GURU NANAK DEV ENGINEERING COLLEGE BIDAR
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ENGINEERING:E043 MCA:C570 MBA: B181 M.TECH: T834

Introduction to Electronics and Communication
BESCK104C/204C

[As per Choice Based Credit System (CBCS) scheme]

2022 SCHEME

(Strictly for internal circulation only)

VTU PREVIOUS QUESTION PAPERS&SOLUTIONS

Name of the staff I/C: **Prof. Ramesh Patil, E&CE Department.**

CBCS SCHEME

USN 3 G N 2 4 [illegible]

BESCK104C

First Semester B.E/B.Tech. Degree Examination, Dec.2024/Jan.2025
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU formula Handbook is permitted.

		Module – 1	M	L	C
1	a.	With a neat block diagram, explain the DC power supply.	6	L2	CO1
	b.	With a circuit diagram explain the working of voltage doubler.	6	L2	CO1
	c.	With circuit diagram and waveforms, explain the working of Bi – Phase full wave rectifier.	8	L2	CO1
		OR			
2	a.	Draw the circuit of Zener diode voltage regulator and explain the working.	6	L2	CO1
	b.	What is multistage amplifier? Show that the overall gain of multistage amplifier is product of individual stage gains.	6	L3	CO1
	c.	What are the advantages of negative feedback? Derive an expression for overall voltage gain of negative feedback amplifier.	8	L3	CO1
		Module – 2			
3	a.	State and explain conditions for oscillations (Barkhausen criterion).	6	L1	CO2
	b.	With circuit diagram, explain the working Wein Bridge Oscillator.	6	L2	CO2
	c.	With circuit diagram and waveforms, explain the working of single stage astable mutlivibrator circuit using op-amp.	8	L2	CO2
		OR			
4	a.	List the ideal characteristics of op-Amp.	6	L1	CO2
	b.	Explain the following parameters of the op-Amp. i) Slew Rate ii) Input offset voltage iii) CMRR.	6	L1	CO2
	c.	How op-Amp can be used as an integrator with necessary output equation and waveforms.	8	L2	CO2
		Module – 3			
5	a.	i) Convert $(256.45)_{10} = (?)_2 = (?)_{16}$ ii) Find x if $(211)_x = (152)_8$ iii) Convert $(357.14)_8 = (?)_{16}$.	8	L3	CO3
	b.	Subtract $(1010.11)_2$ from $(1001.10)_2$ using 1's and 2's complement methods.	6	L3	CO3
	c.	State and prove DeMorgan's theorems for 3 input variables.	6	L2	CO3

		OR			
6	a.	Simplify the following Boolean expressions : i) $f_1 = \bar{x}\,\bar{y} + xy + \bar{x}y$ ii) $f_2 = x \oplus y \oplus z$.	6	L4	CO3
	b.	Obtain canonical forms of the following Boolean expressions [SoP form]. i) $f = a + \bar{b}c$ ii) $f = xy + \bar{x}z$.	6	L3	CO3
	c.	Design full adder circuit using basic gates.	8	L3	CO3
		Module – 4			
7	a.	Define embedded system. Differentiate between embedded systems and general purpose computing system.	6	L1	CO4
	b.	Draw the block diagram of embedded system and explain the different elements.	6	L2	CO4
	c.	Differentiate between : i) Microprocessor Vs Microcontroller ii) RISC Vs CISC.	8	L1	CO4
		OR			
8	a.	Draw the block diagram of instrumentation system and explain.	8	L2	CO4
	b.	What is seven segment display? Explain the types of seven segment display.	8	L2	CO4
	c.	What are sensors and Actuators?	4	L2	CO4
		Module – 5			
9	a.	With a neat diagram, explain modem communication system.	6	L2	CO5
	b.	Define modulation and explain amplitude modulation with waveforms.	6	L2	CO5
	c.	With waveforms, explain ASK, FSK and SPK modulation techniques.	8	L2	CO5
		OR			
10	a.	Explain different modes of radio wave propagation.	8	L1	CO5
	b.	What is multiplexing? Explain different types of multiplexing in communication system.	8	L2	CO5
	c.	Explain the advantages of digital communication over analog communication.	4	L1	CO5

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Question Paper Solutions

Sub: Introduction to Electronics and Communication.

Code: BESCK104C. Staff: Prof. RAMESH PATIL
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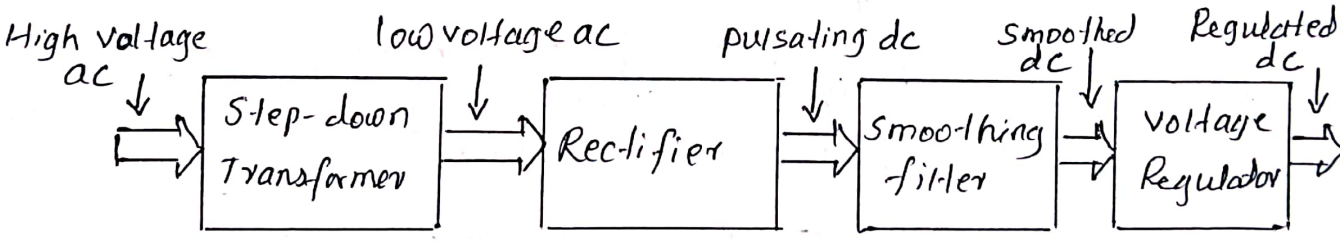
Academic year: 2024-2025 - ODD

Dec 2024 / Jan, 2025 Question paper.

Module - 1

Q1 a. With a neat block diagram explain the DC power supply. (6M)

Ans: A power supply is an electrical device that supplies electric power to an electrical load. The DC power supply is one which supply correct dc voltage and current to the load. The block diagram of a dc power supply is shown in fig.



Since the mains input is at a relatively high voltage a step-down transformer of appropriate turns ratio is used to convert this to a low voltage. The ac output from the transformer secondary is then rectified using diodes to produce pulsating d.c. output. This is then smoothed or filtered using a capacitor filter before applying to voltage regulator circuit

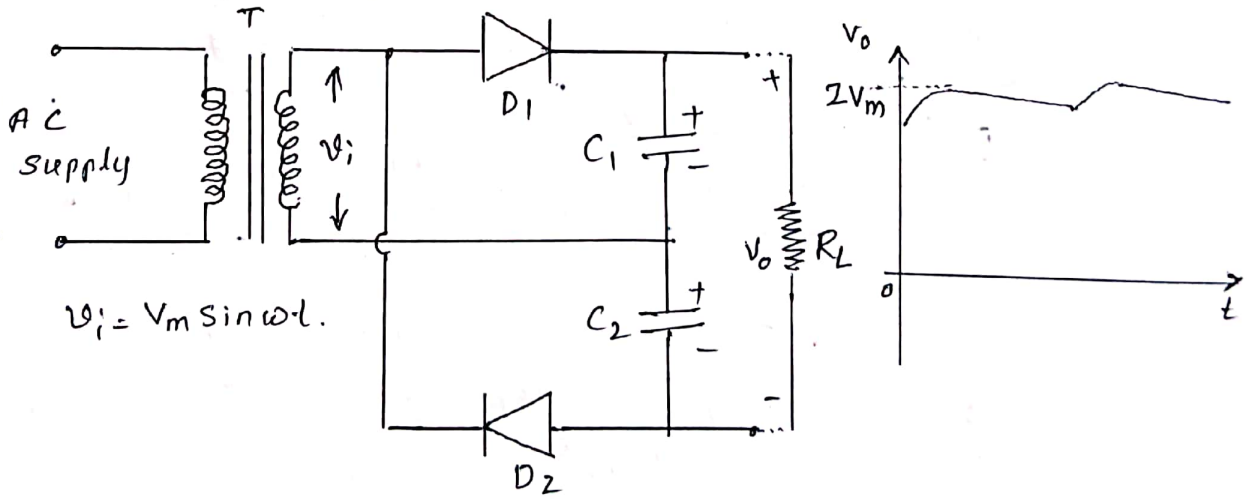
so that output voltage remains constant irrespective of variations in input voltage and load.

Q1. b. With a circuit diagram explain the working of voltage doubler. (6M)

Ans: The voltage multiplier is an electronic circuit that delivers the output voltage whose amplitude (peak value) is two, three or more times greater than the amplitude (peak value) of the input voltage.

Voltage doubler.

In this output peak voltage is two times input peak voltage. By adding second diode and capacitor, the output of half wave rectifier is increased. A voltage doubler using this technique is shown in fig.



C_1 will charge to positive peak of secondary voltage and C_2 will charge to negative peak of secondary voltage. Since the output is taken from C_1 and C_2 connected in series the resulting output voltage is twice that produced by one diode alone.

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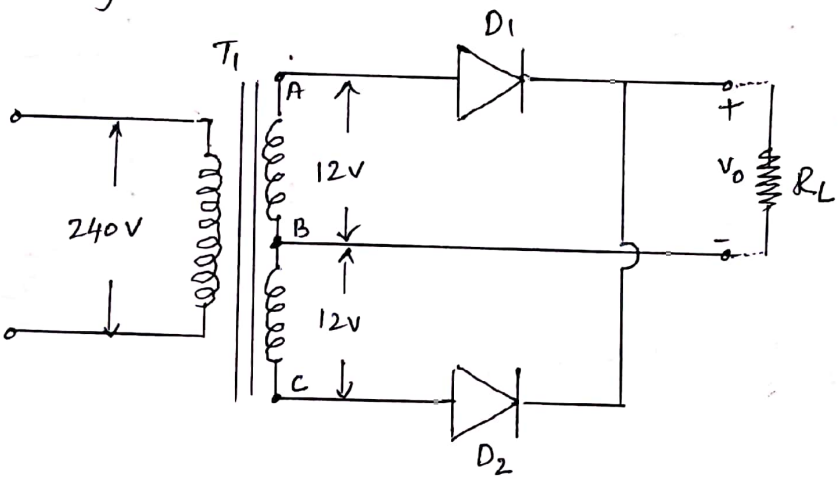
Q1. c. with neat circuit diagram and waveforms, explain the working of Bi-phase full wave rectifier. (8m)

Ans: A Full-wave rectifier circuit converts both half cycles (+ve half cycle and -ve half cycle) of input voltage into pulsating dc output voltage.

* Bi-phase rectifier circuit.

Fig. shows a simple bi-phase rectifier circuit.



Mains voltage (240V) is applied to the primary of the step-down transformer (T_1) which has two identical secondary windings, each providing 12V rms. The turns ratio of T_1 will be thus 240/12 or 20:1 for each secondary winding.

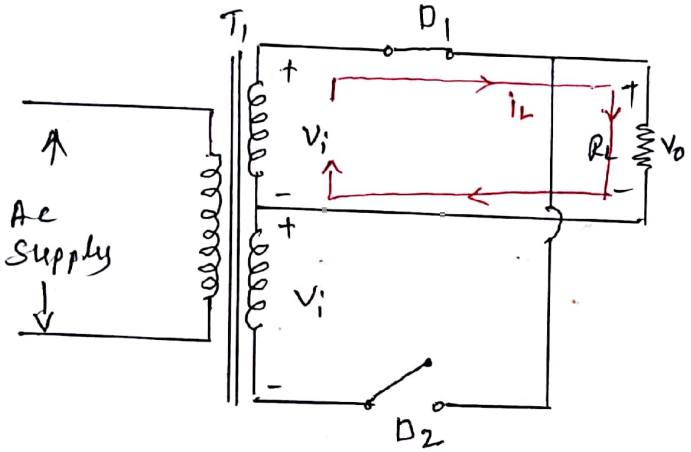
* working of Bi-phase rectifier.

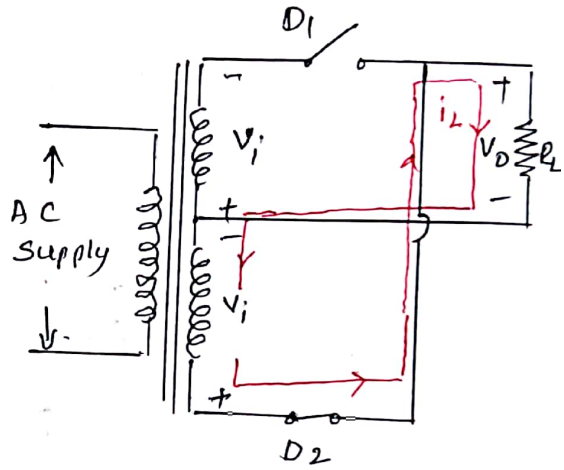
During +ve half cycle, point A will be positive with respect to point B. similarly point B will be positive with respect to point C. In this condition diode D_1 will conduct and diode D_2 will not conduct.

on negative half cycle, point C will be positive with respect to point B. similarly, point B will

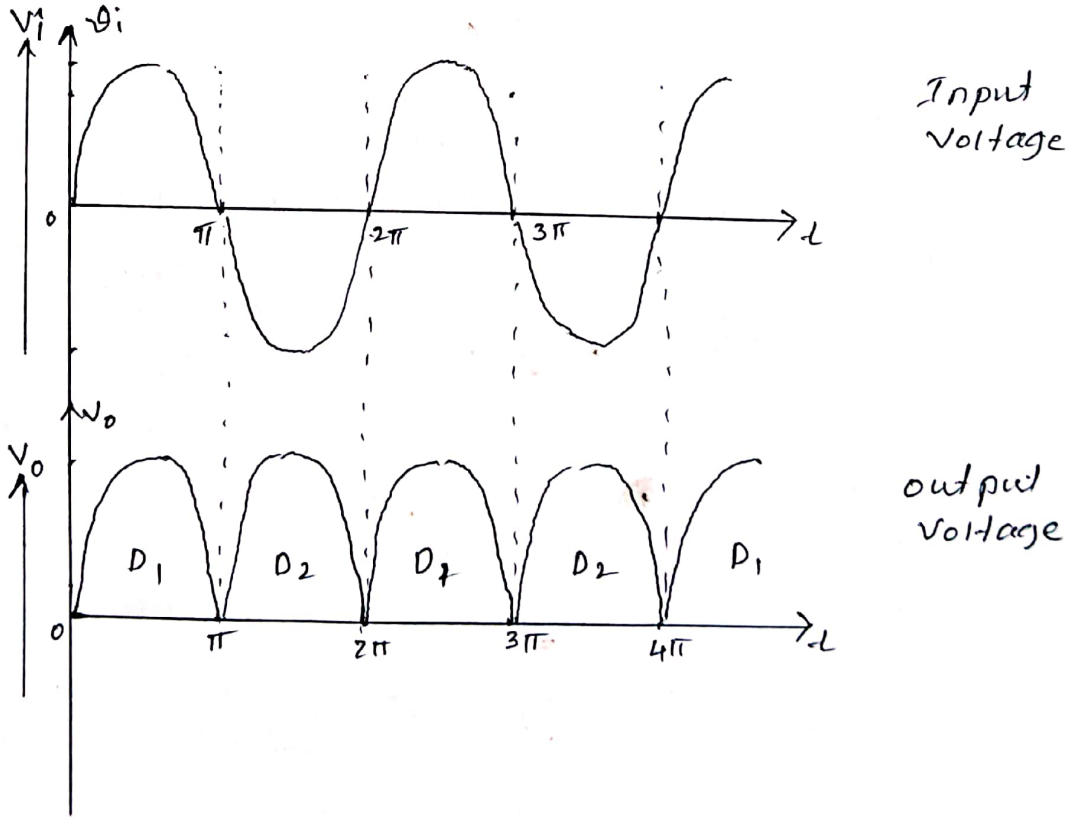
be positive with respect to point A. In this condition diode D_2 will conduct and diode D_1 will not conduct. So during +ve half cycles D_1 alone conducts and during −ve half cycles, D_2 alone conducts.

Fig. show below the bi-phase rectifier circuit with the diodes replaced by switches.





Input and output wave forms.

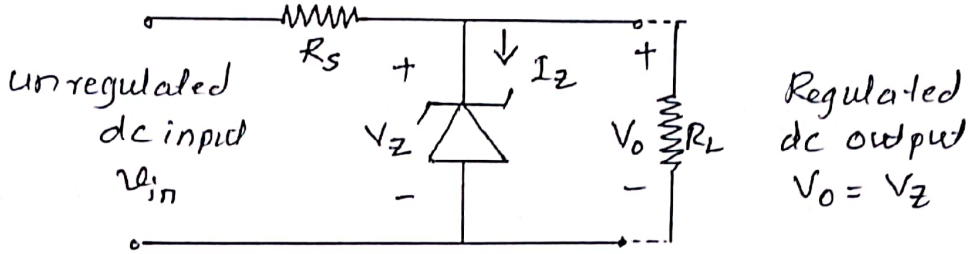


OR.

Q2. a. Draw the circuit of Zener diode voltage Regulator and explain the working. (6M)

Ans: A voltage regulator is a circuit that maintains a fixed output voltage irrespective of changes to the input voltage or load conditions.

A simple voltage regulator using zener diode is shown in fig.



in fig. R_S is included to limit the zener current to a safe value when the load is disconnected. When the load R_L is connected, the zener current I_Z will fall as current is diverted into the load resistance.

The output voltage V_Z remain at the zener voltage

From fig. $$V_Z = V_{in} \times \frac{R_L}{R_L + R_S}$$

where V_{in} is the unregulated input voltage. Thus the maximum value of R_S can be calculated as

$$R_{S_{max}} = R_L \left[\frac{V_{in}}{V_Z} - 1 \right]$$

The power dissipated in zener diode will be given by $P_Z = I_Z \times V_Z$

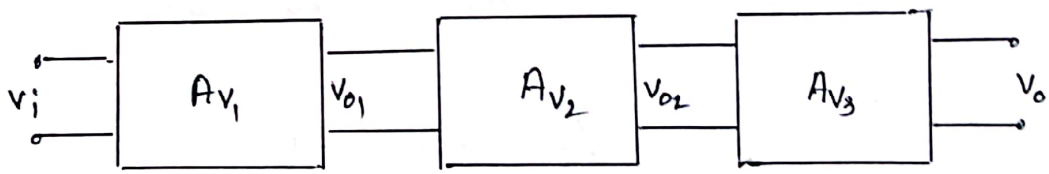
Hence the minimum value of R_s can be determined from no-load condition.

$$R_{s_{min}} = \frac{V_{in} - V_Z}{I_Z} = \frac{V_{in} - V_Z}{\frac{P_{Z\,max}}{V_Z}} = \frac{(V_{in} - V_Z) \times V_Z}{P_{Z\,max}}$$

$$\therefore \quad R_{s_{min}} = \frac{V_{in} V_Z - V_Z^2}{P_{Z\,max}}.$$

Q 2. b. What is multistage amplifier? Show that the overall gain of multistage amplifier is product of individual stage gains. (6M)

Ans: In order to provide sufficiently large value of gain, it is necessary to use number of interconnected stages within an amplifier. This is called multistage amplifier. The overall gain of multistage amplifier with several stages is simply the product of the individual voltage gains.



Over all gain $A_V = \frac{V_o}{V_i}$

$$A_{V_1} = \frac{V_{o1}}{V_i}, \quad A_{V_2} = \frac{V_{o2}}{V_{o1}}, \quad A_{V_3} = \frac{V_o}{V_{o2}}$$

$$\therefore \text{ overall gain } A_V = \frac{\cancel{V_{o1}}}{V_i} \times \frac{\cancel{V_{o2}}}{\cancel{V_{o1}}} \times \frac{V_o}{\cancel{V_{o2}}}$$

$$= \frac{V_o}{V_i}$$

$$\therefore \quad A_{V_1} = A_{V_1} \times A_{V_2} \times A_{V_3}$$

Q 2. c. What are the advantages of negative feedback? Derive an expression for overall voltage gain of negative feedback amplifier (8M)

Ans: * Advantages of negative feedback.

Although negative feedback results in reduced gain. It has many advantages. They are.

1) controls the gain
2) increases input impedance and decreases output impedance.
3) Reduce distortion
4) increased Bandwidth. etc.

* Expression.

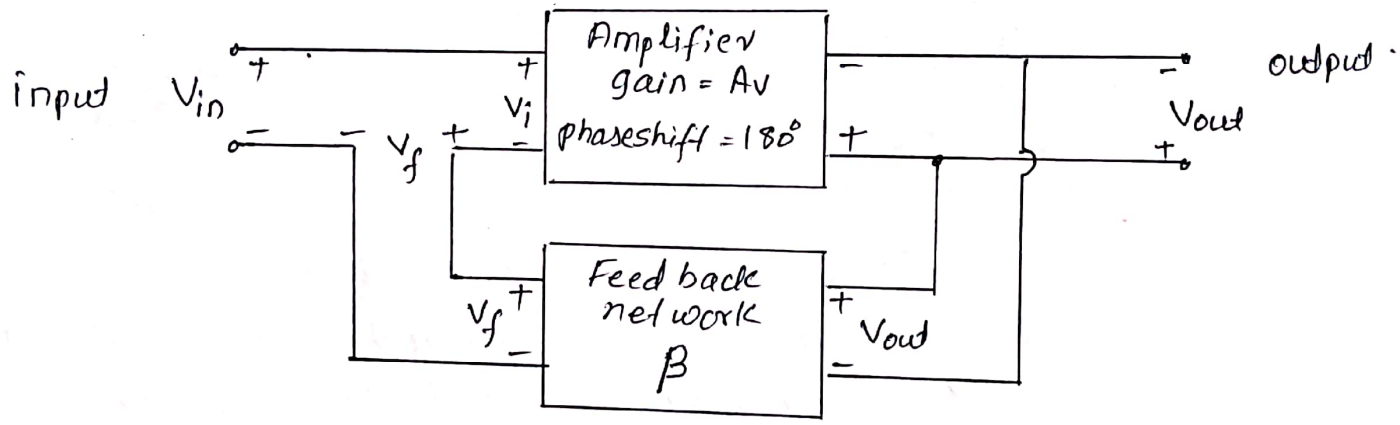


Fig. shows the block diagram of an amplifier with negative feed back.

