\beta V_0$ $V_0(1 + A\beta) = AV_s$ (for proper steps 2 marks) $A_f = V_0/V_s = A/(1 + A\beta)$	2 1
27.	Calculate the output voltage for the circuit shown below  	4
Ans	<u>For non-inverting amplifier:</u> $V_0 = (1 + R_f/R_i)V_i$ $V_0 = (1 + 10k/4.7k)0.5 = 1.56$ V <u>For inverting adder:</u> $V_0 = -[(R_f/R_1)xV_1 + (R_f/R_2)xV_2]$ $V_0 = -[(10k/6.8k)x1.56 + (10k/3.3k)x0.75]$ $= -4.56$ V	1 1 1 1
28.	A Colpitt's oscillator generates a frequency of 500 kHz. The capacitors to be used are $C_1 = 100$ pF and $C_2 = 10$ pF. Find the value of inductance.	4
	$f = \frac{1}{2\pi\sqrt{LC_T}}$ OR $L = \frac{1}{4\pi^2 f^2 C_T}$ Where $C_T = \frac{C_1 C_2}{(C_1 + C_2)}$ $C_T = \frac{100 \times 10^{-12} \times 10 \times 10^{-12}}{(100+10) \times 10^{-12}} = 9.09 \times 10^{-12}$F $L = \frac{1}{4\pi^2 (500 \times 10^3)^2 (9.09 \times 10^{-12})}$ (for substitution and simplications 2 marks) L = 11.157 mH	1 2 1

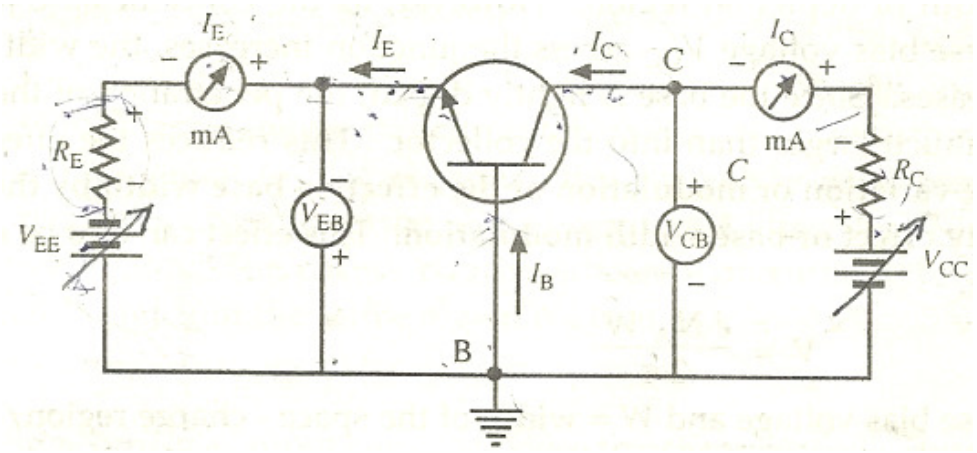
Qn. No.	ELECTRONICS	Marks Allotted
29.	Derive an expression for modulation index in terms of V_{max} and V_{min}. Draw the modulated wave.	4
Ans	 Amplitude Modulated wave Modulation index, $m_a = V_m/V_C$ From figure, $V_m = \frac{Vmax - Vmin}{2}$ ……..(1) $V_C = Vmax - V_m$ $V_C = Vmax - \left[\frac{Vmax - Vmin}{2}\right]$ from equation(1) $V_C = \frac{Vmax + Vmin}{2}$ (proper steps - 2 marks) $m_a = \frac{Vmax - Vmin}{Vmax + Vmin}$	1 2 1
30.	Explain two-input DTL NAND gate with a circuit. Write its truth table	4
Ans	 DTL NAND Gate **Ckt – 1 mark**	1
	Truth table Inputs: A, B; Output: Y(Vout) 0 0 1 0 1 1 1 0 1 1 1 0 **Table - 1 mark**	1
	Working ➢ When A = 0, B = 0, then D_1 and D_2 conducts, Q off, therefore $Y(V_{out}) = 1$ ➢ A = 0, B = 1, then D_1 conduct and D_2 doesn't conducts, Q off, $Y(V_{out}) = 1$ ➢ A = 1, B = 0, then D_1 doesn't conducts and D_2 conduct, Q off, $Y(V_{out}) = 1$ ➢ A = 1, B = 1, then D_1 and D_2 doesn't conducts, Q on, therefore $Y(V_{out}) = 0$	2

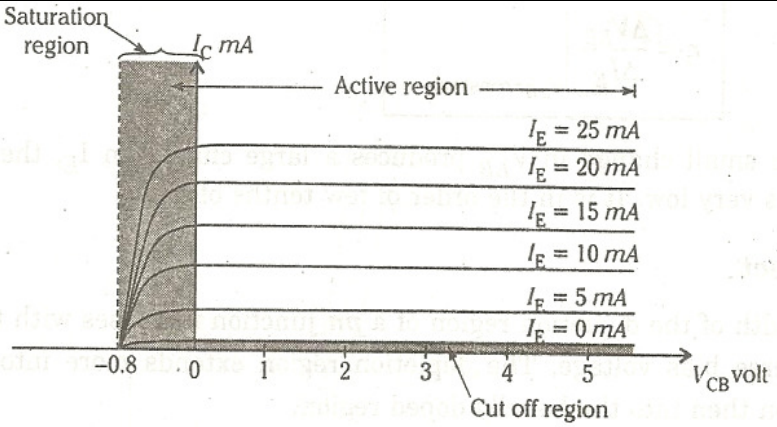
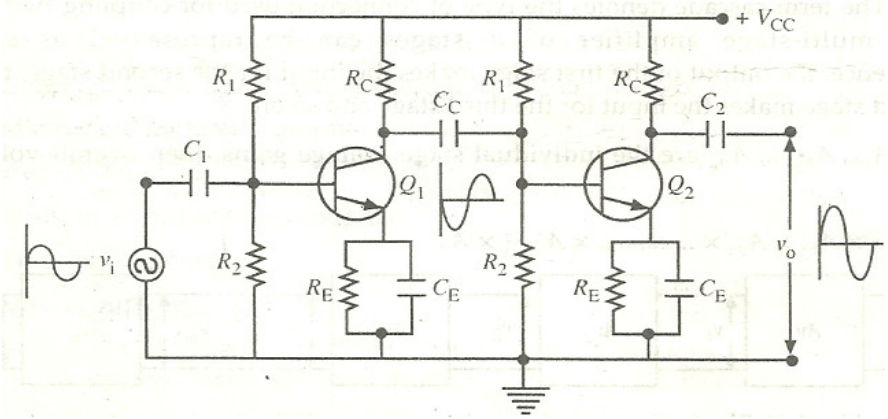
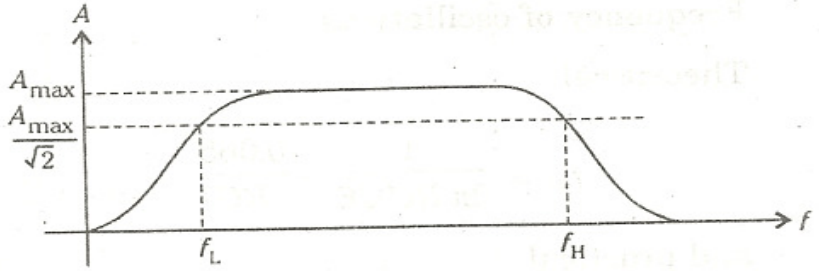
Qn. No.	ELECTRONICS	Marks Allotted
31.	Using K-map, simplify the following Boolean expression Y = f(A, B, C, D) = ∑m(0, 1, 4, 5, 6, 8, 9, 12, 13, 14). Draw the logic diagram for the simplified expression using basic gates	4
Ans	 $Y = \bar{C} + B\bar{D}$  	2 1 1
	PART - D	
32.	Describe an experiment to study the frequency response of CC amplifier	6
Ans	Aim: To conduct an experiment to draw frequency response of CC amplifier Equipment & components: CC amplifier circuit, DC power supply, signal generator, CRO, etc.,  CC Amplifier Observations: Note: Suitable components values must be considered Voltage gain = V_0/V_i	1 1