The overall voltage gain with feedback is given by

$$G = A_F = \frac{V_{out}}{V_{in}}$$

from fig voltage gain without feed back.

$$A_V = \frac{V_{out}}{V_i} \quad \text{—1)}$$

$$A_F = \frac{V_{out}}{V_{in}}, \quad \text{feed back factor } \beta = \frac{V_f}{V_{out}}$$

from eqn 1), we have $V_{out} = A_v . V_i$

but $V_i = V_{in} - V_f$

$\therefore V_{out} = A_v (V_{in} - V_f)$

$= A_v (V_{in} - \beta V_{out})$ $\quad \because V_f = \beta V_{out}$.

$V_{out} (1 + \beta A_v) = A_v V_{in}$.

$\therefore$ overall all gain, G or $A_F = \frac{V_{out}}{V_{in}}$

$$\therefore \boxed{A_F = \frac{A_v}{1 + \beta A_v}}$$

Module - 2

Q 3.a. State and explain conditions for oscillations (Barkhausen Criterion) (6M).

Ans: * conditions for oscillations (Barkhausen Criterion)

1) The feedback must be positive
i.e the signal feedback must arrive back in-phase with the signal at the input. The phase shift should be 0° or 360°.

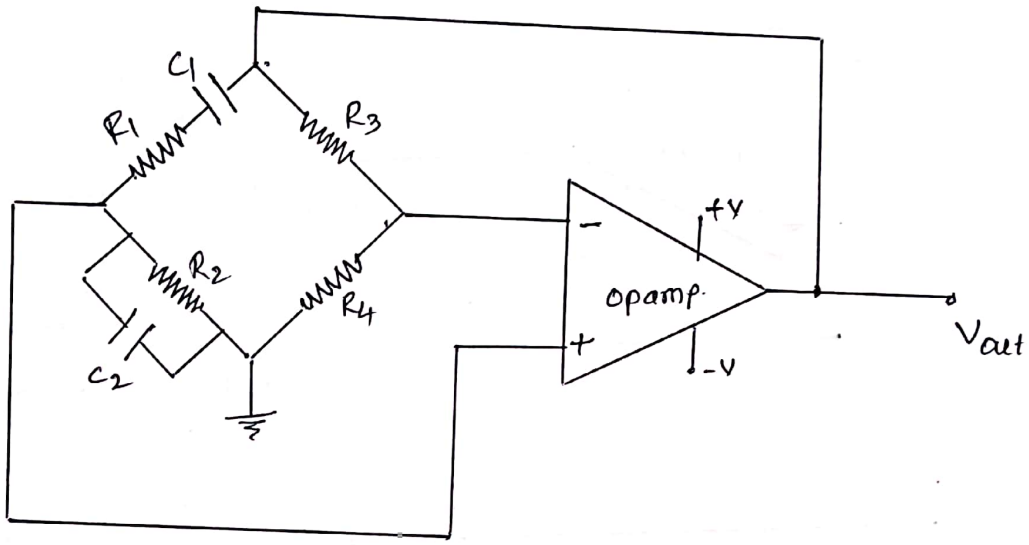
2) The overall closed loop gain must be equal to 1 or just greater than 1 initially
i.e $|A\beta| = 1$

Hence to create an oscillator we simply need an amplifier with positive feedback and closed loop gain equals to unity. In practical oscillator, it is not necessary to supply an input signal to start oscillation, instead oscillations are self starting and begin oscillations as soon as dc power is applied.

Q3.6. With circuit diagram, explain the working of Wein Bridge oscillator (6m)

Ans: An oscillator is a circuit which produces a continuous, repeated, alternating waveform (ac) without any input.

The wein bridge oscillator is shown in fig.



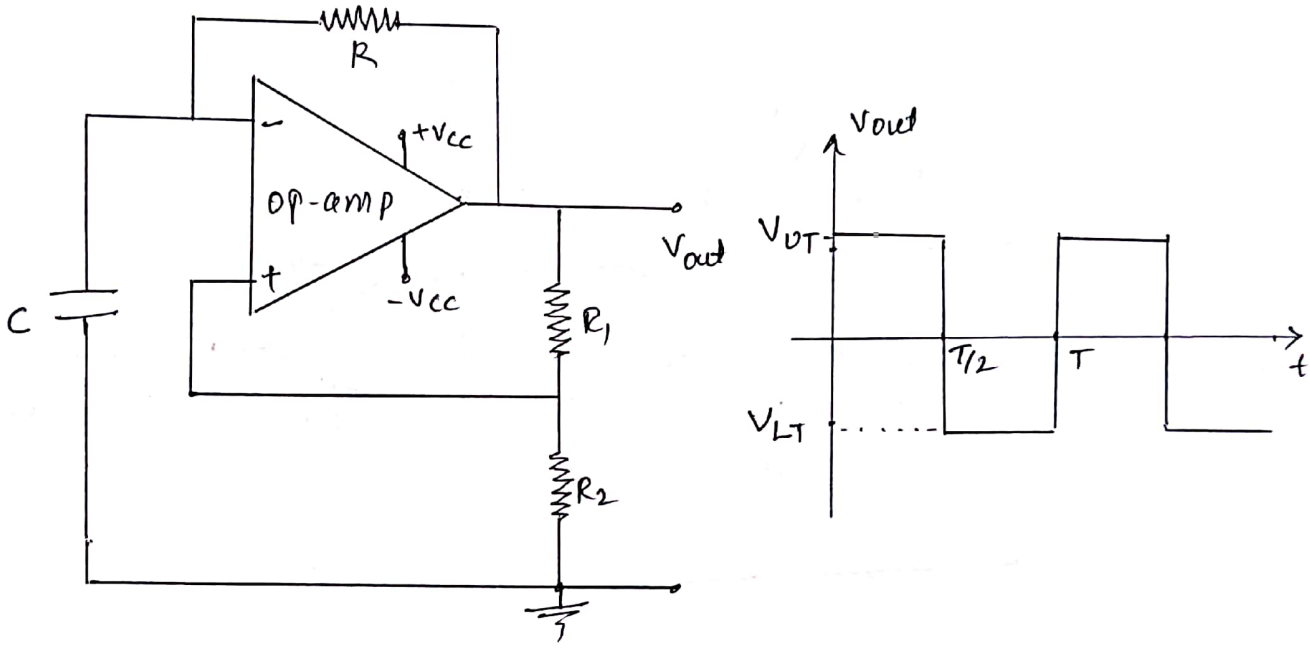
The feed back network comprises of a wein bridge circuit. The op-amp is used in non inverting configuration. Oscillation occurs at the frequency for which the phase shift through wein bridge is 0°, because amplifier is in non inverting mode. wein bridge oscillator produces sinusoidal oscillations.

when $R_1 = R_2$ and $C_1 = C_2$. The frequency of oscillation is given by

$$f = \frac{1}{2\pi RC}$$

Q 3.c. With circuit diagram and wave-forms, explain the working of single stage astable multivibrator circuit using op-amp. (8M).

Ans: A simple form of astable oscillator (multivibrator) that produces a square wave output can be built using just one op-amp, as shown in fig.



The circuit employs positive feedback with output fed back to the non-inverting input via the voltage divider formed by R_1 and R_2.

The upper threshold voltage will be given by

$$V_{UT} = V_{cc} \times \frac{R_2}{R_1 + R_2}$$

The lower threshold voltage will be given by.

$$V_{LT} = -V_{cc} \times \frac{R_2}{R_1 + R_2}.$$

Finally, the time for one complete cycle of the output waveform produced by the astable multivibrator is given by.

$$T = 2RC \ln\left(1 + 2\left(\frac{R_2}{R_1}\right)\right)$$

Frequency, $F = \frac{1}{T}$

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OR

Q4. a. List the ideal characteristics of op-amp (6M).

Ans: 1) Infinite openloop voltage gain, i.e $A_{v_{OL}} = \infty$.

2) Infinite input resistance i.e $R_i = \infty$

3) Zero output resistance. i.e $R_o = 0$

4) Infinite Bandwidth, i.e $BW = \infty$

5) Infinite slewrate i.e slewrate $= \infty$

6) Zero input offset voltage i.e $V_{io} = 0$

Q4. b. Explain the following parameters of op-amp.
i) slew rate ii) Input offset voltage iii) CMRR. (6m)

Ans: i) Slew rate:

Slew rate is the rate of change of output voltage with time.

$$\therefore \text{slew rate} = \frac{\Delta V_{out}}{\Delta t} \quad V/\mu s.$$

Higher the slewrate, better the performance of the op-amp. slew rate indicates how fast the output of an op-amp can change in response to the changes in the input.

ii) Input offset voltage.

Input offset voltage is the voltage that must be applied between the two input terminals such that the output voltage becomes zero.
Typical value is between 1 mv to 15 mv.

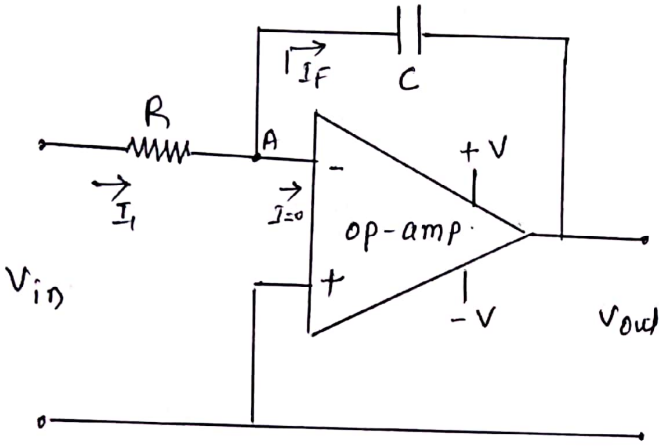
iii) CMRR

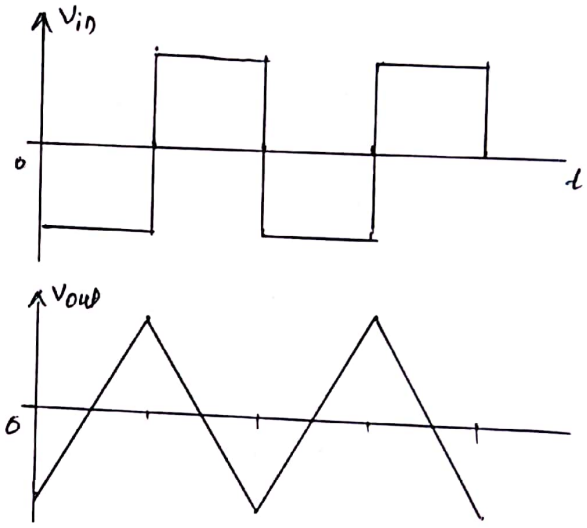
Common mode Rejection Ratio (CMRR) is defined as the ratio of differential gain to the common mode gain

$$\text{i.e } CMRR = \frac{A_d}{A_{cm}}$$

Q4. C. Explain How op-amp can be used an integrator with necessary output equation and waveforms. (8m).

Ans: An integrator is a circuit in which the output voltage is proportional to the integral of the input voltage. An integrator using an op-amp is shown in fig.





Input and output waveforms.

KCL at node A

$$I_1 = I_F$$

$$\frac{V_{in}}{R} = C\frac{dv_c}{dt}$$

$$= C\frac{d(0-V_{out})}{dt}$$

$$\frac{V_{in}}{R} = -C\frac{dV_{out}}{dt}$$, integrating both sides & solvin for V_{out}.

$$\int -\frac{V_{in}}{RC}.dt = \int dV_{out}.dt.$$

$$\therefore \quad V_{out} = -\frac{1}{RC}\int V_{in}.dt.$$

Module. 3

Q5. a. i) Convert $(256.45)_{10} = (?)_2 = (?)_{16}$

ii) Find x if $(211)_x = (152)_8$

iii) Convert $(357.14)_8 = (?)_{16}$ (8m)

Soln : Consider integer part 256 , consider fractional part 0.45

2	256	
2	128	0
2	64	0
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

LSB ↑ MSB.

$0.45 \times 2 = 0.90$ carry 0 MSB

$0.90 \times 2 = 1.80$ carry 1

$0.80 \times 2 = 1.60$ carry 1

$0.60 \times 2 = 1.20$ carry 1

$0.20 \times 2 = 0.40$ carry 0 LSB

$\therefore (256.45)_{10}$

$= (100000000.01110)_2$ ⇐ Ans

take

$(\underbrace{100}_{1}\underbrace{000}_{0}\underbrace{000}_{0}.\underbrace{011}_{7}\underbrace{10}_{0})_2$

$\therefore (256.45)_{10} = (100.70)_{16}$ ⇐ Ans.

ii) if $(211)_x = (152)_8$ find x.

If two numbers are equal in any number system they will be equal in decimal number system as well, i.e equating the decimal equivalent of two numbers we get.

$$2x^2 + 1x^1 + 1x^0 = 1\times8^2 + 5\times8^1 + 2\times8^0$$

$$2x^2 + x + 1 - 64 - 40 - 2 = 0$$

$$2x^2 + x - 105 = 0$$

$$\therefore x = \frac{-1 \pm \sqrt{1^2 - 4\times2(-105)}}{2\times2}$$

$x = 7$ ⇐ Ans.

iii) $(357.14)_8 = (?)_{16}$

replace each octal digit in to 3 bit Binary no

$$\begin{array}{ccccccccc} 3 & 5 & 7 & \cdot & 1 & 4 \\ (011 & 101 & 111 & . & 001 & 100)_2 \end{array}$$

binary to hexadecimal have group of 4 bits and replace each group with hexadecimal digit.

$$\underbrace{0000}_{0}\ \underbrace{1110}_{E}\ \underbrace{1111}_{F}\ .\ \underbrace{0011}_{3}\ \underbrace{0000}_{0}$$

$\therefore\ (357.14)_8 = (EF.30)_{16}$.

Q 5.b Subtract $(1010.11)_2$ from $(1001.10)_2$ using 1's & 2's Complement methods. (6m)

Soln : * Using 1's complement

$(1001.10)_2 - (1010.11)_2$

1) 1's complement of $(1010.11)_2$ is $(0101.00)_2$

2)
$$\begin{array}{r} 1001.10 \\ +\ 0101.00 \\ \hline 1110.10 \end{array}$$
no carry

3) Take 1's complement of above addition & attach -ve sign

4) $-(0001.01)_2$ ⇐ Ans.

* Using 2's complement.

1) 2's complement of 1010.11 is $(0101.00)_2 + 1$ i.e $(0101.01)_2$

2)
$$\begin{array}{r} 1001.10 \\ +\ 0101.01 \\ \hline 1110.11 \end{array}$$
no carry

3) Take 2's complement of above addition & attach -ve sign

4)
$$\begin{array}{r} 0001.00 \\ +1 \\ \hline -(0001.01)_2 \end{array}$$
⇐ Ans.

Q5. c. State and prove DeMorgan's theorems for 3 input variables. (6m)

Ans: * Theorem 1 statement

"Complement of a sum is equal to the product of the complements."

i,e $\overline{A+B+C} = \bar{A}.\bar{B}.\bar{C}$

* proof: using truth Table.

LHS = RHS

A	B	C	$\overline{A+B+C}$	$\bar{A}.\bar{B}.\bar{C}$
0	0	0	1	1
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	0	0
1	0	1	0	0
1	1	0	0	0
1	1	1	0	0

* Theorem 2 statement.

" Complement of a product is equal to the sum of the complements"

i,e $\overline{ABC} = \bar{A}+\bar{B}+\bar{C}$

* proof: using Truth table.

LHS = RHS.

A	B	C	$\overline{ABC}$	$\bar{A}+\bar{B}+\bar{C}$
0	0	0	1	1
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

OR

Q 6.a. simplify the following Boolean expressions.

i) $f_1 = \bar{x}\bar{y} + xy + \bar{x}y$

ii) $f_2 = x \oplus y \oplus z$ (6m)

Soln: i) $f_1 = \bar{x}\bar{y} + xy + \bar{x}y$

$= \bar{x}\bar{y} + (x+\bar{x})y$

$= \bar{x}\bar{y} + 1 \cdot y$ $\quad \because x+\bar{x} = 1$

$= \bar{x}\bar{y} + y$ $\quad \because x+\bar{x}y = x+y.$

$= \bar{x} + y$

Q 6.b. obtain canonical forms of the following boolean expressions (sop form) (6m)

i) $f = a + \bar{b}c$

ii) $f = xy + \bar{x}z$

Soln: i) $f = a + \bar{b}c$

$= a(b+\bar{b}) + \bar{b}c(a+\bar{a})$

$= ab + a\bar{b} + a\bar{b}c + \bar{a}\bar{b}c.$

$= ab(c+\bar{c}) + a\bar{b}(c+\bar{c}) + a\bar{b}c + \bar{a}\bar{b}c$

$\therefore f = abc + ab\bar{c} + a\bar{b}c + a\bar{b}\bar{c} + a\bar{b}c + \bar{a}\bar{b}c$

above expression is conanical form in sop.

ii) $f = xy + \bar{x}z$

$= xy(z+\bar{z}) + \bar{x}z(y+\bar{y})$

$f = xyz + xy\bar{z} + \bar{x}yz + \bar{x}\bar{y}z.$

above expression is in canonical form in sop.

Q6.c Design full adder circuit using basic gates. (8m)

Ans: Full adder is a combinational circuit that forms the arithmatic sum of three input bits. The third input bit is for applying carry input. The truth table for full adder is shown below.

Inputs			Outputs	
A	B	C_{in}	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

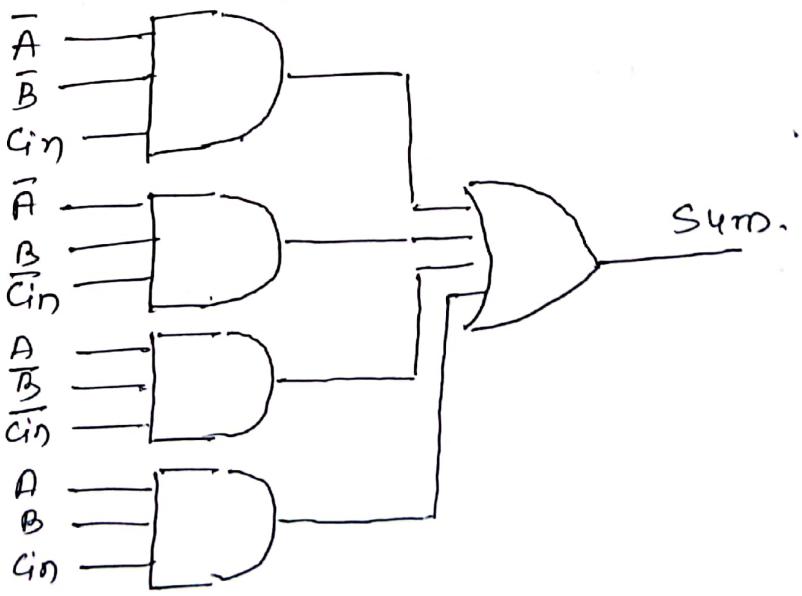
from the truth table

$$Sum = \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} + A\bar{B}\bar{C}_{in} + ABC_{in}.$$

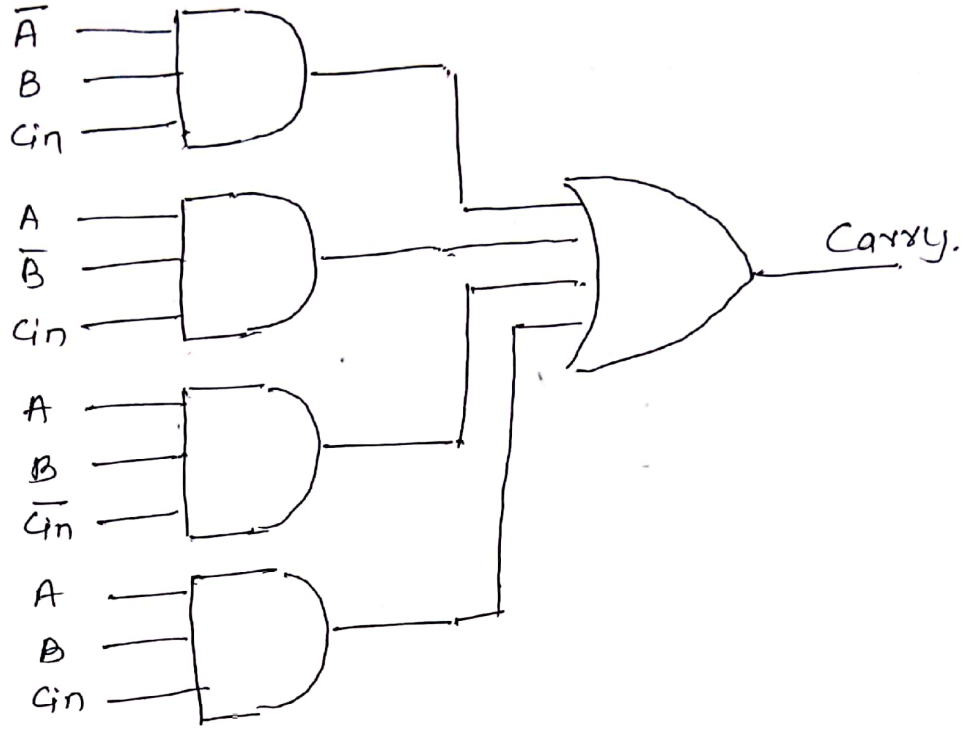
$$Carry = \bar{A}BC_{in} + A\bar{B}C_{in} + AB\bar{C}_{in} + ABC_{in}.$$

* Realization of full adder using basic gates:

Sum:



Carry.



Module - 4

Q 7. a. Define embedded system. Differentiate between embedded system and general purpose computing system. (6m)

Ans: * Definition:

An embedded system is an electronic/ electro-mechanical system designed to perform a specific function and is a combination of both hardware and firm ware (Software)

* Embedded system V/S General computing system.