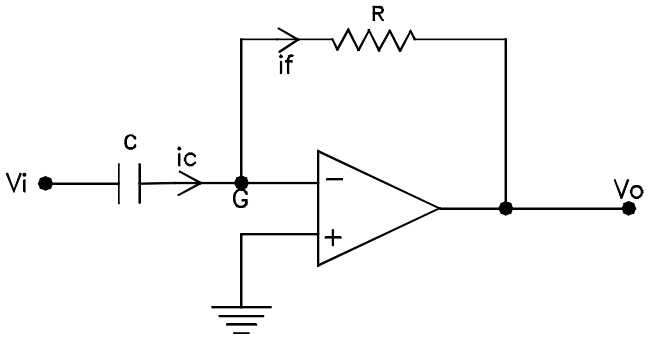
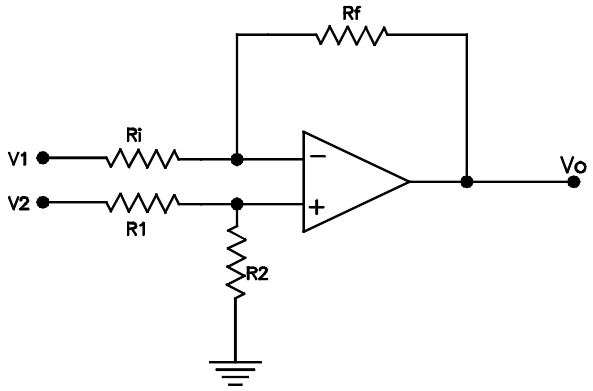
Frequency	Input voltage, Vi	Output voltage, V0	Gain = V_0/V_i

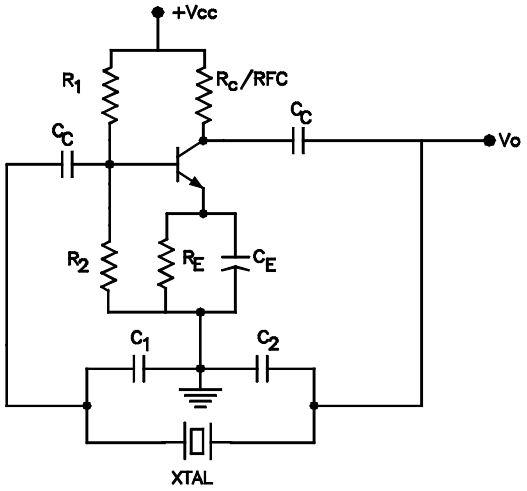
1

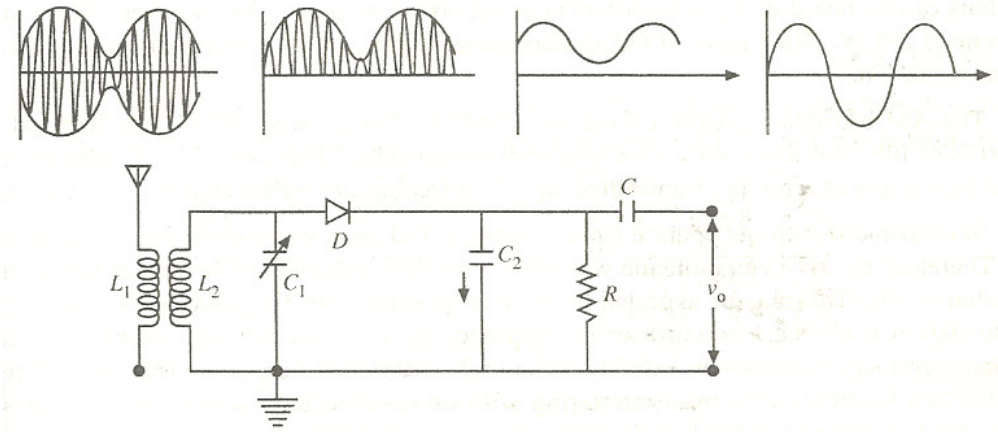
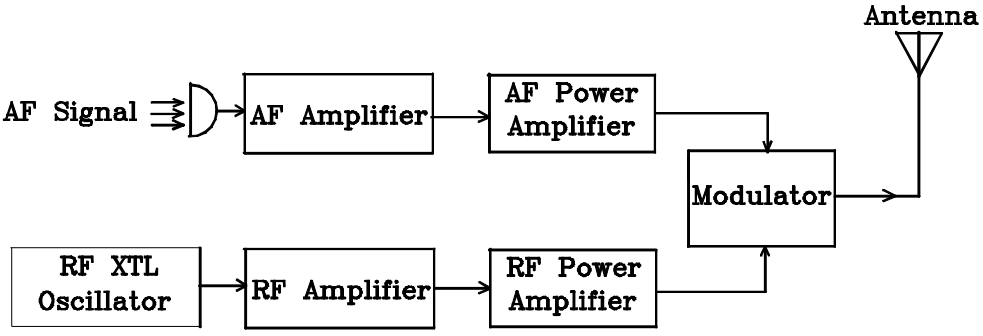
Qn. No.	ELECTRONICS	Marks Allotted
32 Ans	 Frequency response Procedure: ➢ Connect signal generator to input terminals. ➢ Connect CRO across input & output terminals. ➢ Keep suitable input voltage, observe & record output voltage. ➢ Do the experiment for different frequencies. ➢ Determine gain for each frequency using the formula, $A_V = V_0/V_i$ ➢ Plot a graph of voltage gain verses frequency (Proper procedure must be considered) Result: Frequency response of CC amplifier is drawn experimentally	1 1 1
	OR	
32.	Describe an experiment to study RS flip-flop using NAND gates	6
Ans	Aim: To conduct & to study RS flip-flop using NAND gates Equipment & components: Digital IC trainer, IC 7400, connecting wires etc.,	1
	 Pin diagram of IC 7400 Pin diagram - 1 mark	
	 RS flip-flop using NAND gates Circuit diagram - 1 mark Note: Pin number connections in proper order must be considered.	1

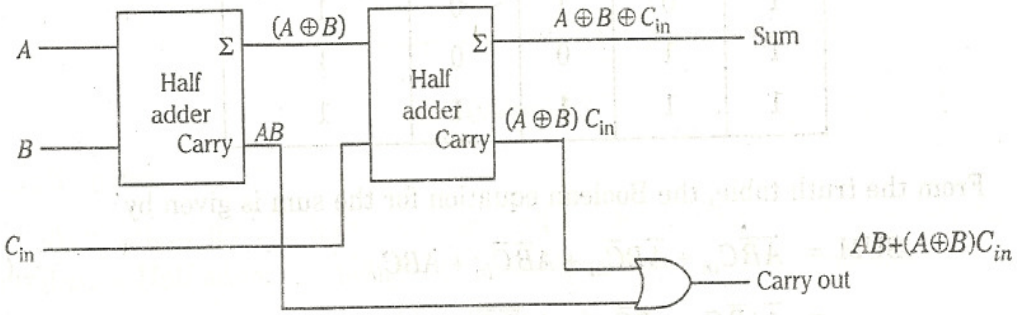
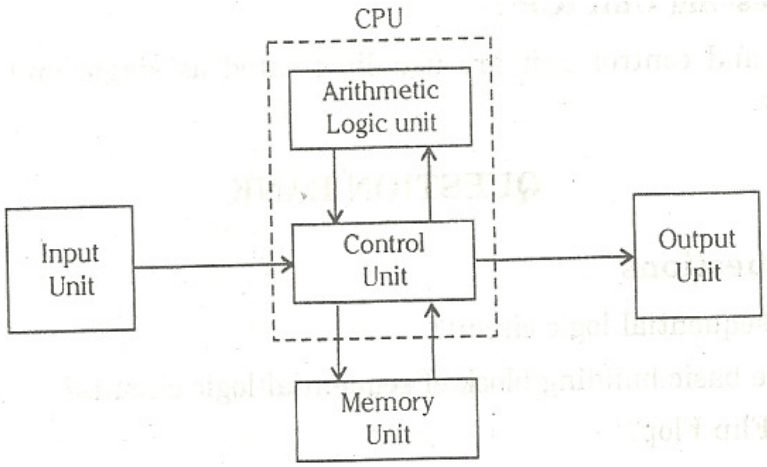
Qn. No.	ELECTRONICS	Marks Allotted
Ans	Truth table Inputs: S, R; Outputs: Q, $\overline{Q}$; Conditions 0 0 Last state Last state No change 0 1 0 1 Reset 1 0 1 0 Set 1 1 1 1 Forbidden Procedure: ➢ Connect pin 7 to Gnd and pin 14 to $+V_{CC}$. ➢ Circuit connections are made to form RS flip-flop. ➢ Verify the truth table for various input conditions. (Proper procedure must be considered) Result: RS flip-flop using NAND gate is constructed and truth table is verified.	2 1 1
33a.	With the circuit diagram, describe the procedure to draw output characteristics in CB mode.	4
Ans	 CB Amplifier An arrangement to draw characteristics of CB amplifier is shown in figure. Suitable meters and power supplies are used to carryout the experiment. Output Characteristics: To draw output characteristics keep input current I_E constant. By varying output voltage V_{CB} note down corresponding output current I_C. Do experiment for different I_E. Plot a graph of I_C verses V_{CB} for constant I_E. (Proper procedure must be considered)	1 2