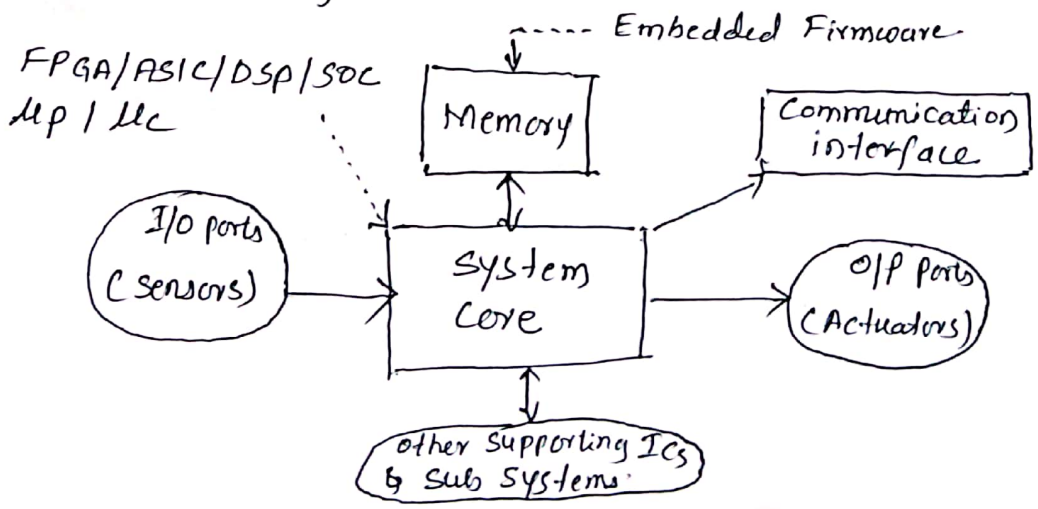
General purpose computing system.	Embedded system.
1) A system which is a combination of generic hardware and general purpose operating system (GPOS) for executing a variety of applications.	1) A system which is combination of special purpose hardware and embedded OS for executing a specific set of applications.

Contd...

General purpose computing system	Embedded System
2) contains a general purpose operating system (GPOS)	2) may or may not contain an OS for functioning
3) Applications are alterable by the user. It is also possible for the end user to re-install the OS and also add or remove user applications	3) The firmware (software) of the embedded system is pre-programmed and it is non-alterable by the end user.
4) performance is key deciding factor in the selection of the system.	4) Application specific requirements are key deciding factors. (like power requirements, memory etc.).
5) Takes the support of hardware and OS to save the power	5) Less / not at all tailored towards reduced operating power requirements.
6) Respone requirements are not time critical	6) Response time requirement is highly critical.
7) Execution behaviour is not deterministic	7) Execution behaviour is deterministic for certain types of embedded systems.

Q. 7. b. Draw the block diagram of embedded system and explain the different elements (6m).

Ans: Block diagram.



A typical embedded system contains a single chip controller which acts as the master brain of the system. A controller can be a microprocessor, or a microcontroller or FPGA (Field programmable Gate Array) or DSP (Digital signal processor) or an ASIC (Application specific integrated circuit.

Key boards, push button switches etc are examples of for input devices whereas LEDs, LCD, buzzers etc are examples for output devices.

The memory of the system is responsible for holding the control algorithm and other important configuration details.

It has communication interface to send the signal to the other systems. It also consists of subsystem as a seperate chip

Q 7. c. Differtiate between
i) Microprocessor Vs Microcontroller
ii) RISC Vs. CISC. (8M)

Ans: * Microprocessor Vs. Microcontroller.

Microprocessor	Micro Controller.
1) A siliconchip representing a Central processing unit (CPU), which is capable of performing arithmatic as well as logical operations according to a predefined set of instructions.	1) A microcontroller is a highly integrated chip that contains a CPU, RAM, Rom for program storage, timer and intrupt control units & dedicated I/O ports.

Contd...

Microprocessor	Microcontroller.
2) It is a dependent unit. it requires combination of other chips like timers, program and data memory chips, intrupt controller etc. for functioning.	2) It is a self contained unit and it does not require intrupt controller, timer, UART etc. for its functioning
3) most of the time general purpose in design and operation	3) mostly application oriented or domain specific.
4) does not contain a built-in I/o port	4) most of the processors contain built-in I/o ports.
5) Targetted for high end market where performance is important	5) Targetted for embedded market where performance is not so critical.
6) Limited power saving options.	6) Includes lot of power saving features
Ex: Intel 8086 Microprocessor	Ex: Intel 8051 microcontroller

* RISC Vs CISC

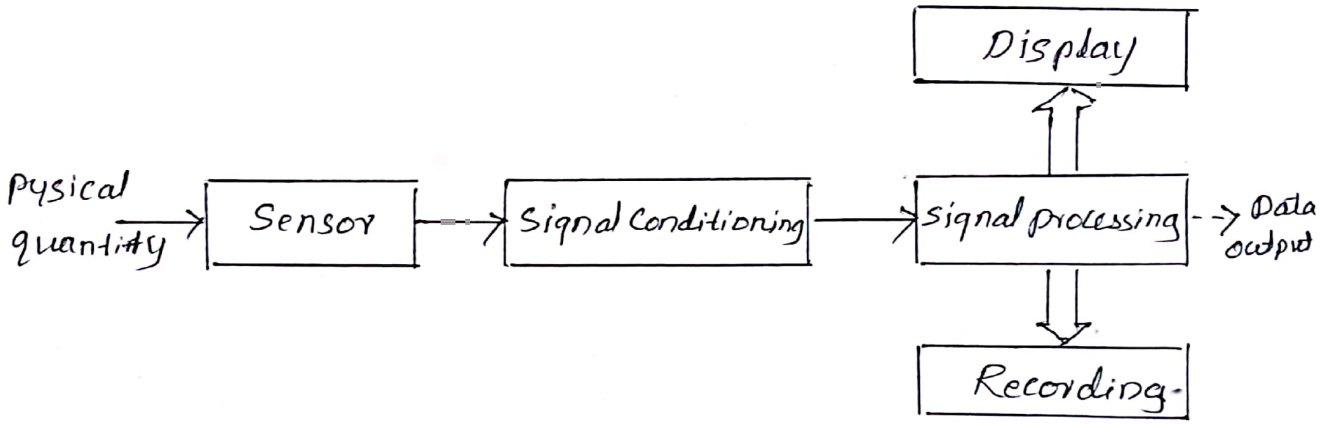
RISC	CISC.
1) Lesser number of instructions.	1) Greater number of instructions.
2) Instruction pipelining and increased execution speed.	2) Generally no instruction pipelining feature.
3) Orthogonal instruction set	3) Non-Orthogonal instruction set
4) operations are performed on registers only, the only memory operations are load & store.	4) operations are performed on registers or memory depending on the instruction.
5) Large number of registers are available	5) Limited number of general purpose registers.
6) programmer needs to write more code, fixed length instruction.	6) variable length instruction
7) Less silicon usage	7) more silicon usage.
8) Harvard Architecture	8) Harvard or Von-Neumann architecture.

OR

Q 8. a. Draw the block diagram of instrumentation system and explain (8m).

Ans: Instrumentation refers to the process of measuring and monitoring physical parameters such as temperature, pressure, flow rate, etc in various industrial, scientific and medical applications.

Fig. shows the arrangement of an instrumentation system.



The physical quantity (eg. temperature) to be measured acts upon a sensor that produces an electrical output signal. This signal passed to the signal conditioning since the output produced by sensor may contain unwanted signal (i.e noise). So further signal conditioning is required. output signal conditioning is applied for further signal processing, display or for recording.

Q 8. b. What is seven segment display? Explain the types of seven segment display. (8M).

Ans: The 7-Segment display is an output device for displaying alpha numeric (0-9 and A-F) characters. It contains eight LED segments arranged in a special form. Out of the 8 LED segments, 7 are used for displaying alpha numeric characters. The LED segments are named A to G and the decimal point LED segment named as DP.

7-segment LED display are available in two configurations, namely.

1) Common anode and 2) Common cathode.

Other types of seven segment display (SSD) includes.

Dual in package (DIP) SSD.

Surface mount Device (SMD) SSD.

Dot matrix SSD

LCD SSD.

Q 8.c. What are sensors and Actuators? (04M)

Ans: A sensor is a special kind of transducer that is used to generate an input signal to a measurement, instrumentation or control signal. Sensor is a device that provide us with a means of generating signals that can be used as inputs to electronic circuits.

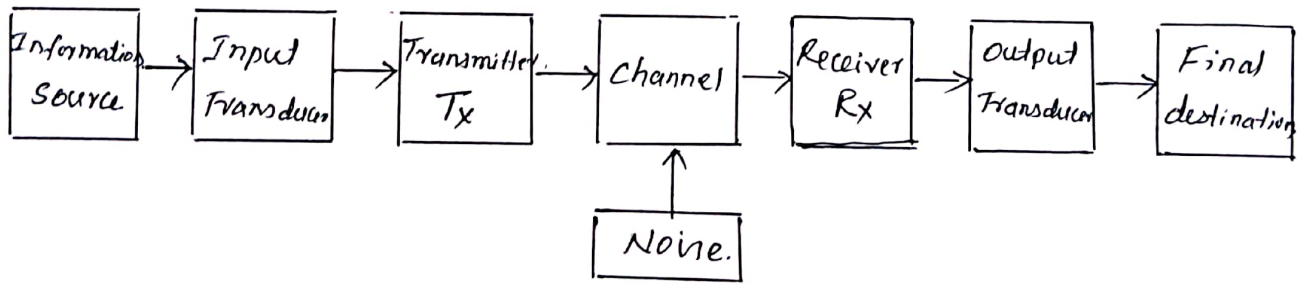
Types of Sensors: Active or passive.

Actuators are transducers which converts electric signals to corresponding physical action (motion). Actuator acts as an output device. Sensors are input devices.

Module - 5.

Q 9. a. With neat diagram, explain modern communication system. (6M)

Ans: Fig. shows a block diagram of modern communication system.



We see from fig. the main constituents of basic communication system are

1) Information source and input transducer.
2) Transmitter
3) Channel or medium
4) Noise.

5) Receiver

6) output transducer and final destination.

The message comes from information source. It may contain human voice, picture, code, data and other combinations. The transmitter is a collection of electronic circuits designed to convert the information into a signal suitable for transmission over a given communication medium. Channel provides the physical connection between the transmitter and receiver. Channel may be wired or wireless. Noise is random undesirable electrical energy that enters the communication system via the medium and interferes with the transmitted message. Receiver is a collection of electronic circuits designed to convert the signal back to the original information and send it to the final destination.

Q9. b. Define modulation and explain amplitude modulation with waveforms. (6m)

Ans: Modulation is the process in which any one of the parameters (amplitude, frequency, or phase) of the high frequency carrier signal is varied according to the instantaneous value (amplitude) of the low frequency message or information signal, keeping other parameters constant.

Amplitude modulation is the process in which the amplitude of the carrier signal is varied according to the amplitude of the message signal, where as the frequency and phase are kept constant.

If carrier signal, $c(t) = V_c \cos\omega_c t$

message signal, $m(t) = V_m \cos\omega_m t$.

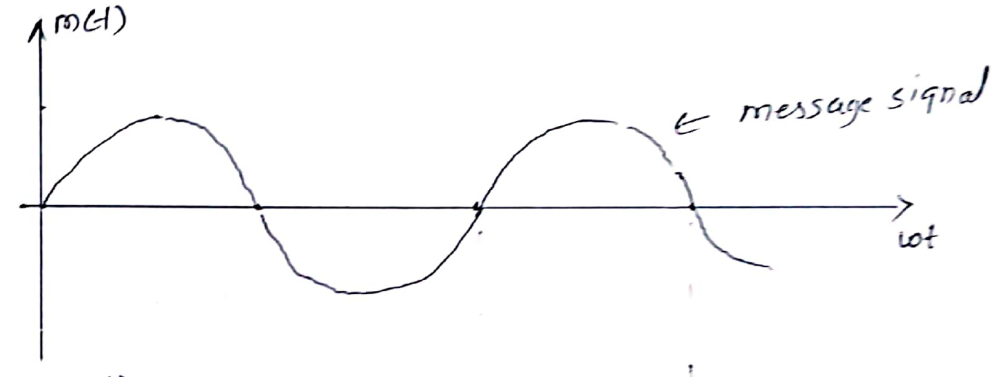
Then.

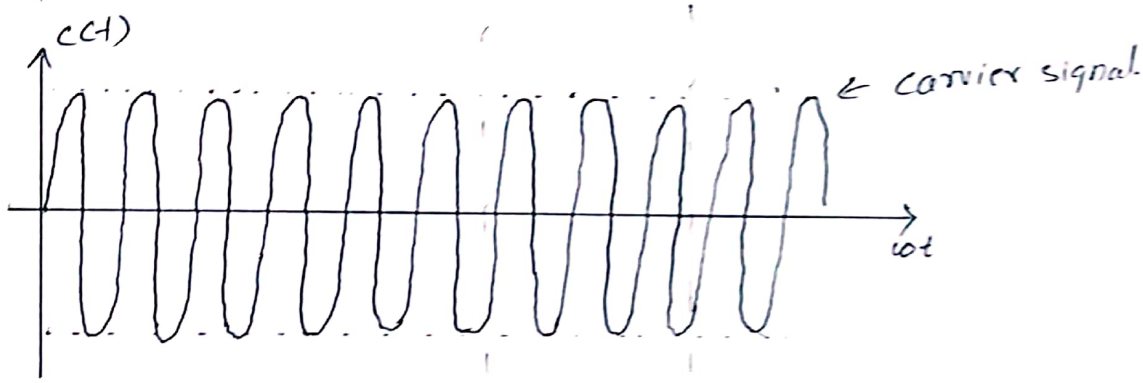
Amplitude modulated signal will be

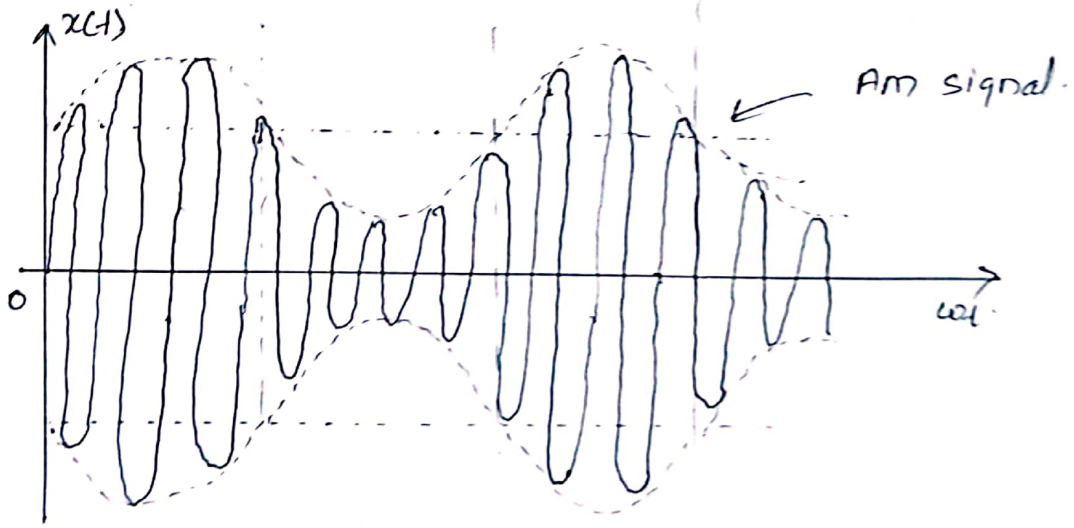
i.e AM wave $x(t) = (V_c + V_m \cos\omega_m t)\cos\omega_c t$.

$= V_c(1 + m\cos\omega_m t)\cos\omega_c t$.

where $m = \frac{V_m}{V_c}$ = modulation index.





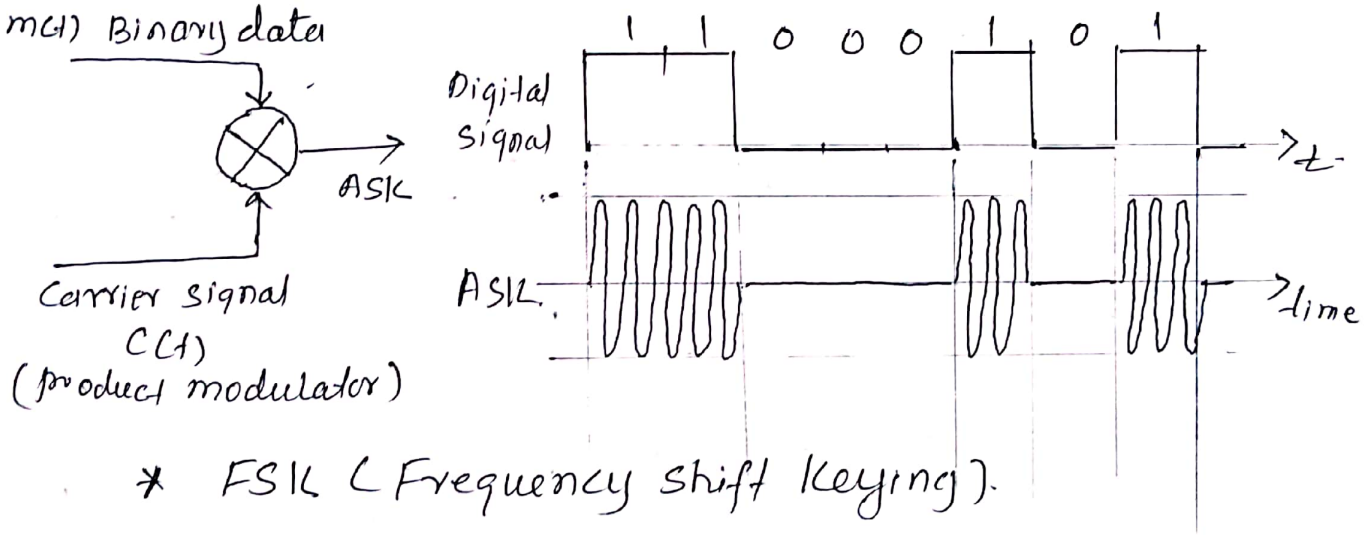


Q 9. C. With waveforms, explain ASK, FSK and PSK modulation techniques. (8m)

Ans: These modulation techniques will come under digital modulation schemes.

* ASK (Amplitude shift keying).

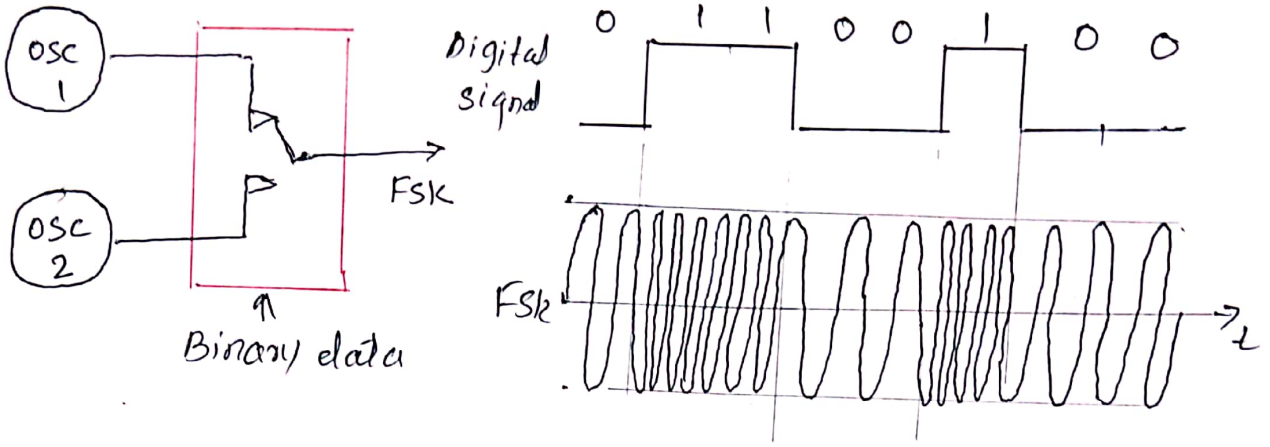
ASK represents digital data as variations in the amplitude of the carrier wave. ASK signal can generated when the incoming binary data and the sinusoidal carrier are applied to a product modulator as inputs.



* FSK (Frequency shift keying).

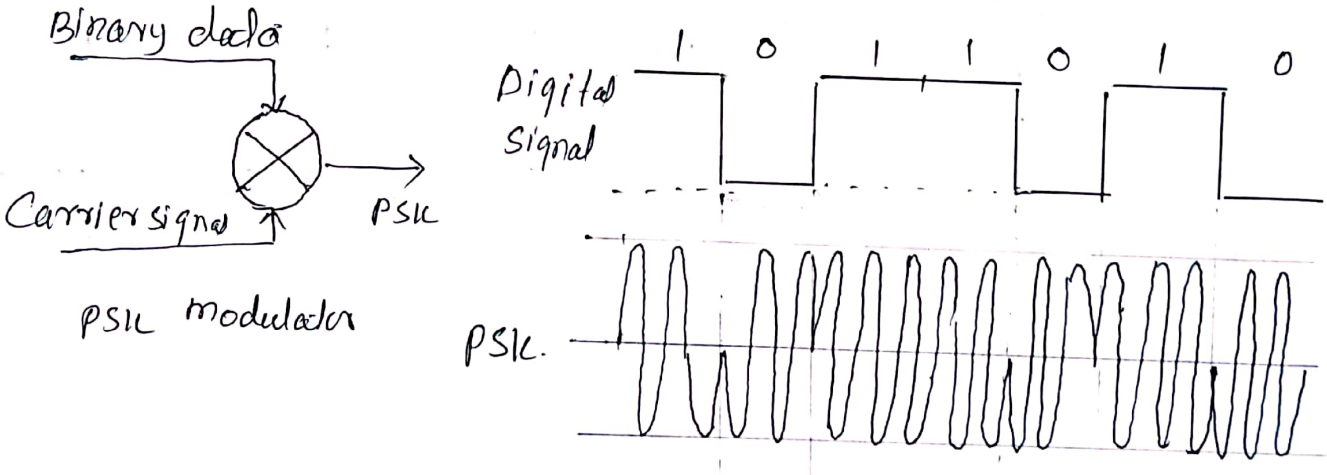
In this technique digital signal is transmitted by switching between low frequency and high frequency in order to represent 0's and 1's. The simplest FSK is binary FSK. It uses a pair of discrete frequencies to transmit binary (0's & 1's) information

fig. next page.