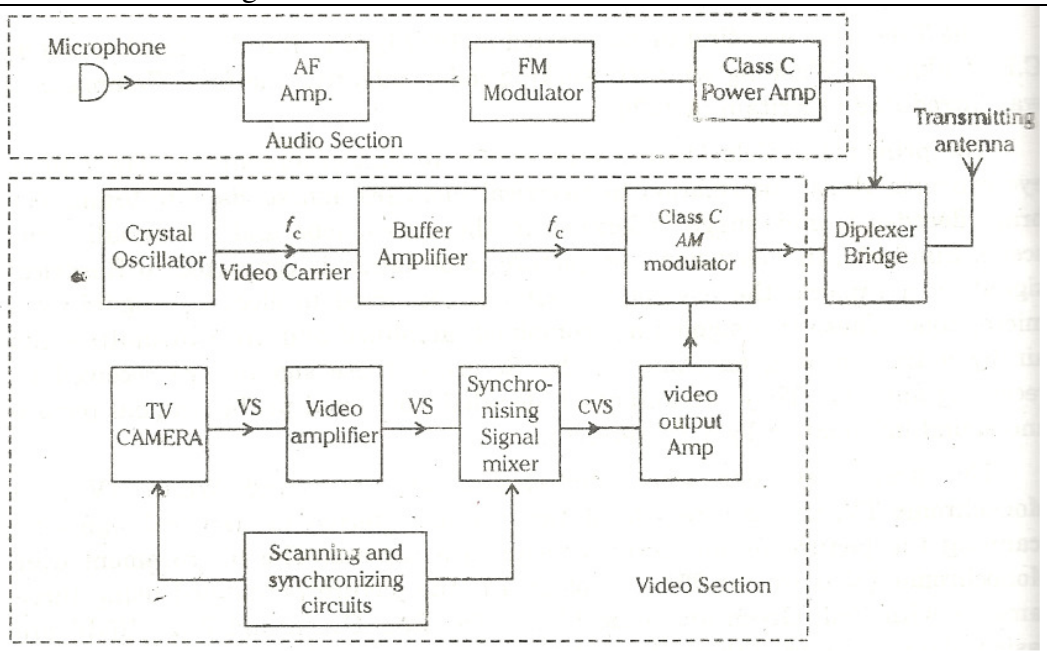
Qn. No.	ELECTRONICS	Marks Allotted
33a. Ans	 Output Characteristics of CB amplifier	1
33b.	Mention the steps involved to obtain dc equivalent circuit	2
Ans	➢ Reduce all AC sources to zero ➢ Open all capacitors	1 1
34.	Explain the working of RC coupled amplifier with a circuit. Draw its frequency response. Mention its one advantage.	6
Ans	 RC Coupled amplifier Circuit diagram of RC coupled amplifier is shown in figure. One stage of CE amplifier is coupled to next stage by coupling capacitors. <u>Working</u>: Coupling capacitor allows ac signals but blocks dc signals. The first CE amplifier produces a phase shift of 180^0 and second stage also produces a phase shift 180^0. Therefore the output V_0 is in same phase with input V_i. <u>Frequency response of RC coupled amplifier:</u> 	2 2 1

Qn. No.	ELECTRONICS	Marks Allotted
34 Ans	Advantage of RC coupled amplifier: ➢ Inexpensive. ➢ Wide frequency response. ➢ Less frequency distortion. ➢ Gain is large. Anyone advantage	1
35a.	What is a differentiator? Derive an expression for its output voltage.	4
Ans	<u>Differentiator:</u> The Op-amp circuit whose output is proportional to the derivative of the input signal is called differentiator.	1
	 Op-Amp differentiator	1
	From the figure $i_C = if$ $dQ/dt = (0 - V_0)/R$ $C[dV_i/dt] = - V_0/R$ Therefore, $V_0 = -RC[dV_i/dt]$ (Proper steps must be considered)	2
35b.	Draw the circuit diagram of Op-Amp subtractor. Write the expression for output voltage when all the resistors are equal.	2
Ans	 Op-Amp Subtractor	1
	<u>Expression for output</u> when Rf = Ri = R1 = R2 = R $V_0 = V_2 - V_1$	1

Qn. No.	ELECTRONICS	Marks Allotted
36a.	What is piezoelectric effect? Draw the circuit of crystal oscillator. Mention any one advantage.	4
Ans	<u>Piezoelectric effect:</u> When an AC voltage is applied between the faces of quartz crystal it vibrates at the frequency of the applied voltage. Consequently, if the crystal is vibrated mechanically an AC voltage is generated.	1
	<u>Crystal Oscillator:</u> 	2
	<u>Advantage of xtal oscillator:</u> ➢ Frequency stability. ➢ High quality factor. ➢ Long life. Any one advantage	1
36b.	An RC phase shift oscillator produces oscillations of frequency 200 Hz with C = 0.1 μF. Calculate the value of R.	2
Ans	$f = \frac{1}{2\pi R C\sqrt{6}}$ OR $f = 0.065/RC$ OR $R = \frac{1}{2\pi f C\sqrt{6}}$ OR $R = 0.065/fC$	1
	$R = \frac{1}{2 \times 3.142 \times 200 \times 0.1 \times 10^{-06} \times \sqrt{6}} = 3.248\ k\Omega$	1
37a.	The equation of FM wave is $V_{FM} = 20(\sin 8 \times 10^8 t + 10 \sin 4800t)$. Find: (i) Carrier frequency (ii) Modulting frequency (iii) Modulation index & (iv) Frequency deviation.	4
Ans	The standard form of FM equation is $V_{FM} = V_C \sin(\omega_c t + m_f \sin\omega_m t)$ ……..(1) But the given expression is $V_{FM} = 20(\sin 8 \times 10^8 t + 10 \sin 4800t)$ .....(2)	

Qn. No.	ELECTRONICS	Marks Allotted
37a. Ans	To solve this problem, equation (1) need tobe equated to equation (2). This is not possible because equation (2) is not of the standard FM equation form. **Note: If the quastion number (37a) is written by the student, full (4) marks must be awarded.**	**4**
37b.	Express $Y = A + \overline{B}\,\overline{C}$ into standard cononical SOP form.	2
Ans	$Y = A + \overline{B}\,\overline{C}$ $Y = A(B+\overline{B})(C+\overline{C}) + (A+\overline{A})\overline{B}\,\overline{C}$ $Y = ABC + A\overline{B}C + AB\overline{C} + A\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,\overline{C}$	1 1
38a.	Explain linear diode detector with a circuit and waveforms.	4
	 Linear diode detector Working: ➢ Diode D rectifies AM wave. ➢ Capacitor C_2 provides low reactance to carrier and high reactance to signal. ➢ Resistor R provides discharging path to C_2. ➢ Capacitor C adds zero level to detected signal.	1 1 2
38b.	Draw the block diagram of AM transmitter.	2
	 Block diagram of AM Transmitter	2
39a.	What is full adder? Draw block diagram of full adder using two half adders and OR gate. Write its truth table.	4

Qn. No.	ELECTRONICS	Marks Allotted
39a. Ans	Full adder: Full adder adds three binary digits at a time.	1
		
	Full adder using two half adders	1
	Truth Table of full adder	
	Inputs / Outputs	
	A | B | C_{in} | Carry | Sum 0 | 0 | 0 | 0 | 0 0 | 0 | 1 | 0 | 1 0 | 1 | 0 | 0 | 1 0 | 1 | 1 | 1 | 0 1 | 0 | 0 | 0 | 1 1 | 0 | 1 | 1 | 0 1 | 1 | 0 | 1 | 0 1 | 1 | 1 | 1 | 1	2
39b.	Draw the block diagram of digital computer and label the blocks.	2
Ans		
	Block diagram of digital computer	2

Qn. No.	ELECTRONICS	Marks Allotted
40a.	Draw the block diagram of monochrome TV transmitter.	4
Ans	 Block diagram of monochrome TV transmitter	4
40b.	What are the advantages of E-mail?	2
Ans	Advantage of E-mail: ➢ Any information (text, audio, video) can be send or receive. ➢ Transmission is immediate and to any distance. ➢ Any data size can be sent. ➢ A data can be send to any number of recipients. ➢ The information sent/received can be directly used for further processing. ➢ Economical. (OR Any two acceptable advantage – each carry 1 mark)	2

***** s*h*i*v*a*s*h*a*n*k*a*r *****