* Phase shift keying (PSK)

The simplest form of PSK is binary phase shift-keying (BPSK). In this case the carrier phase is shifted between two different phases (typically 0° and 180°) depending on whether 0-bit or 1-bit is being transmitted.

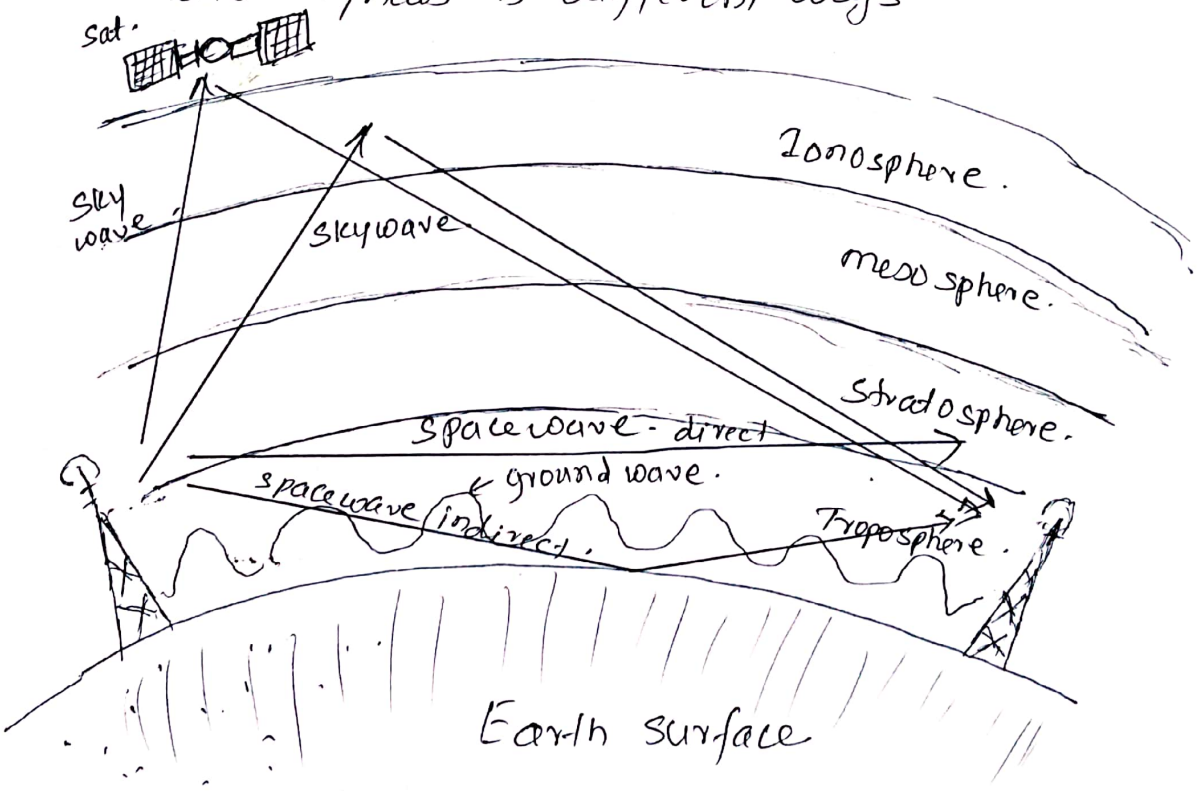


OR

Q10. a. Explain different modes of radio wave propagation. (8m).

Ans: Radio waves exhibit the properties of light with the velocity 3×10^8 m/s. These are electromagnetic (EM) waves that consists of electric and magnetic field components. radio waves exhibit properties such as refraction, reflection, diffraction, absorption, polarization and scattering.

Radio wave propagation is the way of transmitting radio signals in different ways.



i) Ground waves or surface wave

Ground waves can be used for radio communication. Ground wave transmission is very reliable irrespective of the atmospheric conditions.

Freq. range : 30K to 3 MHz.

Transmission distance : 100 to 1000 Km.

Ex: Am radio broadcast.

ii) Space wave:

In space wave, radio waves move in the earth's troposphere within about 12 KM over the surface of the earth. Frequency range: 3MHz to 30MHz

Ex: TV transmission.

The space wave is made up two components:

a) a direct or line of sight wave from the transmitting to the receiving antenna and.

b) an indirect or ground reflected wave traversing from transmitting antenna to ground and reflected to the receiving antenna.

iii) Sky Wave.

Radio waves transmitted from the transmitting antenna reach the receiving antenna after reflection from the ionosphere. Ionosphere is the ionized region extending about 80 kms. above the earth's surface. It support large distance propagation. The frequency range of operation is very high.

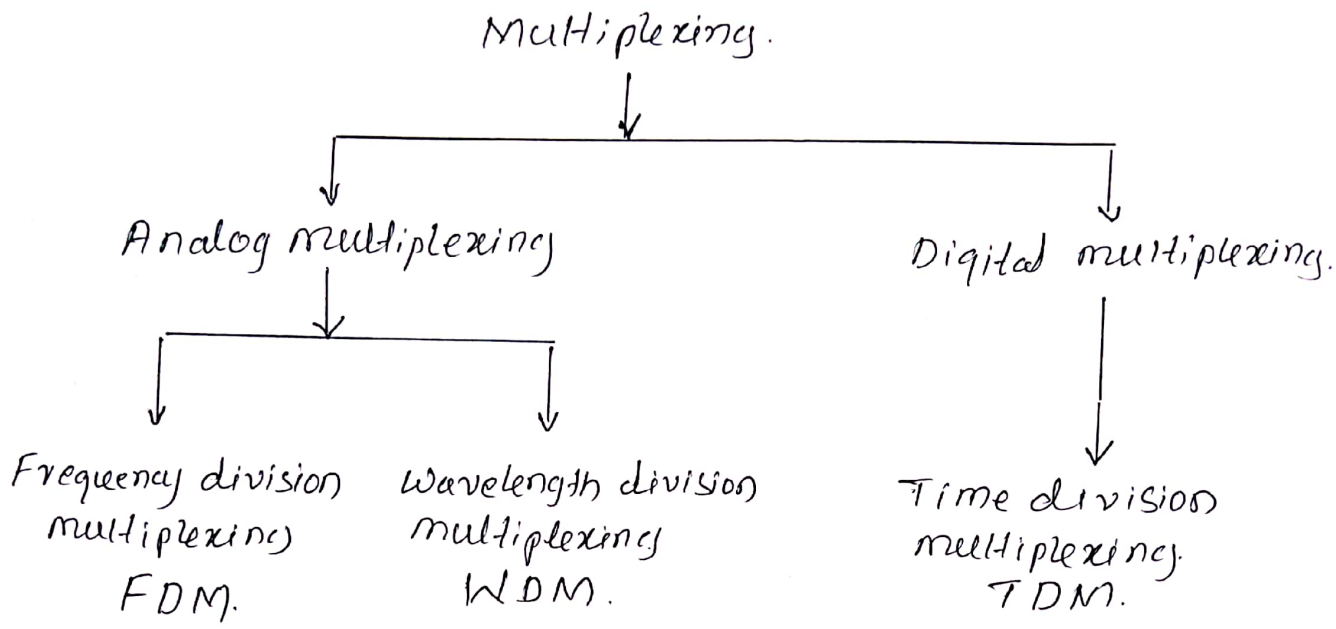
Sky wave propagation is widely used in mobile and satallite communications.

Q 10.b. What is multiplexing?. Explain different types of multiplexing in communication system. (8m)

Ans: Multiplexing is a process which allows more than one signal to be transmitted through a single channel.

In multiplexing, each message signals are modulated with different carrier frequencies. At the transmitter they can be mixed and transmitted. At the receiver end, all different transmitted signals can be easily seperated by the known carrier frequencies.

Types of multiplexing.



Due to multiplexing, it is possible to increase the number of communication channels. so that more information can be transmitted. The typical applications of multiplexing are telephone, satellite communication etc.

Q 10. c. Explain the advantages of digital communication over analog communication. (4m).

Ans: Advantages of Digital communication.

1) The effect of distortion, noise, and interference is much less affected
2) Digital circuits are more reliable and easy to design and cheaper than analog circuits.
3) The occurance of cross-talk is very rare in digital communication.
4) Combining digital signals using TDM is much easier than combining analog signals using FDM.
5) Digital signals can be saved and retreived more conveniently than analog signals.

CBCS SCHEME

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BESCK204C/BESCKC204

Second Semester B.E./B.Tech. Degree Examination, June/July 2024
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Draw the block diagram of Regulated power supply and mention the function of each block.	8	L2	CO1
	b.	With the use of circuit diagram and waveforms, explain the working of Half wave rectifier with capacitor filter.	8	L2	CO1
	c.	Mention advantages of –ve feedback.	4	L1	CO1
		OR			
Q.2	a.	List out and explain the various types of amplifiers.	8	L1	CO1
	b.	With neat diagram, explain the concept of negative feedback amplifier.	7	L2	CO1
	c.	Write a note on Multistage amplifiers.	5	L1	CO1
		Module – 2			
Q.3	a.	Explain the working of RC – ladder network oscillator.	6	L2	CO2
	b.	Define Multivibrators. Explain the working of single stage, astable multivibrator with diagram.	8	L1	CO2
	c.	Explain its working of Weinbridge Oscillator with diagram.	6	L2	CO2
		OR			
Q.4	a.	Define the following terms with respect to the Op Amp : i) CMRR ii) Slew rate iii) Supply voltage rejection ratio iv) Input offset voltage v) Input offset current.	10	L1	CO2
	b.	Explain how Op_Amp can be used as i) Voltage follower ii) Integrator.	10	L2	CO2
		Module – 3			
Q.5	a.	Convert i) $(3568)_{10} = (?)_2$ ii) $(3FD)_{16} = (?)_2$ iii) $(110111)_2 = (?)_{10}$ iv) $(1234)_{10} = (?)_8$ v) $(5678)_{10} = (?)_{16}$.	10	L2	CO3
	b.	Write any four Boolean theorems and Identities.	10	L1	CO3
		OR			
Q.6	a.	Simplify the following Boolean functions : i) $Y = A\overline{B} + AB$ ii) $F = B[(A + \overline{B})(B + C)]$ iii) $Z = B(A + C) + C$.	8	L3	CO3

	b.	Explain Half adder circuit with truth table, Realize the circuit for sum and carry using basic gates.	8	L2	CO3
	c.	Write the Symbol and Truth Table of AND and OR – Gate.	4	L1	CO3
		Module – 4			
Q.7	a.	Define Embedded system and explain the classification of Embedded system based on Complexity and Deterministic behavior.	10	L2	CO4
	b.	Compare Embedded system and General computing system.	6	L1	CO4
	c.	List out the major applications areas of Embedded system.	4	L1	CO4
		OR			
Q.8	a.	With the use of diagram, explain the core of an Embedded system.	8	L2	CO4
	b.	Compare RISC and CISC.	6	L1	CO4
	c.	Write a short notes on Sensors and 7 – segment LED displays.	6	L2	CO4
		Module – 5			
Q.9	a.	With the help of block diagram, explain the basic Communication system.	10	L2	CO5
	b.	Define Noise and explain the various kinds of noises.	10	L2	CO5
		OR			
Q.10	a.	Define Multiplexing and explain types of Communication systems.	8	L2	CO5
	b.	Classify and explain the Multiple Access Techniques.	8	L2	CO5
	c.	Mention the Need for Modulation.	4	L1	CO5

*****

Question paper Solutions.

Sub: Introduction to electronics and communication.

Code: BESCK204C Academic year: 2023 - 2024 EVEN.

June/July. 2024 Question paper.

Sub I/C: prof. Ramesh Patil, E&CE dept
GNDEC, Bidar.

Module: 1

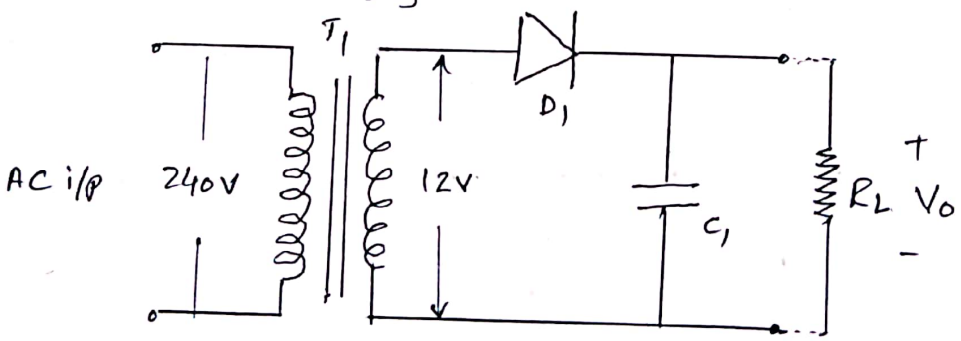
Q.1.a. Draw the block diagram regulated power supply and mention the function of each block. (08m)

Ans: Refer QP. DEC 2024/Jan 2025 Qution no Q.1.a BESCK104C.

Q.1.b. With the use of Circuit diagram and waveforms explain the working of Half wave rectifier with Capacitor filter. (8m)

Ans: In simple way, a rectifier is a device which converts ac voltage to pulsating dc voltage using one or more semiconductor diodes.

Halfwave rectifier with capacitor filter is as shown in fig.



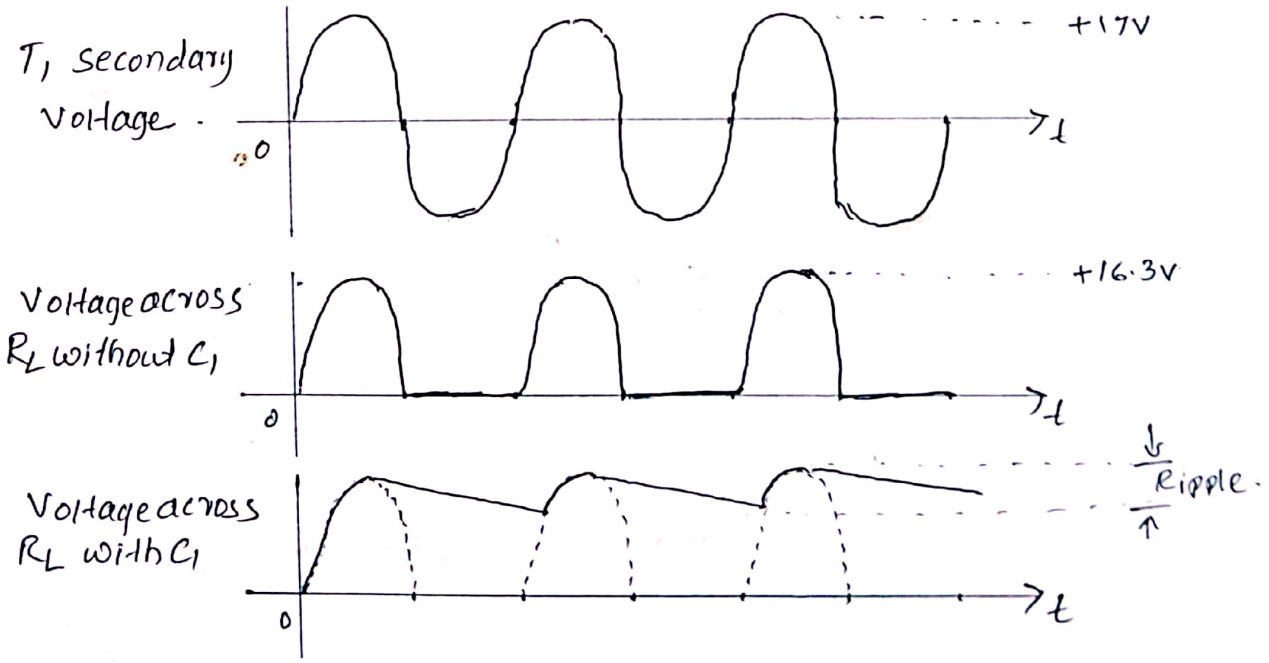
Mains voltage (220 V to 240V) is applied to the primary of a step-down transformer T_1. The secondary of T_1 steps down the 240 V_{rms} to 12 V_{rms}. Thus the turn ratio of T_1 will be 240/12 or 20:1.

Capacitor C_1 mentains output voltage V_o nearly equal to the peak voltage, when the diode is not conducting. This capacitor is called reservoir capacitor.

During +ve half cycle of secondary voltage, D_1 conducts and will charge C_1 to the peak value seen across R_L (16.3V). Because, C_1 and R_L are in parallel, the voltage across R_L will be the same as that across C_1.

During -ve half cycle, D_1 will be reverse biased and in non-conducting state, As a consequence, the diode will act like open switch and the only discharge path for C_1 is through R_L. The discharge time constant is determined by the capacitance value C_1 and the load resistance R_L.

Following fig. shows the secondary voltage waveform (input waveform) together with the voltage developed across R_L (output waveform) with and without C_1.



$$V_p = \sqrt{2} \cdot V_{rms} = \sqrt{2} \times 12 \approx 17V.$$

Q 1.c. Mention advantages of -ve feedback. (4m)

Ans: Although negative feedback results in reduced gain, It has many advantages, they are.

1) controls the gain.
2) increases input impedance and output impedance
3) Reduce distortion
4) Increased bandwidth.
5) decreased Noise. etc.

OR.

Q 2.a. List out and explain various types amplifiers. (8m)

Ans: An amplifier is a circuit, which can be used to increase the amplitude of the input voltage or current at the output.

* Types of amplifiers

1) a.c. coupled amplifiers.
In ac coupled amplifiers, different stages are coupled together in a such a way that dc levels are isolated and only the ac components of a signal are transformed from stage to stage.

2) d.c. coupled amplifiers.
In dc coupled amplifiers, stages are coupled together in such a way that stages are not isolated to dc voltages. Both ac and dc signal components are transferred from stage to stage.

3) Large signal amplifiers.
Large signal amplifiers are designed to amplify voltage levels 1V to 100V.

4) Small-signal amplifiers.

Small signal amplifiers are designed to amplify low level signals normally less than 1V and often much smaller.

5) Audio frequency amplifiers.

Audio frequency amplifiers operate in the band of frequencies that is normally associated with audio signals. i.e 20Hz to 20 KHz.

6) Wide band amplifiers.

Wide band amplifiers are capable of amplifying a very wide range of frequencies, typically from a few tens of hertz (Hz) to several mega hertz (MHz.).

7) Radio frequency amplifiers.

Radio frequency amplifiers operates in the band of frequencies that is normally associated with radio signals. i.e 100KHz to over 1 GHz.

8) Low noise amplifiers.

Low noise amplifiers are designed so that they contribute negligible noise to signal being amplified. These amplifiers are designed to amplify voltage levels less than 1mV.

Q. 2.b. With neat diagram explain the concept of negative feed back amplifier (7M)

Ans: Refer Question paper Dec 2024/JAN 2025, Q.N. 2.c BESCK104C

Q 2.c Write note on multistage amplifiers (5M)

Ans: In order to provide sufficiently large values of gain, it is necessary to use a number of interconnected stages within an amplifier. This is called multistage amplifier. The overall gain of multistage amplifiers with several stages is simply the product of the individual voltage gains i.e $A_v = A_{v_1} \times A_{v_2} \times A_{v_3}$ etc.

However the bandwidth of multistage amplifier is less than bandwidth of each individual stage. Signals can be coupled between the individual stages of multistage amplifier using one of the coupling methods.

1) RC coupling.
Resistors and capacitors are used between two stages for coupling.

2) LC coupling.
inductors and capacitors are used between two stages for coupling.

3) Transformer coupling
Transformer is used to connect one stage to another.

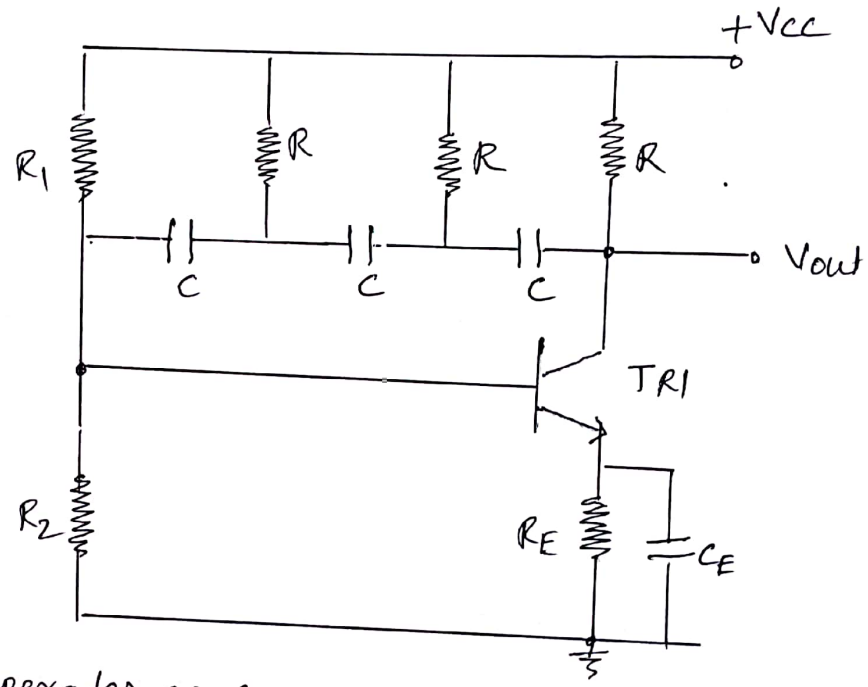
4) Direct coupling
One stage o/p is connected directly to input of second stage and so on.

Module - 2.

Q. 3. a. Explain the working of RC ladder network oscillator. (6m)

Ans: An oscillator is a circuit which produces a continuous, repeated, ac waveform without any input.

A simple phase-shift oscillator based on a three stage R-C Ladder network shown in fig.



TR1 operates as common-emitter amplifier stage with R_1 and R_2 providing base bias and R_E and C_E providing emitter stablization.

The total phase shift provided by the RC ladder network is 180° at the frequency of oscillation. The transistor provides the other 180° phase shift. Over all phase-shift will be 360° or 0°.

The frequency of oscillations will be given by

$$f = \frac{1}{2\pi\sqrt{6}\,RC} \text{ Hz.}$$

The loss associated with ladder network is 29. Thus the amplifier must provide at least gain of 29. in order for the circuit to oscillate.

Q 3.b. Define multivibrators. Explain the working of single stage astable multivibrator with diagram. (8m)

Ans: An electronic circuit that produces a non-sinusoidal waveform as its output is known as a multivibrator. The waveform are basically a square wave, rectangular wave etc.

A simple form of astable oscillator that produces a square wave output can be built using just one op-amp, as shown in fig.

[for full Answer refer Q.P. Dec 2024 / Jan 2025 BESCK104C Q. no. 3.C].

Q 3.c. Explain the working of Weinbridge oscillator with diagram. (6m)

Ans: Refer Q.P. Dec 2024 / Jan 2025 Q. no. 3.C BESCK104C.

OR

Q 4.a. Define the following terms with respect to op-amp: i) CMRR ii) Slew rate iii) supply voltage Rejection Ratio SVRR iv) Input offset voltage v) Input off set current. (10m)

Ans: i) CMRR (Common mode rejection Ratio)

It is defined as the ratio of differential gain to the common mode gain

i.e $CMRR = \frac{A_d}{A_{cm}}$

$= 20 \log_{10} \frac{A_d}{A_{cm}}$ in dB.

ii) Slew rate

Slew rate is the rate of change of output voltage with time.

$$\therefore \text{Slew rate} = \frac{\Delta V_{out}}{\Delta t} \quad V/\mu s.$$

Higher the slew rate, better the performance of the op-amp.

iii) Supply voltage Rejection Ratio SVRR.

It is defined as.

$$SVRR = \frac{\Delta V_{io}}{\Delta V_{cc}}$$

The change in op-amp input offset voltage V_{io} caused by variation in supply voltage V_{cc}.

Lower the value of SVRR better the op-amp.

iv) Input offset voltage (V_{io})

Input offset voltage is the voltage that must be applied between the two input terminals such that the output voltage becomes zero.

Typical value is between 1 mv to 15 mv.

v) Input offset current. (I_{io})

It is the difference between the currents flowing in to the non-inverting and inverting terminals.

$$I_{io} = |I_{B1} - I_{B2}|$$

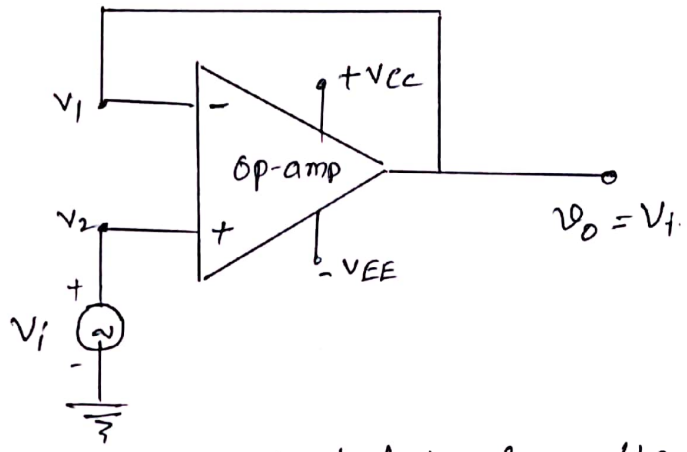
Where I_{B1} = current in to inverting terminal

I_{B2} = current in to non inverting terminal.

Q 4. b. Explain how op-amp can be used as
i) Voltage follower ii) Integrator. (10m)

Ans: i) Voltage Follower.

A circuit in which the output voltage follows the input voltage is called voltage follower circuit. It is shown in fig.



The node V_2 is at potential V_i, from the concept of virtual ground, V_1 is also at same potential as V_2

$$\therefore V_1 = V_2 = V_i$$

Now node V_1 is directly connected to the output, Hence we can write

$$V_o = V_i$$

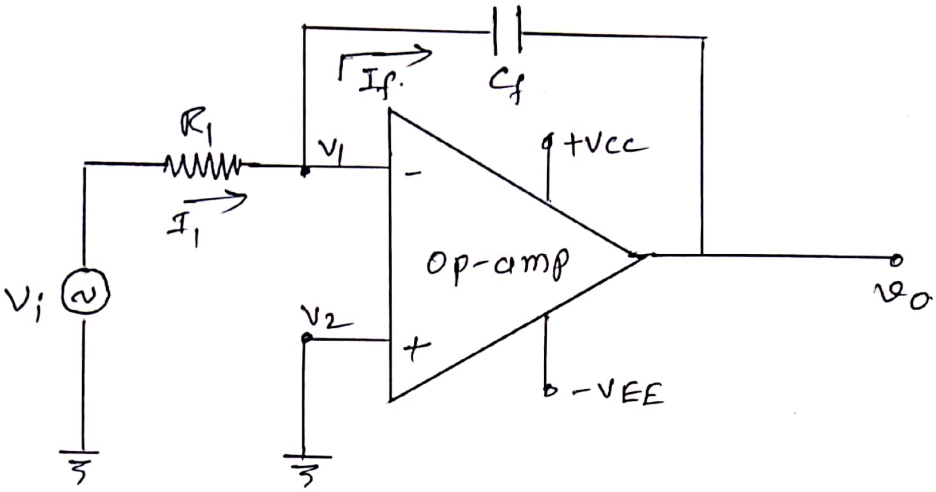
$\therefore$ the output voltage follows the input.

ii) Integrator.

In an integrator circuit, the output voltage is the integration of the input voltage.

Consider the op-amp integrator circuit as shown in fig.

for fig. see next page.



Applying KCL at node V_1

$$I_1 = I_F$$

$$\frac{V_i - V_1}{R_1} = C_f \frac{d(V_1 - V_o)}{dt}.$$

$$\frac{V_i}{R_1} = -C_f \frac{dv_o}{dt} \qquad \because V_1 = 0$$

Integrating both sides

$$\int_0^t \frac{v_i}{R_1} \cdot dt = -C_f \int_0^t \frac{dv_o}{dt} \cdot dt$$

$$= -C_f \cdot V_o$$

$$\therefore \quad V_o = -\frac{1}{R_1 C_f} \int_0^t v_i \cdot dt.$$

Hence output voltage is integration of input voltage.

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Module - 3.

Q 5 a. Convert i) $(3568)_{10} = (?)_2$ ii) $(3FD)_{16} = (?)_2$
iii) $(110111)_2 = (?)_{10}$ iv) $(1234)_{10} = (?)_8$
v) $(5678)_{10} = (?)_{16}$. (10m).

Soln: i) $(3568)_{10} = (?)_2$

Using successive division by two method.

2	3568		
2	1784	— 0	LSB
2	892	— 0	
2	446	— 0	
2	223	— 0	
2	111	— 1	
2	55	— 1	
2	27	— 1	
2	13	— 1	
2	6	— 1	
2	3	— 0	
2	1	— 1	
	0	— 1	MSB

$\therefore (3568)_{10}$
$= (110111110000)_2$. ⇐ Ans.

ii) $(3FD)_{16} = (?)_2$.

Replacing each Hexadecimal digit into four bit binary number.

3 F D
0011 1111 1101

$\therefore (3FD)_{16} = (001111111101)_2$. ⇐ Ans

iii) $(110111)_2 = (?)_{10}$

Using sum of weights method.

$110111 = 1\times2^5 + 1\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$
$= 32 + 16 + 0 + 4 + 2 + 1$

$\therefore (110111)_2 = (55)_{10}$ ⇐ Ans.

iv) $(1234)_{10} = (?)_8$

using successive division by 8 method.

8	1234	
8	154	→ 2 LSD
8	19	→ 2 ↑
8	2	→ 3
	0	→ 2 MSD

$\therefore (1234)_{10} = (2322)_8$

Ans

v) $(5678)_{10} = (?)_{16}$

using successive division by 16 method

16	5678	
16	354	→ E LSD
16	22	→ 2 ↑
16	1	→ 6
	0	→ 1 MSD

$\therefore (5678)_{10} = (162E)$

Q 5, b. Write any four Boolean theorems and Identities. (10M)

Ans: * Theorems.

1) De Morgan's Theorems:

States that the complement of the sum of two variables is equal to the product of their complements and vice versa.

$$\overline{(A+B)} = \bar{A} \cdot \bar{B}$$

$$\overline{(AB)} = \bar{A} + \bar{B}$$

2) Distributive theorem.

States that the sum of a variable and the product of two variables is equal to the sum of the products of variable with each of the two other variables.

i.e $A + (B * C) = (A+B) * (A+C)$

3) Associative Theorem.

States that the order in which variables are grouped for addition or multiplication does not affect the result.

$(A+B)+C = A+(B+C)$

$(A \cdot B) \cdot C = A \cdot (B \cdot C)$

* Identities.

1) ~~Commutative~~ Absorption identity

States that a variable can absorb the sum or product of itself with another variable.

$A + AB = A$

$A \cdot (A+B) = A$.

2) Commutative Identity.

States that the order of variables in sum or product does not affect the result.

$A + B = B + A$.

$A \cdot B = B \cdot A$.

3) Idempotent identity

States that a variable can be added or multiplied with itself without changing the result.

$A + A = A$

$A \cdot A = A$.

4) Null element identity.

States that the sum of variable with its complement is equal to 1, and the product of variable with its complement is equal to 0.

$A + \bar{A} = 1$

$A \cdot \bar{A} = 0$.

OR

Q6 a. Simplify the following Boolean functions

i) $Y = A\bar{B} + AB$

ii) $F = B[(A+\bar{B})(B+C)]$

iii) $Z = B(A+C)+C$. (8m)

Ans: i) $Y = A\bar{B} + AB$

$= A(\bar{B}+B)$ $\quad \because B+\bar{B}=1$

$= A \cdot 1$

$= A$ ⇐ Ans.

ii) $F = B[(A+\bar{B})(B+C)]$

$= B[AB+AC+B\bar{B}+\bar{B}C]$

$= ABB+ABC+BB\bar{B}+B\bar{B}C$ $\quad \because BB=B$, $B\bar{B}=0$

$= AB+ABC+0+0$

$= AB[1+C]$ $\quad \because 1+C=1$

$= AB$ ⇐ Ans

iii) $Z = B(A+C)+C$

$= AB+BC+C$

$= AB+(B+1)C$. $\quad \because B+1=1$

$= AB+1 \cdot C$.

$= AB+C$ ⇐ Ans.

Q.6.b. Explain Half adder circuit with truth table Realize the circuit for sum and carry using basic Gates. (8m).

Ans: A half adder is a combinational circuit which performs the arithmatic addition two one bit number and generates sum and carry. It is not have any provision for applying carry input. It has 2 inputs and 2 outputs.

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Truth Table.

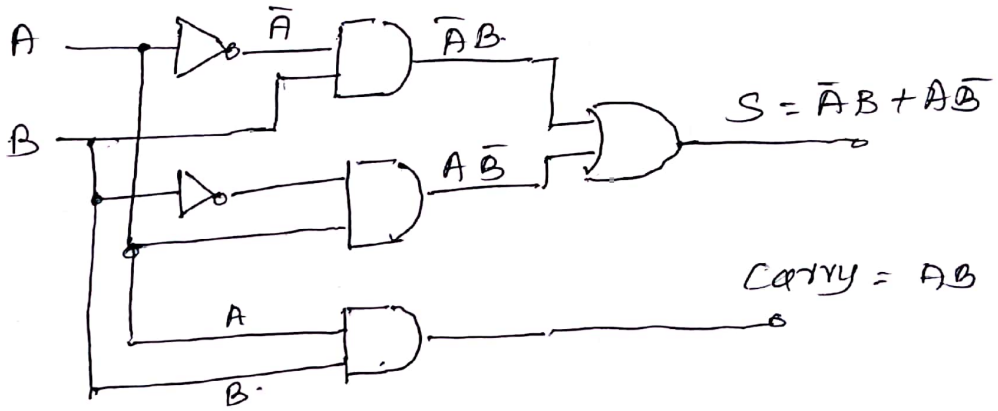
Inputs		outputs	
A	B	S Sum.	C Carry.
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

from truth table

Sum, $S = \bar{A}B + A\bar{B}$

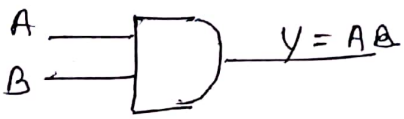
Carry, $C = AB$.

* Realization of Half adder using basic gates



Q6. c. Write the symbol and Truth table of AND and OR Gate. (4M)

Ans: * AND Gate



Symbol

Truth table

I/P		O/P
A	B	Y = AB
0	0	0
0	1	0
1	0	0
1	1	1

* OR Gate

symbol.

Truth Table.

I/P		O/P
A	B	Y = A+B
0	0	0
0	1	1
1	0	1
1	1	1

Module 4.

Q.7.a. Define Embedded System and explain the Classification of embedded system based complexity and deterministic behavior. (10m)

Ans: An embedded system is an electronic/electro-mechanical system designed to perform a specific function and is a combination of both hardware and firmware (Software).

* Classification of embedded system based on complexity.

1) Small-Scale Embedded systems.

A small scale embedded systems are usually around low performance and low cost 8 or 16 bit microprocessor / microcontrollers. A small scale embedded system may or may not contain OS for its functioning. Ex: Electronic Toy.

2) Medium-Scale Embedded systems.

Slightly complex in hardware and firmware. These are built around 16 or 32 bit microprocessor / microcontrolls or DSP (Digital signal processors)

3) Large scale embedded systems / complex systems.

These are built around high performance 32 or 64 bit RISC processors or RSOC or multicore processor and programmable logic devices.

Ex: Decoding / encoding of media, cryptographic function implementation etc.

* Classification of embedded system based on deterministic behavior.

1) Hard Real-Time systems.

These systems have a strict deadline for task completion, and missing a deadline can have catastrophic consequences.

- Examples: Air traffic control systems, medical devices, and automotive control systems.
- Characteristics: predictable and guaranteed response times, high reliability and fault tolerance.

2) Soft Real-Time Systems.

These systems have a deadline for task completion, but missing a deadline may not have severe consequences.

- Examples: multimedia systems, video streaming, audio processing etc.

3) Non Real-time systems.

These systems do not have strict deadline for task completion, and response times are not critical.

- Examples: consumer electronics, appliances and general purpose computers.

Q7. b. Compare embedded system and general computing system. (6m).

Ans: Refer Question paper Dec 2024/Jan 2025 Q.no. 7.a.

Q 7.c. List out the major application areas of embedded systems. (4m)

Ans:

1) Consumer electronics: Camcorders, Cameras etc
2) Household appliances: TV, DVD player, washing machines, Fridge, microwave oven, etc.
3) Home automation and security systems: Air conditioners, sprinklers, intruder detecting alarm, CCTV Cameras, fire alarms etc
4) Automotive industry: ABS, engine control, ignition systems, automatic navigation systems etc.
5) Telecom: Cellular phones, telephone switches, handset
6) Computer peripherals: printers, scanners, Fax machines etc
7) Computer networking systems: Network Routers, switches, hubs, etc.
8) Health care: Different kinds of scanners, EEG, ECG machines etc
9) Banking and retail: ATMs, currency counters, etc.
10) Card readers: Barcode, smart card readers, hand held devices etc.
11) wearable Devices: Health and fitness trackers etc
13) Cloud computing and Internet of Things (IOT).

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OR.

Q 8.a. With the use of diagram explain the core of an Embedded system. (8M).

Ans: Refer question paper DEC 2024 / JAN 2025 Q no. 7.b. BESCK104C.

Q 8.b. Compare RISC and CISC. (6M).

Ans: Refer question paper DEC 2024 / JAN 2025 Q.no. 7.C ii) BESCK104C

Q 8.C. Write a short notes on sensors and 7-segment LED displays. (6M).

Ans: A sensor is a special kind of transducer that is used to generate an input signal to a measurement, instrumentation or control signal. It converts any physical parameter to be measured into electrical signal either in the form of analog or digital signal.

Types of sensors: Active or passive.

Sensors acts as input devices to embedded systems.

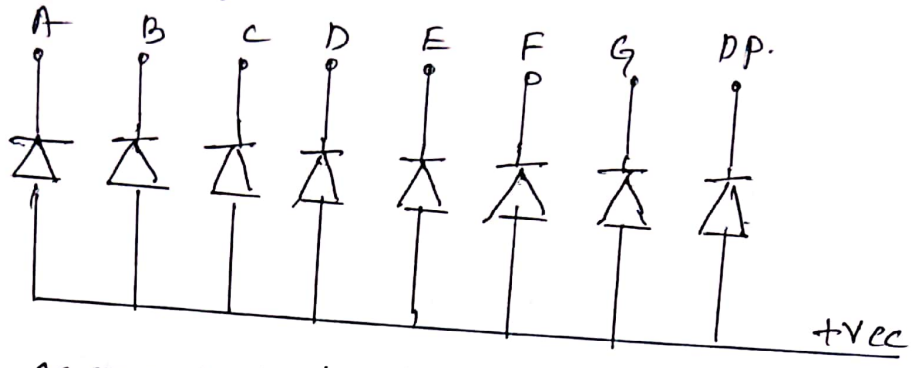
Ex: microphone, thermocouple, Rotary potentiometer etc.

- 7-segment LED display.

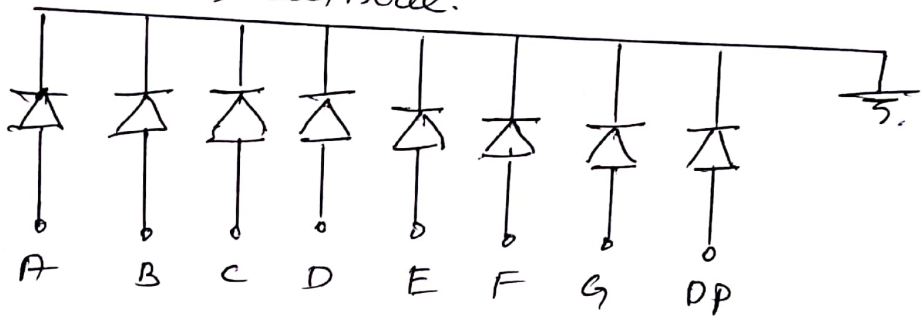
The 7-segment LED display is an output device for displaying alpha numeric (0-9 and A-F) characters. It contains 8 LED segments arranged in special form. out of 8 LEDs, 7 are used for displaying alpha numeric characters. The LED segments are named A to G and the decimal point LED segment is named as DP.

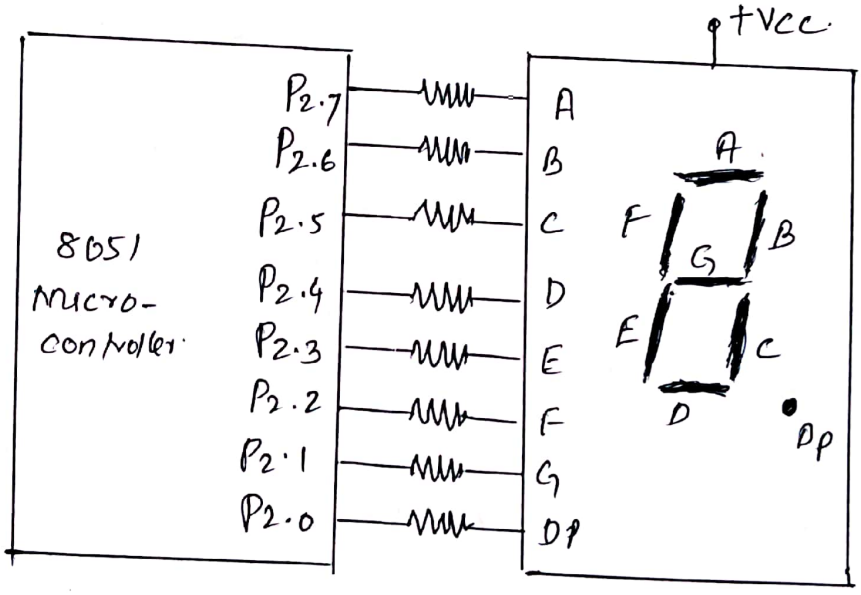
The 7-segment LED displays are available in two different configurations namely i) common anode and ii) common cathode.

* Common anode:



* Common cathode:





Module - 5.

Q 9.a. With the help of block diagram explain the basic communication system. (10m).

Ans. Refer Question paper DEC 2024 / JAN 2025 Q no. 9.a. BESCK104C.

Q 9.b Define Noise and explain the various kinds of noises. (10m).

Ans: Noise refers to any unwanted or undesirable signal that interferes with the desired signal in a communication system or electronic circuit.

Types of Noises:

1) Thermal noise
- Caused by the random motion of particles in a conductor.
- present in all electronic devices
- increases with temperature

2) Shot noise
- Caused by random arrival of electrons at a detector
- present in devices that rely on the flow of electrons, ~~at a detector~~ such as photodiodes and vaccum tubes.
- increases with square root of the current.

3) Electromagnetic interference (EMI) Noise.
- Caused by external electromagnetic fields, such as radio waves and electrical signals.
- Can be radiated or conducted into a system.
- Can be mitigated using shielding and filtering

4) Impulse Noise.

- caused by sudden, brief distrubances in a signal
- can be caused by electrical surges, lightning strikes or othe external events.
- can be mitigated using surge protectors and filtering

5) Atmospheric Noise.

- caused by electromagnetic radiation from natural sources, such as lightning and solar activity.
- can interfere with radio communication system.

6) Industrial Noise.

- caused by electromagnetic radiation from human-made sources, such as machinery and electrical equipment.

OR

Q 10.a Define multiplexing and explain types of communication systems. (8m).

Ans: multiplexing is a process which allows more than one signal to transmit through a single channel. multiplexing allows the maximum utilization of channel bandwidth.

Types of multiplexing: FDM, TDM & WDM.

FDM: Frequency Division multiplexing
TDM: Time Division multiplexing
WDM: Wavelength division multiplexing.

* Types of communication systems:

- Communication systems based on physical Infrastructure.

1) Line communication systems.

There is a physical link, called the hardware channel between the transmitter and the receiver in the communication system.

Ex: Landline telephony, Cable TV etc.

2) Radio communication systems:

There is no physical link and natural resources such as space air and water are used as software channels.

Ex: Radio broadcasting etc.

- Communication systems based on signal specifications.

There are two types

i) Nature of information signal.

ii) Nature of the transmitted signal.

Based on the nature of information signal

i) Analog communication systems

ii) Digital communication systems

Based on the nature of transmitted signal, the information (baseband) signal can be either transmitted as it is without modulation or through a carrier signal with modulation.

Accordingly

i) Base band communication system

ii) Carrier communication system.

Ex. of base band: Landline telephony & Fax etc.

Examples of carrier communication:

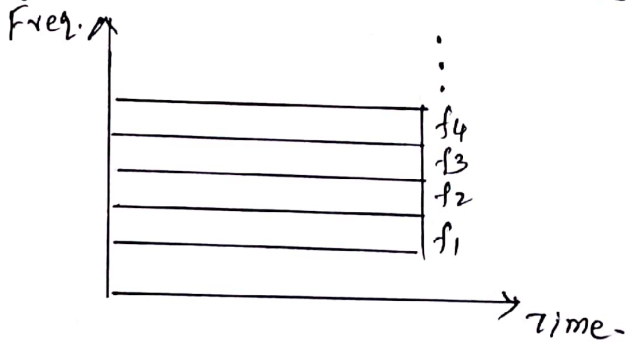
TV transmission, radio broadcast etc.

Q10. b. Classify and explain multiple Access Techniques. (8m)

Ans: multiple Access is a technique to provide communication service to multiple users over a single channel. It allows multiple mobile users share the allotted spectrum in the most effective manner.

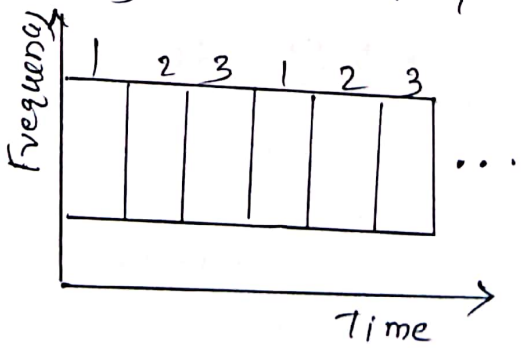
* Frequency Division multiple Access (FDMA)

Available frequency band is split into smaller frequency channels, and different channels are assigned to different users. The carriers are seperated by gaurd bands, which avoid the interference between the users.



* Time Division multiple Access (TDMA)

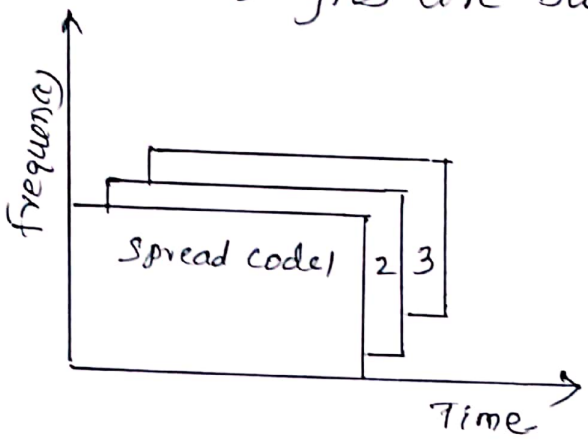
Various users can transmit at the same frequency band at different times. Every user is permitted to transmit only in specific time slots using common frequency band.



GSM uses the combination of both TDMA & FDMA.

* Code Division Multiple Access (CDMA)

Mobiles receive signals on the same carrier frequency and at the same time. But the signals are labled by the use of codes, which allows a mobile to seperate its own signal from the others. CDMA is the common platform on which 3G technologies are built.



Q10. c. Mention the need for modulation (4m)

Ans:

1) Reduces the hight of antenna.
2) Avoids mixing of signals
3) Increase the range of communication
4) Allows multiplexing of signals
5) Allows adjustment in bandwidth
6) Improves the quality of reception.

CBCS SCHEME

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BESCK104C/BESCKC104

First Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	What is Regulated power supply? With neat block diagram, explain the individual blocks.	8	L2	CO1
	b.	What is a rectifier? With neat circuit diagram and output waveforms, explain full wave bridge rectifier with capacitor filter.	8	L2	CO1
	c.	With circuit diagram brief out the operation of voltage doubler.	4	L2	CO1
		OR			
Q.2	a.	Draw the circuit diagram of voltage regulator and explain the operation.	7	L2	CO1
	b.	Explain the concept of negative feedback amplifier with relevant equations and diagrams.	5	L2	CO1
	c.	Explain Frequency response of RC coupled amplifier.	8	L2	CO1
		Module – 2			
Q.3	a.	Explain the Barkhausen criteria for oscillations. In wein bridge oscillator if $C_1 = C_2 = 200nF$ determine the frequency of oscillation when $R_1 = R_2 = 4k\Omega$.	7	L3	CO2
	b.	With neat circuit diagram, explain the operation of ladder network oscillator.	7	L2	CO2
	c.	Explain the operation of single stage Astable multivibrator with its circuit diagram.	6	L2	CO2
		OR			
Q.4	a.	List out the Ideal characteristics of an op-amp.	7	L2	CO2
	b.	Explain the following with respect to operational amplifier, i) Inverting amplifier ii) Integrator.	8	L2	CO2
	c.	An operational amplifier operating with negative feedback produces an output voltage of 2V when supplied with an input of 400μV. Determine the value of closed – loop voltage gain and express the answer in decibels.	5	L3	CO2
		Module – 3			
Q.5	a.	Convert the following : i) $(FACE)_{16} = (\quad)_{10}$ ii) $(65.45)_{10} = (\quad)_2$ iii) $(111101101011.11011)_2 = (\quad)_8$ iv) $(2604.10546875)_{10} = (\quad)_{16}$	8	L3	CO3

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	b.	Perform the following : i) $(1010100)_2 - (1000100)_2$ using 2's compliment. ii) $(4456)_{10} - (34324)_{10}$ using 10's compliment method.	6	L3	CO3
	c.	State and prove De – Morgan's theorems with its truth table.	6	L2	CO3
		OR			
Q.6	a.	Implement the Boolean functions using logic gates. i) $F_1 = x + y'z$ ii) $x'y'z + x'yz + xy'$	6	L3	CO3
	b.	Write the step by step procedure to design a combinational circuit.	6	L2	CO3
	c.	Implement full adder circuit with its truth table and draw the logic diagram of sum and carry.	8	L3	CO3
		Module – 4			
Q.7	a.	What is an embedded system? Compare embedded system and General computing systems.	7	L2	CO4
	b.	Explain classification of embedded systems.	7	L2	CO4
	c.	What is the difference between RISC and CISC processors?	6	L2	CO4
		OR			
Q.8	a.	Discuss major application areas of embedded systems with examples.	7	L2	CO4
	b.	Write short note on : i) Transducers ii) Sensors iii) Actuators.	6	L2	CO4
	c.	Write a short note on 7-segment LED display.	7	L2	CO4
		Module – 5			
Q.9	a.	With neat block diagram, explain modern communication system.	8	L2	CO5
	b.	Write a note on Hard wired channel and Soft wired channel.	6	L2	CO5
	c.	Explain with a neat diagram, the concept of Radio wave propagation and its different types.	6	L2	CO5
		OR			
Q.10	a.	Explain Amplitude Modulation (AM) and Frequency Modulation (FM) with neat waveforms.	8	L2	CO5
	b.	List out the advantages of Digital communication over Analog communication.	6	L2	CO5
	c.	Explain different multiple Access Techniques.	6	L2	CO5

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Question paper solutions

Sub: Introduction to Electronics and Communication

Code: BESCK104C

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GNDEC, Bidar

Academic year: 2023 - 2024 ODD

Dec 2023 / Jan 2024 Question paper.

Module - 1

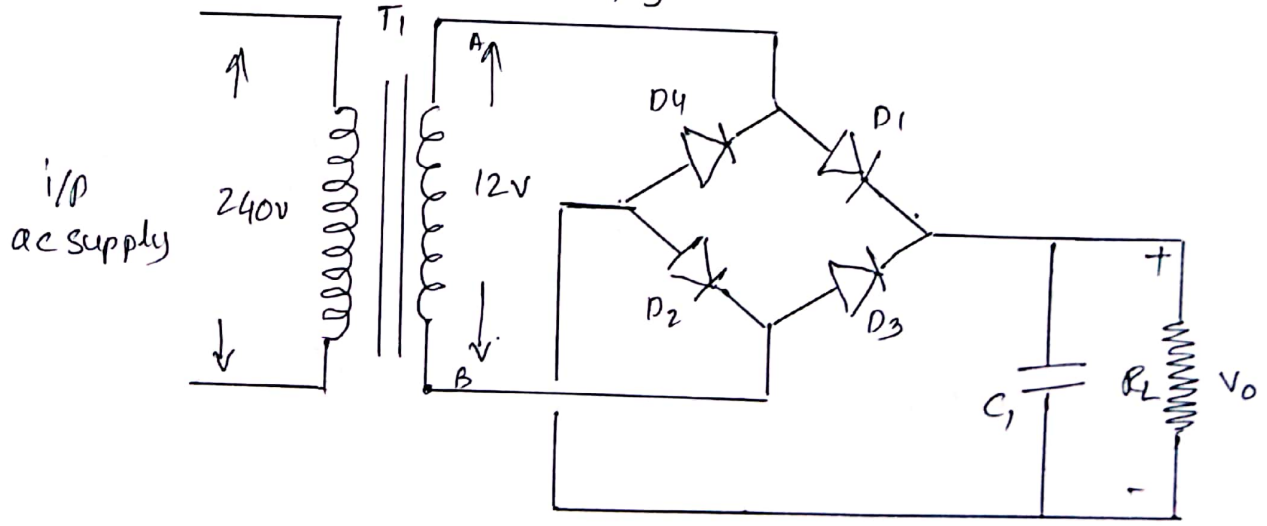
Q1.a. What is Regulated power supply? with neat block diagram, explain the individual blocks (8m)

Ans: Refer Question paper Dec24/Jan2025, Q.no. 1.a

Q 1.b. What is rectifier? with neat circuit diagram and output wave forms explain full-wave bridge ~~amplifier~~ rectifier with capacitor filter (8m)

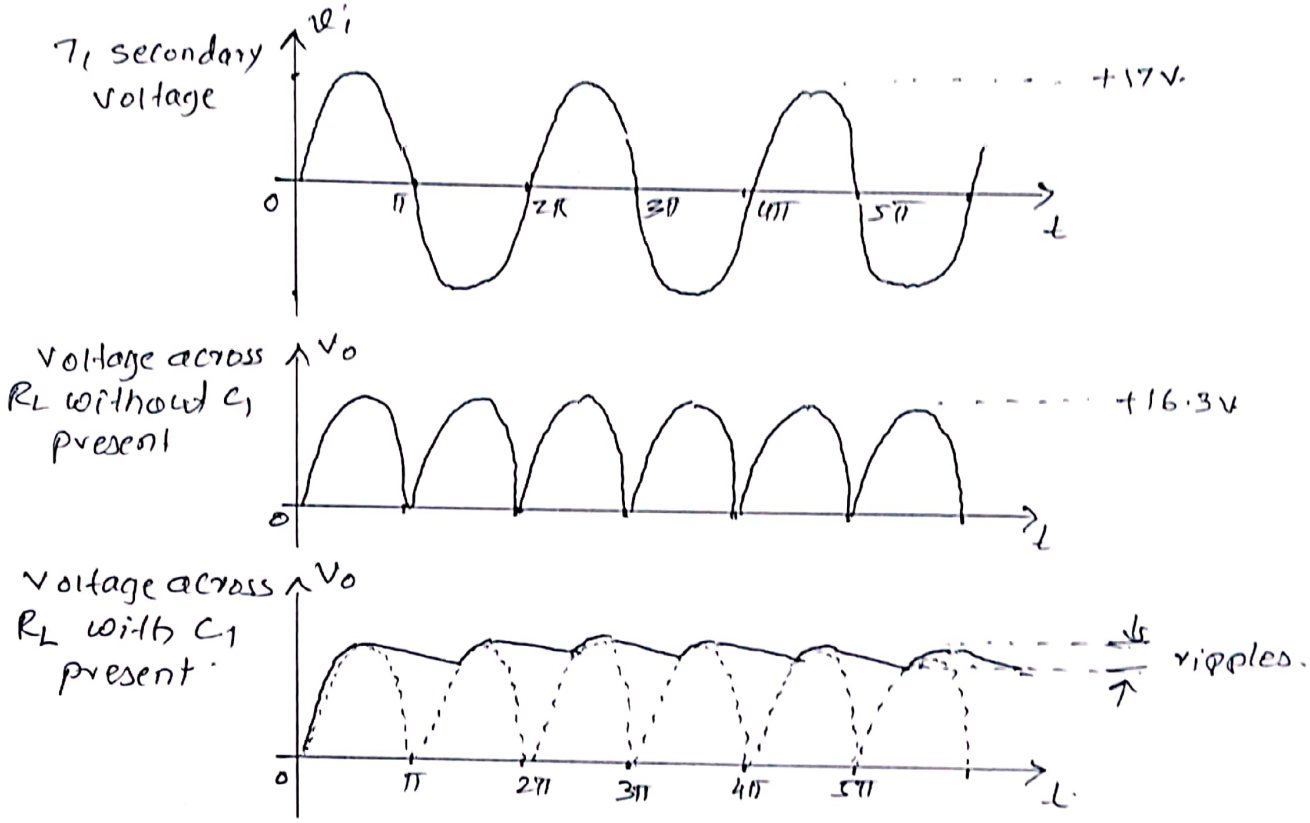
Ans: In a simple way, a rectifier is a device which converts ac voltage to pulsating dc voltage using one or more semiconductor diodes.

In bridge full wave rectifier four diodes are used in which two diodes are conducting in each half cycles. A bridge full wave rectifier with capacitor filter is shown in fig.



In fig diode D_1 and D_2 are conducting during +ve half cycle while diodes D_3 and D_4 are conducting during -ve half cycle. A reservoir capacitor (filter capacitor) C_1 can be added to maintain smooth output voltage when the diodes are not conducting.

The output waveforms with and without capacitor C_1 are shown in fig. below.



Q.1.c. With near circuit diagram briefout the operation of voltage doubler. (4m)

Ans: Refer Question paper DEC 24/JAN 2025 Q.no. 1.b. BESCK104C.

OR

Q.2.a.i Draw the circuit diagram voltage regulator and explain the operation.

Ans: Refer Question paper DEC 24/JAN 2025 Q.no. 2.a BESCK104C.

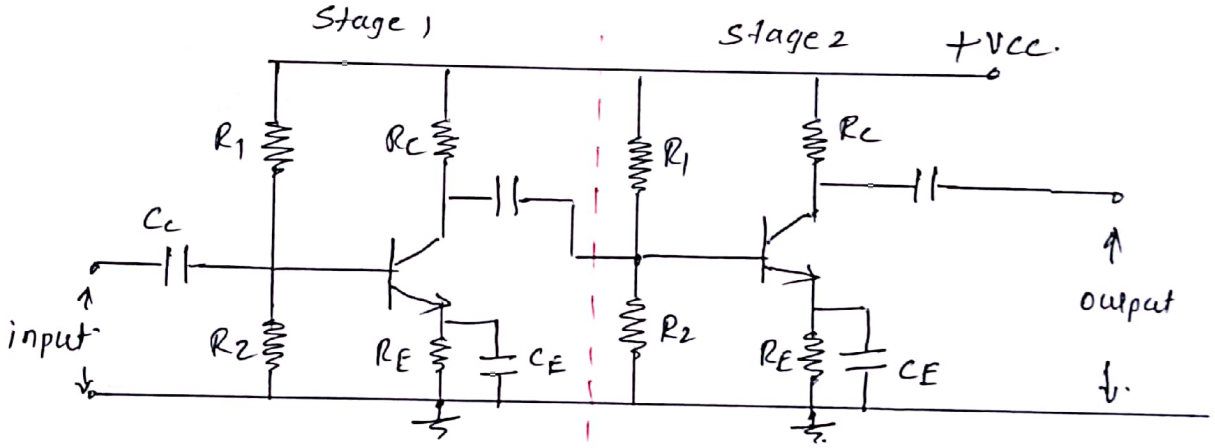
Q.2.b. Explain the concept of negative feedback amplifier with relevent equations and diagrams. (5m)

Ans: Refer Question paper Dec24/Jan 2025 Q.no. 2.c. BESCK104C.

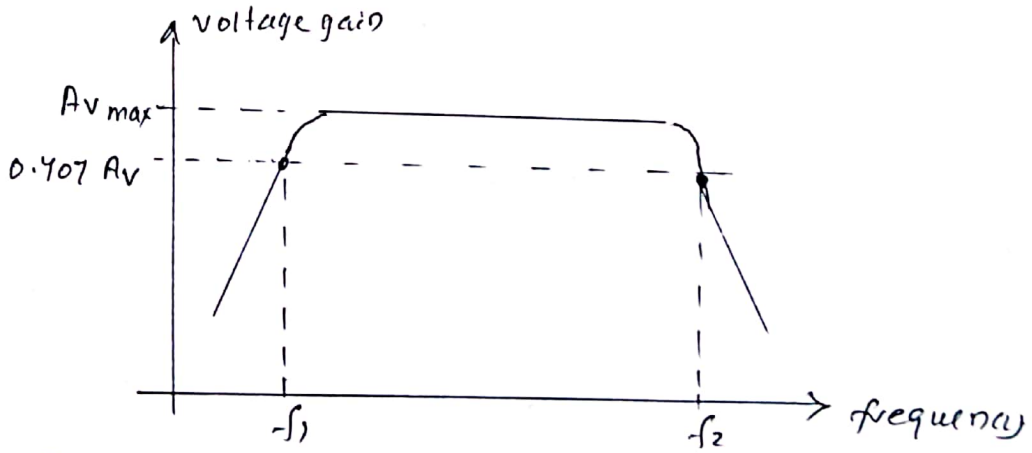
Q 2.c Explain frequency response of RC coupled amplifier. (8m)

Ans: The frequency response of an amplifier refers to the band of frequencies or frequency range that amplifier was ~~defined~~ designed to amplify.

In RC coupled amplifier, the stages are coupled together using capacitors and resistors. Below fig shows a practical example of this coupling method.



* Frequency response



In above fig.

Bandwidth $= (f_2 - f_1)$ Hz.

Module - 2.

Q.3.a. Explain the Barkhausen criteria for oscillations. In wein bridge oscillator if $C_1 = C_2 = 200nF$. Determine the frequency of oscillation when $R_1 = R_2 = 4k\Omega$. (7m)

Ans: Refer Question paper Dec 24/Jan 2025 Q.no. 3.a. BESCK104C

In wein bridge, frequency of oscillation is given by.

$$f = \frac{1}{2\pi RC}$$

$R = R_1 = R_2 = 4\,k\Omega$. and $C = C_1 = C_2 = 200nF$.

$$\therefore f = \frac{1}{2\pi \times 4\times10^3 + 200\times10^{-9}}$$

$$= 198.9\ Hz.$$

Q 3.b With neat circuit diagram, explain the operation of ladder network oscillator. (7m)

Ans: Refer Question paper June/July 2024 Q.no. 3.a. BESCK 204C.

Q.3.c. Explain the operation of single stage astable multivibrator with its circuit diagram. (6m)

Ans: Refer Question paper Dec 24/Jan 2025 Q.no. 3.c. BESCK 104C.

OR

Q.4.a. List the ideal characteristics of an op-amp. (7m)

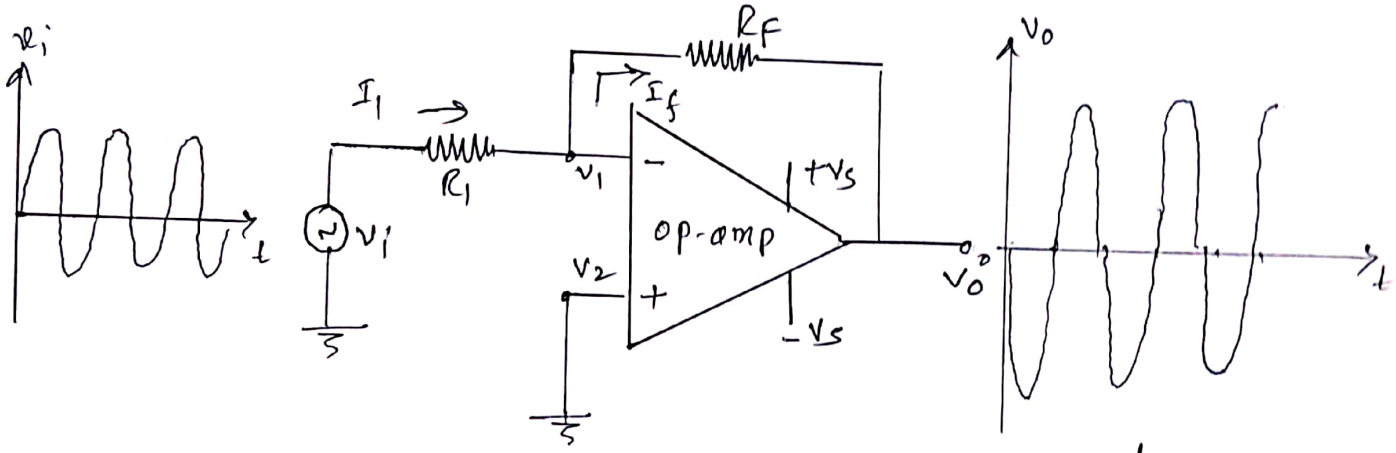
Ans: Refer. Question paper Dec 24/Jan 2025 Q.no. 4.a. BESCK104C

Q4. b. Explain the following with respect to operational amplifier. (8m).

i) Inverting amplifier ii) Integrator

Ans: i) Inverting amplifier.

In inverting amplifier output signal having phase shift of 180° as compared to input signal.



From the concept of virtual ground

$V_1 = V_2 = 0$.

Applying KCL at node V_1

$$I_1 = I_f.$$

$$\frac{(V_i - 0)}{R_1} = \frac{(0 - V_o)}{R_f} \qquad \because V_1 = 0$$

Solving for V_o

$$\boxed{V_o = -\frac{R_f \cdot V_i}{R_1}}$$

−ve sign indicates that o/p voltage is inverted (i.e 180° phase shift) of input voltage.

ii) Integrator.

Refer Question paper nec24/ Jan 2025 Q.no. 4.c.

Q.4.c. An operational amplifier operating with negative feed back produces an output voltage of 2V when supplied with an input of 400 μV. Determine the value of closed loop gain and express the answer in decibels. (5M)

Soln:

$v_o = 2V$, $v_i = 400\,\mu V$.

Closed loop voltage gain

$$A_{v(CL)} = \frac{v_o}{v_i} = \frac{2}{400\times10^{-6}} = 5000$$

$$A_{v(CL)} \text{ in dB} = 20\log_{10} 5000 = 73.97 \text{ dB} \Leftarrow \text{Ans.}$$

Module - 3

Q.5.a. Convert the following.

i) $(FACE)_{16} = (?)_{10}$ ii) $(65.45)_{10} = (?)_2$

iii) $(1111011011011.11011)_2 = (?)_8$

iv) $(2604.10546875)_{10} = (?)_{16}$ (8M)

Soln: i) $(FACE)_{16} = (?)_{10}$ using sum of weights method

$$= F\times16^3 + A\times16^2 + C\times16^1 + E\times16^0$$
$$= 15\times16^3 + 10\times16^2 + 12\times16 + 14\times1$$
$$= 61440 + 2560 + 192 + 14$$
$$= (64206)_{10} \Leftarrow \text{Ans.}$$

ii) $(65.45) = (?)_2$ using successive division & " multiplication

2	65	
2	32	→ 1 LSB
2	16	→ 0
2	8	→ 0
2	4	→ 0
2	2	→ 0
2	1	→ 0
	0	1 MSB

$0.45\times2 = 0.90$ carry. 0 MSB

$0.90\times2 = 1.80$ carry 1

$0.80\times2 = 1.60$ carry 1

$0.60\times2 = 1.20$ carry 1 LSB

$\therefore (65.45)_{10} = (1000001.0111)_2$.

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iii) $(1110110111011.11011)_2 = (?)_8$.

Grouping into 3-bits

001 | 111 | 011 | 011 | 011 . 110 | 110

1 7 3 3 3 . 6 6

$= (17333.66)_8$.

iv) $(2604.10546875)_{10} = (?)_{16}$.

16	2604	
16	162	→ C
16	10	→ 2
	0	→ A

$0.10546875 \times 16 = 1.6875$ carry 1

$0.6875 \times 16 = 11.00$ carry B.

$\therefore = (A2C.1B)_{16}$.

Q.5.b. Perform the following

i) $(1010100)_2 - (1000100)_2$ using 2's complement

ii) $(4456)_{10} - (34324)_{10}$ using 10's complement (6m)

Soln: i) $(1010100)_2 - (1000100)_2$ using 2's complement.

step: a) Taking 2's complement of $(1000100)_2$

0111011
+1
0111100 ← 2's complement.

step: b) Adding above 2's complement with $(1010100)_2$

1010100
+0111100
discard carry → 10010000

step c) $(0010000)_2$ ← Ans.

ii) $(4456)_{10} - (34234)_{10}$ using 10's complement

Step a): Taking 10's complement of $(34234)_{10}$

$$\begin{array}{r} 99999 \\ -\ 34234 \\ \hline 65765 \\ +1 \\ \hline 65766 \end{array}$$ ← 10's complement.

Step: b) adding 10's complement with $(4456)_{10}$

$$\begin{array}{r} 04456 \\ +\ 65766 \\ \hline 70222 \end{array}$$ no carry

Step c) Taking 10's complement of above answer and attach -ve sign.

$$\begin{array}{r} 99999 \\ -\ 70222 \\ \hline 29777 \\ +1 \\ \hline 29778 \end{array}$$

$-(29778)_{10}$ ⇐ Ans.

Q.5.c. State and prove Demorgan's theorems with its truth table. (6m.)

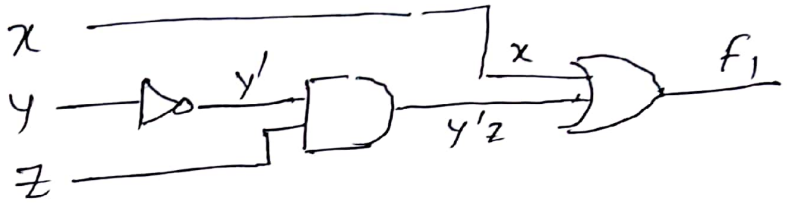
Ans: Refer. Question paper Dec24/Jan2025 Q.no. 5.c. BESCK104C

OR

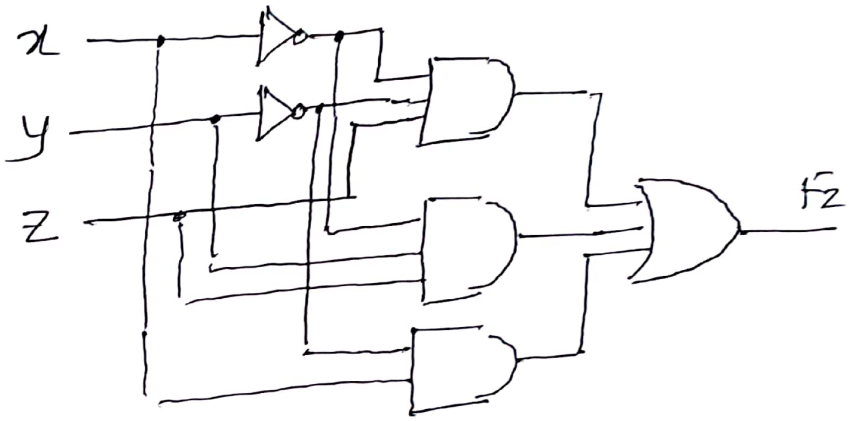
Q.6 a. Implement the Boolean functions using basic gates

i) $F_1 = x + y'z$ ii) $F_2 = x'y'z + x'yz + xy'$ (6m)

Soln: i) $F_1 = x + y'z$



ii) $x'y'z + x'yz + xy'$



Q.6.b. write the step by step procedure to design a combinational circuit. (6m)

Ans: Refer Question paper Jan/Feb 2023 Q.6.c.

Q.6.c. Implement full adder circuit with it's Truth table and draw the logic diagram of sum and carry (8m)

Ans: Refer Question paper Dec 24/Jan 25 Q.6.c.

Module - 4

Q.7.a. What is an embedded system? Compare embedded system and general computing system (7m)

Ans: Refer Question paper DEC24/JAN 2025 Q.no. 7.a
BESCK104C

Q.7.b. Explain classification of embedded system. (7m)

Ans: Refer. Question paper. June/July 2023. Q.no. 8.c.
BESCK204C

Q 7.c. What is the difference between RISC and CISC processors. (6m)

Ans. Refer Question paper DEC24/JAN 2025 Q.no. 7.c.ii)
BESCK104C.

OR.

Q.8.a. Discuss major applications areas of embedded systems with examples. (7m.)

Ans: Refer Question paper June/July 2024 Q.7.c
BESCK204C.

Q.8.b. Write notes on
i) Transducers ii) sensors iii) Actuators. (6m)

Ans: Refer Question paper JAN/Feb 2023. Q.no. 8.c.
BESCK104C for i) & ii)

iii) Actuator:
Actuator is transducer which converts electric signals to corresponding to physical action (motion). Actuator acts as an output device. Ex: electric motors, stepper motor, robotic arms. etc.

Q.8.c Write a short note on 7-segment LED display (7m)

Ans: Refer Question paper June/July 2024 Q.no. 8.c.
BESCK204C

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Module - 5.

Q.9.a. With neat diagram, explain modern communication system. (8M)

Ans: Refer Question paper Dec24/Jan2025. Q.no. 9.a. BESCK104C

Q.9.b. Write a note on Hardwired channel and Soft wired channel. (6M)

Ans. The transmission medium between the transmitter and the receiver is called a channel.

Depending on the physical implementation, Channel is classified into

I) Hardwire channels.
II) Soft wire channels.

1) Hardwired (Hardware) channels.

These channels are manmade structures which can be used as transmission medium.

i) Transmission Lines.

Ex: twisted pair cables (Land line phone)
Co-axial cables (TV cables)

ii) Wave Guides:

To transmit Ultra High Frequencies (UHF) wave guides are used as medium
wave guides are hollow, circular or rectangular metallic structures.

iii) optical Fiber Cables: (OFC)

In optical fiber cables signals are transmitted in the form of light energy in OFC cables.

2) Softwired (Software) channels

The natural resources which can be used as transmission medium for signals is called Software channels.

Ex: air, openspace, and sea water.

There is no physical link between the transmitter and the receiver in communication system if the Software channels are used.

Q.9.c. Explain with neat diagram, the concept of Radio wave propagation and its different types (6m)

Ans: Refer Question paper DEC 24/JAN 2025 Q.no. 10.a. BESCK104C

OR

Q.10.a. Explain Amplitude modulation (AM) and Frequency modulation (FM) with neat waveforms. (8m)

Ans: Refer Question paper Jan/Feb 2023. Q.no. 10.a. BESCK104C

Q.10.b. List the advantages of Digital communication over analog communication. (6m.)

Ans: Refer Question paper DEC24/JAN2025. Q.no. 10.c. BESCK104C

Q.10.c. Explain different multiple Access Techniques (6m.)

Ans: Refer Question paper June/July 24. Q.no. 10.b. BESCK204C

CBCS SCHEME

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BESCK204C

Second Semester B.E./B.Tech. Degree Examination, June/July 2023
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What is Regulated Power Supply? With neat block diagram, explain the working of DC power supply. Also mention the principal components used in each block.	8	L2	CO1
	b.	What is an Amplifier? Explain the types of Amplifier.	4	L2	CO1
	c.	With neat circuit diagram and wave forms explain full wave bridge rectifier.	8	L2	CO1
		OR			
Q.2	a.	What is Voltage Regulator? With neat circuit diagram, explain the operation of a voltage regulator using Zener diode.	7	L2	CO1
	b.	Mention the advantages of negative feedback in amplifier circuits. With relevant equations and diagram, explain the concept of negative feedback.	7	L2	CO1
	c.	What is Voltage Multiplier? With circuit diagram, explain the operation of voltage doubler.	6	L2	CO1
		Module – 2			
Q.3	a.	What is Op – Amp? Explain the various parameters of Operational Amplifier.	7	L2	CO2
	b.	Sketch the circuits of each of the following based on the use of Op – amp along with input and output wave forms : i) Integrator ii) Voltage follower iii) Comparator.	7	L2	CO2
	c.	Explain the operation of three – stage ladder RC Network Oscillator with neat circuit diagram.	6	L2	CO2
		OR			
Q.4	a.	Explain the Barkhausen criteria for Oscillations. In wein bridge oscillator if $C_1 = C_2 = 100$ nF, determine the frequency of oscillations when $R_1 = R_2 = 1k\Omega$.	7	L3	CO2
	b.	Explain the operation of Single stage Astable multivibrator with its circuit diagram.	7	L2	CO2
	c.	Explain the Ideal characteristics of an Op – amp.	6	L2	CO2

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		Module – 3			
Q.5	a.	Convert the following : i) $(1\ AD.EO)_{16} = (?)_{10}$ ii) $(37.625)_{10} = (?)_2$ iii) $(110100111001.110)_2 = (?)_8$ iv) $(345.AB)_{16} = (?)_2$.	8	L3	CO3
	b.	State and prove De – Morgan's theorems with its truth table.	6	L2	CO3
	c.	Implement the following Boolean functions by using logic gates : i) $F_1 = xy' + x'z$ ii) $F_2 = x'y'z + x'yz + xy'$.	6	L3	CO3
		OR			
Q.6	a.	Perform the following : i) $(1010100)_2 - (1000100)_2$ using 1's complement and 2's complement method. ii) $(4456)_{10} - (34234)_{10}$ using 9's complement and 10's complement method.	8	L3	CO3
	b.	Implement full adder circuit with its truth table and write the expressions for sum and carry.	6	L3	CO3
	c.	Express the Boolean function $F = A + B'C$ in a sum of min terms.	6	L3	CO3
		Module – 4			
Q.7	a.	What is an Embedded system? Compare Embedded system and General computing system.	7	L2	CO4
	b.	Using suitable diagrams, explain Instrumentation and Control System.	7	L2	CO4
	c.	Discuss major application areas of Embedded systems with examples.	6	L2	CO4
		OR			
Q.8	a.	Write a note on Core of Embedded systems with its block diagram.	7	L2	CO4
	b.	Explain how 7 seg LED display can be used to display the data and write a brief note on operation of LED.	7	L2	CO4
	c.	Explain the classification of Embedded systems.	6	L2	CO4
		Module – 5			
Q.9	a.	Describe the blocks of Modem Communication System with neat block diagram.	8	L2	CO5
	b.	Explain with a neat diagram, the concept of Radio wave propagation and its different types.	7	L2	CO5
	c.	Explain different Multiple Access Techniques.	5	L2	CO5
		OR			
Q.10	a.	What is Modulation? Explain Amplitude Modulation (AM) and Frequency Modulation (FM), with neat waveforms.	8	L2	CO5
	b.	List the advantages of Digital Communication over Analog Communication.	6	L2	CO5
	c.	Explain the following with the help of waveforms : i) ASK ii) FSK iii) PSK.	6	L2	CO5

* * * * *

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Question Paper Solutions.

Sub: Introduction to electronics and communication

Code: BESCK204C Academic year: 2022-2023 EVEN

June/July 2023 Question paper.

Sub I/C: prof. Ramesh Patil, E&CE dept. GNDEC, Bidar

Module - 1.

Q1, a. What is regulated power supply? with neat block diagram, explain the working of DC power supply. Also mention the principal components used in each block. (8m)

Ans: Regulated power supply is one which maintains a fixed output voltage irrespective of changes to the input voltage or load condition.

Block diagram and explaination.

Refer Q.P. Dec 24/Jan 2025, Q.No. 1.a.

principal components involved.

1) Step down Transformer.
2) Diodes in rectifier
3) Capacitor as smoothing filter.
4) Zener diode as voltage regulator.

Q1, b What is an amplifier? Explain the types of amplifiers (4m)

Ans: Refer Question paper June/July 2024 Q2.a BESCK204C.

Q1.c. With neat diagram and waveforms explain full wave bridge rectifier. (8M)

Ans: Refer Question paper Jan/Feb.2023 Q.no. 2.a. BESCK104C.

OR.

Q.2.a. What is voltage regulator? With neat circuit diagram, explain the operation of voltage regulator using Zener diode. (7M)

Ans: Refer Question paper Dec 24/Jan 2025 Q.No. 2.a BESCK104C

Q.2.b. Mention the advantages of negative feedback in amplifier circuits. With relevent equations and diagram, explain the concept of negative feed back (7M)

Ans: Refer Question Paper Dec 24/Jan 2025, Q.no. 2.c BESCK104C.

Q.2.c. What is voltage multiplier? With circuit diagram, explain the operation of voltage doubler. (6M).

Ans: Refer Question paper Dec 24/Jan 2025, Q1.b. BESCK104C.

Module 2

Q. 3.a. What is op-amp? Explain the various parameters of operational amplifier. (7M)

Ans: An operational amplifier is a direct coupled high gain amplifier that can be used to amplify dc as well ac input signals. Along with amplification it can also perform mathematical operations on its input signals.

* Op-amp parameters

1) Open loop voltage gain. $A_{V(OL)}$

It is the voltage gain of op-amp when there is no feedback.

i.e $A_{V(OL)} = \frac{V_o}{V_i}$

2) Closed loop voltage gain $A_{V(CL)}$

It is the voltage gain of op-amp with feedback.

i.e $A_{V(CL)} = \frac{V_o}{V_i}$

$= 20 \log_{10} \frac{V_o}{V_i}$ in dB.

3) Input Resistance (R_{in})

Input resistance of an op-amp is defined as the ratio of input voltage to input current expressed in ohms.

i.e $R_{in} = \frac{V_i}{I_i}$ Ω.

4) Output Resistance (R_{out})

The output resistance of an op-amp is defined as the ratio of open ckt voltage at o/p to short ckt output current expressed in ohms

i.e $R_{out} = \frac{V_{o(OC)}}{I_{o(SC)}}$ Ω.

5) Input offset voltage (V_{io})

Input offset voltage is the voltage that must be applied between the two input terminals such that output voltage becomes zero.

Typical value → between 1mV to 15mV.

6) Bandwidth.

It is the range of frequencies over which the amplifier provides uniform gain without any distortion. It is given by.

$$\text{Bandwidth} = (f_2 - f_1)\ Hz.$$

where $f_2 \rightarrow$ upper cut off frequency.

$f_1 \rightarrow$ lower cutoff frequency

7) Slew rate

Slew rate is the rate of change of output voltage with time.

$$\therefore \text{slew rate} = \frac{\Delta V_{out}}{\Delta t}\ V/\mu s.$$

8) CMRR (common mode rejection ratio)

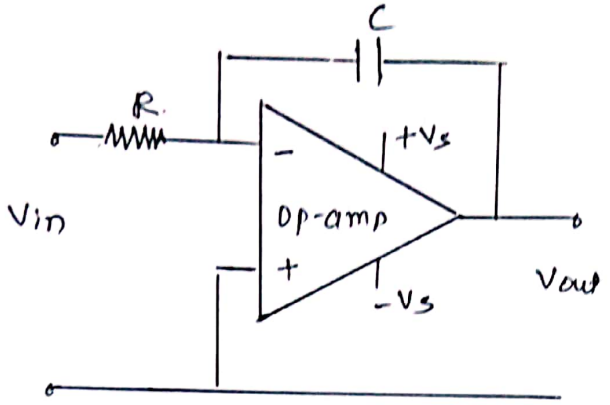
It is defined as the ratio of differential gain to the common mode gain of an op-amp

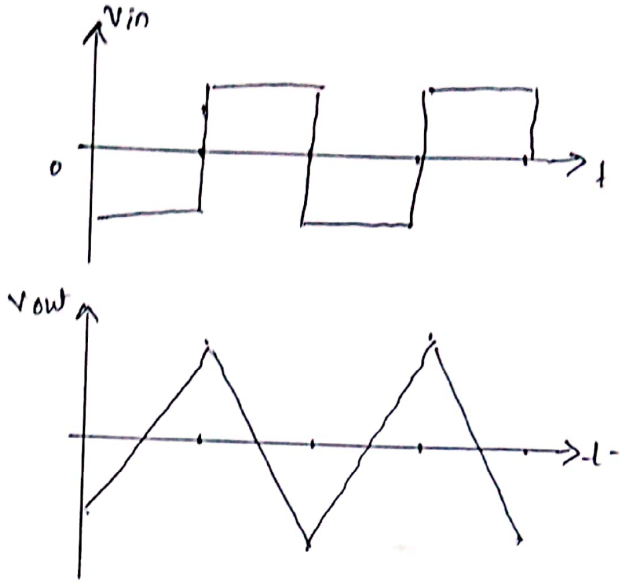
$$\text{i.e. } CMRR = \left|\frac{A_d}{A_{cm}}\right|.$$

Q3.b. Sketch the circuits of each of the following based on the use of op-amp along with input and output waveforms:

i) Integrator ii) voltage follower iii) comparator.

Ans: i) Integrator.

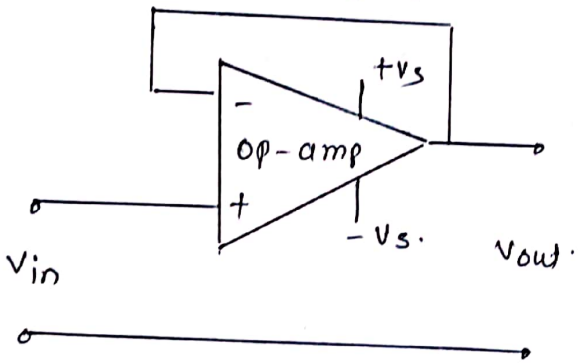


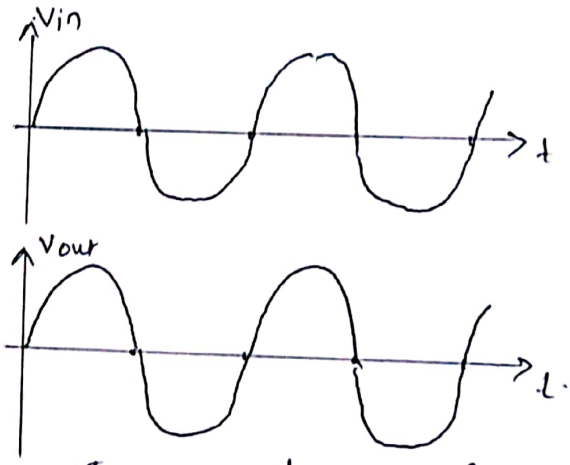


Input & output waveforms

$$V_{out} = -\frac{1}{RC}\int_0^t V_{in}\, dt.$$

ii) Voltage follower.

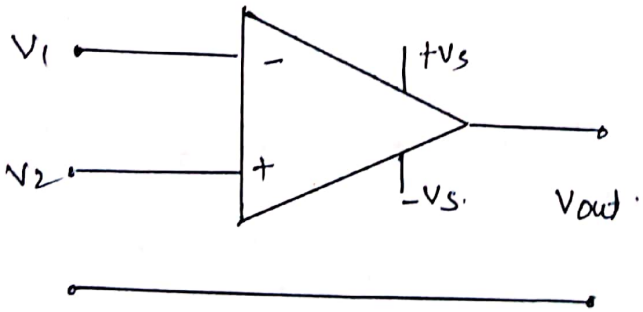


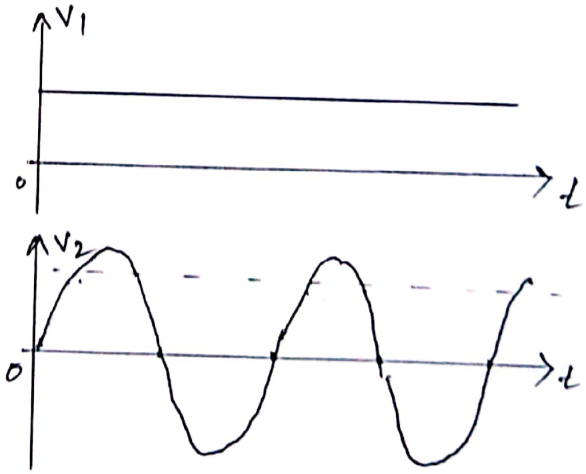


Input & output waveforms

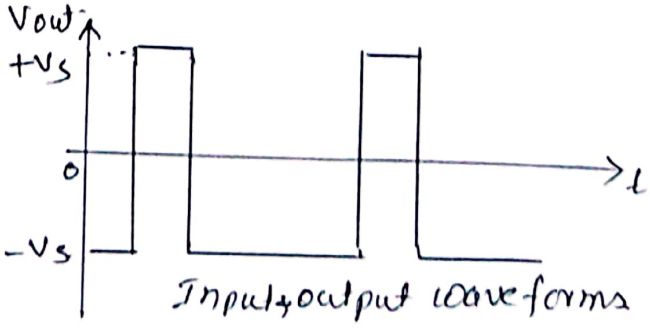
$$V_{out} = V_{in}.$$

iii) Comparator.





The output is either +Vs or -Vs depending on the relative polarity of the two inputs V_1 and V_2.



Input+output waveforms

Q. 3. c. Explain the operation of three-stage ladder RC network oscillator with circuit diagram (6m)

Ans: Refer Question paper June/July 2024. Q. 3.a. BESCK 204C.

OR

Q 4. a Explain the Barkhausen criteria for oscillations. In wein bridge oscillator if $C_1 = C_2 = 100nF$, determine the frequency of oscillations when $R_1 = R_2 = 1k\Omega$. (7m)

Ans: For Barkhausen criteria

Refer. Question paper Dec24/Jan 2025 Q.no. 3.a BESCK104C.

In wein bridge, frequency of oscillation is given by

$$f = \frac{1}{2\pi RC}$$

where $R = R_1 = R_2 = 1k\Omega$ and $C = C_1 = C_2 = 100nF$.

$$\therefore f = \frac{1}{2\pi \times 1 \times 10^3 \times 100 \times 10^{-9}}$$

$$= 1.59 \text{ kHz}.$$

Q.4.b Explain the operation of single stage Astable multivibrator with its circuit diagram (7m)

Ans: Refer Question paper Dec 24/Jan 2025, Q.no. 3.c BESCK104C

Q 4.c. Explain the ideal characteristics of op-amp (6m)

Ans: Refer Question paper Dec 24/Jan 2025, Q.no. 4.a.

Module - 3.

Q.5.a. Convert the following

i) $(1AD.E0)_{16} = (?)_{10}$ ii) $(37.625)_{10} = (?)_2$.

iii) $(110100111001.110)_2 = (?)_8$ iv) $(345.AB)_{16} = (?)_2$

(8m).

Ans: i) $(1AD.E0)_{16} = (?)_{10}$

using sum of weights method.

$= 1\times16^2 + A\times16^1 + D\times16^0 + E\times16^{-1} + 0\times16^{-2}$

$= 256 + 160 + 13 + 0.875 + 0$

$= (429.875)_{10}$ ⇐ Ans

ii) $(37.625)_{10} = (?)_2$.

2	37	
2	18	→ 1 LSB
2	9	→ 0
2	4	→ 1
2	2	→ 0
2	1	→ 0
	0	→ 1 MSB

$0.625\times2 = 1.25$ carry 1 MSB
$0.25\times2 = 0.50$ carry 0
$0.50\times2 = 1.00$ carry 1 LSB

∴ $(37.625)_{10}$
$= (100101.101)_2$.
⇐ Ans

iii) $(110100111001.110)_2 = (?)_8$

using 3 bit grouping & replacing each 3 bit by one octal digit.

$\underbrace{110}_{6}\ \underbrace{100}_{4}\ \underbrace{111}_{7}\ \underbrace{001}_{1}.\ \underbrace{110}_{6}$

$(6471.6)_8$ ⇐ Ans

iv) $(345.AB)_{16} = (?)_2$

replacing each Hex digit by 4-bit binary no.

3	4	5	.	A	B
0011	0100	0101		1010	1011

$= (001101000101.10101011)_2$
⇐ Ans

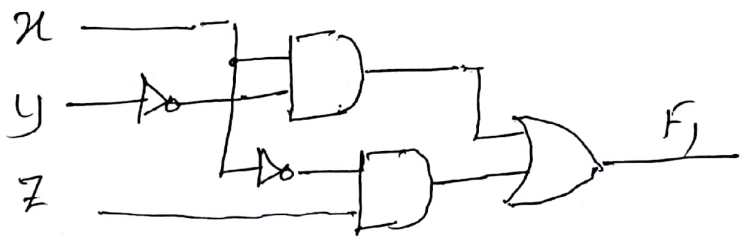
Q5.b. State and prove DeMorgan's theorems with its Truth table. (6m)

Ans: Refer Question paper Dec 24/Jan 2025 - Q.5.c.

Q5.c. Implement the following boolean functions using logic gates.

i) $F_1 = xy' + x'z$ ii) $F_2 = x'y'z + x'yz + xy'$ (6m).

Soln: i) $F_1 = xy' + x'z$.

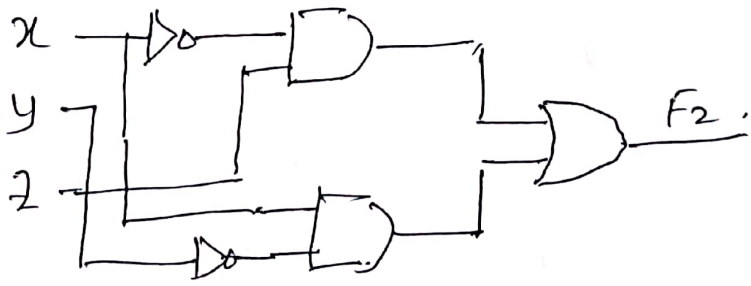


ii) $F_2 = x'y'z + x'yz + xy'$

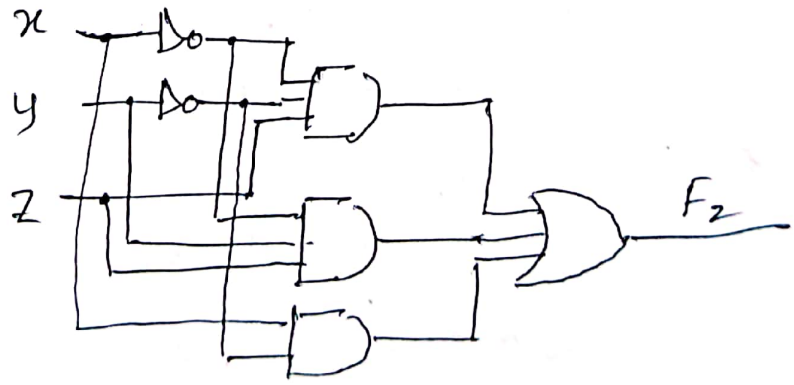
$= x'z(y'+y) + xy'$

$= x'z(1) + xy'$ $\because y+y'=1$

$= x'z + xy'$



or without simplification



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Q. 6.a. Perform the following.

i) $(1010100)_2 - (1000100)_2$ using 1's and 2's complement.

ii) $(4456)_{10} - (34234)_{10}$ using 9's and 10's complement. (8m)

Soln:

i) a) using 1's complement.

Step 1 1's complement of $(1000100)_2$.

$(0111011)_2$.

Step 2: adding with other no.

$$\begin{array}{r} 1010100 \\ +\ 0111011 \\ \hline 10001111 \\ +\ 1 \\ \hline 0010000 \end{array}$$

$(0010000)_2$ ⇐ Ans

b) using 2's complement.

Step 1: 2's complement of $(1000100)_2$.

$$\begin{array}{r} 0111011 \\ +1 \\ \hline (0111100)_2 \end{array}$$

⇐ 2's complement.

Step 2: Adding with other no.

$$\begin{array}{r} 1010100 \\ +\ 0111100 \\ \hline 10010000 \end{array}$$

discard carry

$(0010000)_2$ ⇐ Ans.

ii) $(04456)_{10} - (34234)_{10}$.

a) using 9's complement -

Step 1: 9's complement of $(34234)_{10}$

$$\begin{array}{r} 99999 \\ -\ 34234 \\ \hline 65765 \end{array}$$ ← 9's complement

Step 2: Adding with other no.

$$\begin{array}{r} 04456 \\ +\ 65765 \\ \hline 70221 \end{array}$$

Step 3: Take 9's complement of 70221 & attach -ve sign.

$$\begin{array}{r} 99999 \\ 70221 \\ \hline 29778 \end{array}$$

$\therefore$ $-(29778)_{10}$ ⇐ Ans.

b) using 10's complement -

Step 1: Taking 10's complement of 34234

$$\begin{array}{r} 99999 \\ -\ 34234 \\ \hline 65765 \\ +1 \\ \hline 65766 \end{array}$$ ← 10's complement

Step 2: adding with other no.

$$\begin{array}{r} 04456 \\ +\ 65766 \\ \hline 70222 \end{array}$$

Step 3: Taking 10's complement of above no. and attach -ve sign.

$$\begin{array}{r} 99999 \\ -\ 70222 \\ \hline 29777 \\ +1 \\ \hline 29778 \end{array}$$

$\therefore$ $-(29778)_{10}$ ⇐ Ans.

Q 6.b. Implement full adder circuit with its truth table and write the expression for sum and carry. (6m)

Ans: Refer Question paper DEC24/JAN 2025 Q.no. 6.c. BESCK104C.

Q 6.c. Express the Boolean function $F = A + B'C$ in a sum of min terms. (6m)

Ans: Refer Question paper JAN/Feb 2023. Q.no. 6.a BESCK104C

Module - 4

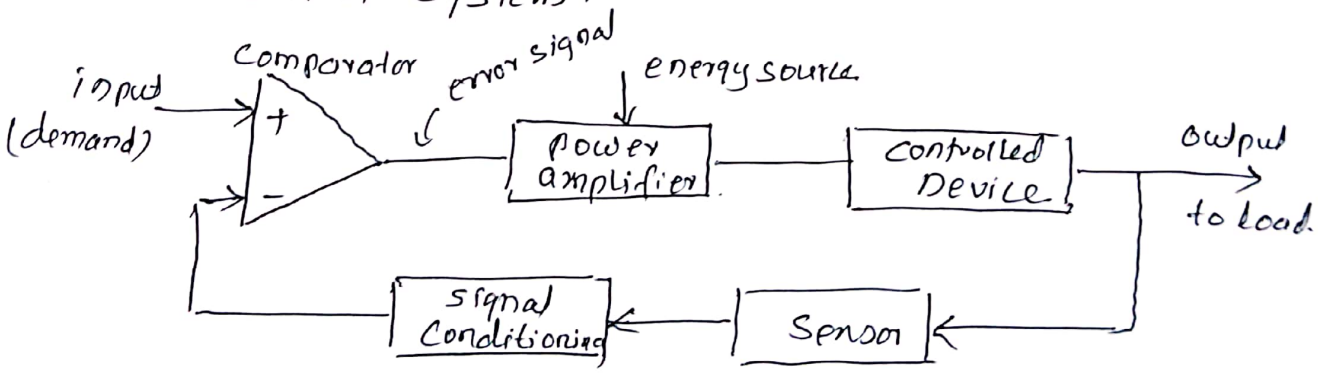
Q 7.a. What is an embedded system? Compare Embedded System and general computing system (7m)

Ans: Refer. Question paper DEC24/JAN2025, Q.no. 7.a. BESCK104C

Q 7.b: Using suitable diagrams, explain Instrumentation and control system. (7m)

Ans: For Instrumentation system.
Refer. Q.p DEC 24/Jan2025, Q.no. 8.a.

Control system.



This uses negative feedback in order to regulate and stable the output. It thus becomes possible to set the input or demand and leave the system to regulate itself by comparing it with a signal

derived from the output via a sensor and appropriate signal conditioning.

A comparator is used to sense the difference in these two signals and where any discrepency is detected the input to the power amplifier is adjusted accordingly. This signal is called error signal.

Q. 7. c. Discuss major applications areas of embedded systems with examples. (6m).

Ans: Refer Question paper June/July 2024. Q.no. 7. C. BESCK204C

OR

Q. 8. a. Write a note on core of embedded system with its block diagram. (7m)

Ans: Refer Question paper Dec 24/ Jan 2025, Q.no. 7.b. BESCK104C.

Q 8. b. Explain how 7 seg LED display can be used to display the data and write brief. note on operation of LED. (7m.)

Ans: Refer Question paper June/July 2024 Q.no. 8.C BESCK204C

(only 7-segment LED display)

Q. 8. c. Explain the classifications of embedded system. (6m).

Answer next page.

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Ans: The classification of embedded systems are as follows.

1) Based on generation
2) Based on complexity and performance requirements.
3) Based on deterministic Behavior.
4) Based on triggering

1) Based on generation.

This classification based on the order in which the embedded systems evolved from the first version to where they are today.

* First Generation.
built around 8-bit microprocessors like 8085 and 4-bit microcontroller.
Ex: Digital telephone key pads, stepper motor controller.

* Second Generation.
built ~~8 bit~~ 16 bit microprocessor and 8 or 16-bit microcontrollers.
Ex: Data Acquisition systems, SCADA etc.

* Third Generation
built around 32-bit microprocessor and 16-bit microcontroller.
Ex: Robotics, media, Networking etc

* Fourth Generation
the system on chip (SoC), reconfigurable processors, use high performance RTOS.
Ex: smart phones, mobile internet devices (MIDs) etc

2) Based on complexity and performance.

* Small scale embedded systems.
  low performance, low cost. build around 8- or 16 bit microprocessor / microcontroller.
  Ex: Electronic Toy.

* Medium scale embedded system.
  Slightly complex in- hardware and firmware. built around 16 or 32 bit microprocessor / micro controllers or DSP.

* Large scale embedded systems.
  These are usually built around high performance 32 or 64-bit RISC processors or RSOC or multicore and programmable logic devices.
  Ex: Decoding / Encoding media, cryptographic function implementation etc.

3) Deterministic behaviour.
- Hard Real time systems.
- Soft Real time systems.
- Non real time systems.

4) Triggering
- Time triggered embedded system
- Even triggered embedded system
- intrupt driven embedded system.

Module - 5.

Q.9.a. Describe the blocks of modern communication system with neat block diagram. (8m)

Ans: Refer Question paper Dec 24/Jan 2025 Q.no. 9a BESCK104C.

Q.9.b. Explain with neat diagram the concept of radio wave propagation and its different types. (7m)

Ans: Refer Question paper Dec 24/Jan 2025, Q.no. 10.a BESCK104C

Q 9. C. Explain different multiple Access Techniques. (5)

Ans: Refer Question paper June/July 2024 Q.no. 10.b BESCK204C.

OR.

Q.10.a. What is modulation? Explain Amplitude modulation (AM) and Frequency modulation (FM) with neat waveforms. (8m)

Ans: Refer Question paper Jan/Feb. 2023 Q.no. 10.a. BESCK 104C

Q.10.b. List the advantages of digital communication over analog communication. (6m)

Ans: Refer Question paper Dec 24/Jan 2025, Q.no. 10.c.

Q.10.c. Explain the following with the help of wave forms.
i) ASK ii) FSK iii) PSK (6m)

Ans: Refer. Question paper Dec 24/Jan 2025, Q.no. 9.c. BESCK104C.

CBCS SCHEME

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BESCK104C/ BESCKC104

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023
Introduction to Electronics and Communication

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Draw the block diagram of DC power supply and explain the individual blocks.	8	L2	CO1
	b.	Draw the circuit diagram of voltage regulation and explain the operation.	6	L2	CO1
	c.	An amplifier produces an output voltage of 2V for an input of 50mV. If the input and output currents in this condition are 4mA and 200mA respectively. Find: i) The voltage gain ii) The current gain iii) The power gain.	6	L3	CO1
		OR			
Q.2	a.	With a neat circuit diagram and waveform. Explain the working operation of a full wave bridge rectifier.	8	L2	CO1
	b.	Draw the circuit diagram of voltage doubler and the working operation.	6	L2	CO1
	c.	Discuss briefly a Negative feedback amplifier with block diagram.	6	L1	CO1
		Module – 2			
Q.3	a.	With circuit diagram, explain the operation of an wien bridge oscillator.	8	L2	CO2
	b.	Define the following operational amplifier parameters value. i) Open loop voltage gain ii) Output Resistance iii) Slew Rate.	6	L1	CO2
	c.	Draw the circuit diagram and input and output waveform of the following operational amplifier circuits i) Differentiators ii) Integrator.	6	L1	CO2
		OR			
Q.4	a.	Explain the single state astable oscillator with circuit diagram.	8	L1	CO2
	b.	What is oscillator? And mention condition for oscillations.	6	L1	CO2
	c.	Explain the operation of summing amplifier using operational amplifier and write the output equation.	6	L2	CO2

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		Module – 3			
Q.5	**a.**	Implement full adder using two half adders and one OR gate. Write the equations for Sum and C_{out}.	**8**	**L3**	**CO3**
	b.	Convert the following numbers to its equivalent numbers and show the steps. i) $(10110001101011.111100000)_2 = (?)_8$ ii) $(10110001101011.11110010)_2 = (?)_{16}$ iii) $(1010.011)_2 = (?)_{10}$	**6**	**L2**	**CO3**
	c.	Using basic Boolean theorems prove i) $(x + y)(x + z) = x + yz$ ii) $xy + xz + y\bar{z} = xz + y\bar{z}$	**6**	**L3**	**CO3**
		OR			
Q.6	**a.**	Express the Boolean function i) $F = A + \bar{B}C$ in a sum of minterms form ii) $F = xy + \bar{x}z$ in a product of maxterms form.	**8**	**L2**	**CO3**
	b.	Subtract the following using 10's complement i) $(72532 - 3250)_{10}$ ii) $(3250 - 72532)_{10}$	**6**	**L2**	**CO3**
	c.	Write the step by step procedure to design a combinational circuit.	**6**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	What is an Embedded system? Compare Embedded systems with general computer systems.	**8**	**L2**	**CO4**
	b.	Mention the classification of Embedded system based on complexity and performance.	**6**	**L1**	**CO4**
	c.	Write a short note on – 7-segment LED display.	**6**	**L2**	**CO4**
		OR			
Q.8	**a.**	Discuss the typical embedded system elements.	**8**	**L2**	**CO4**
	b.	What is the difference between RISC and CISC processors?	**6**	**L1**	**CO4**
	c.	Write a short note on : i) Transducers ii) Sensors.	**6**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Draw the block diagram of basic communication system and briefly explain the individual blocks.	**10**	**L2**	**CO5**
	b.	Discuss the types of communication systems.	**5**	**L2**	**CO5**
	c.	List the advantages of digital communication over analog communication.	**5**	**L1**	**CO5**
		OR			
Q.10	**a.**	Define Amplitude and Frequency modulation. Sketch AM and FM waveform.	**10**	**L1**	**CO5**
	b.	Write a short note on : Amplitude Shift Keying (ASK) modulator and demodulator.	**10**	**L2**	**CO5**

* * * * *

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Question Paper Solutions.

Sub: Introduction to Electronics & communication

Code: BESCK104C. Academic year: 2022-23. ODD.

Jan/Feb 2023

Sub: I/C: Prof. RAMESH PATIL
E&CE Dept. GNDEC, Bidar.

Module - 1

Q1. a. Draw the block diagram of DC power supply and explain the individual blocks (8M)

Ans: Refer Question paper DEC 2024/JAN 2025. Q no. 1. a. BESCK104C.

Q1. b. Draw the circuit diagram of voltage regulation and explain the operation. (6M)

Ans: Refer Question paper DEC 2024/JAN 2025, Q no. 2. a BESCK104C.

Q 1, c. An amplifier produces an output voltage of 2V for an input of 50 mV. If the input and output currents in this condition are 4 mA and 200 mA respectively. Find.
i) voltage gain ii) Current gain iii) power gain (6M)

Soln: Data: $v_i = 50mV$, $V_o = 2V$, $I_i = 4mA$, $I_o = 200mA$.

i) Voltage gain, $A_V = \frac{V_o}{V_i} = \frac{2}{50\times10^{-3}} = 40$

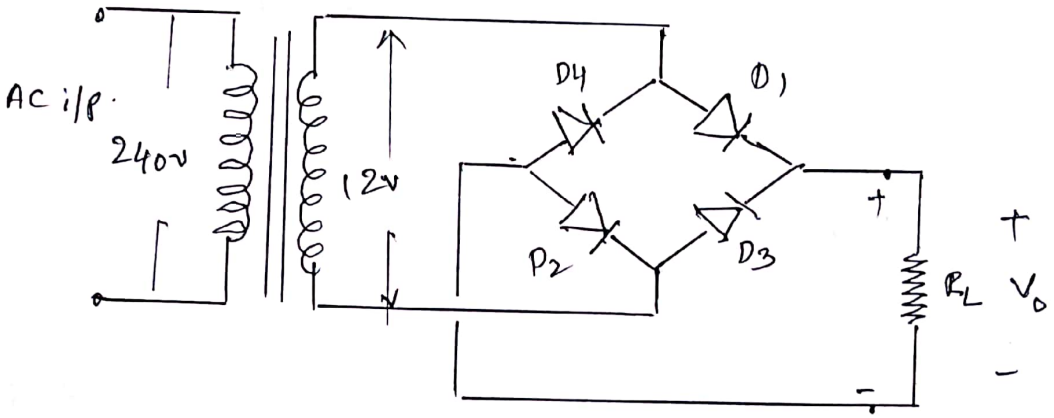
ii) Current gain, $A_I = \frac{I_o}{I_i} = \frac{200\times10^{-3}}{4\times10^{-3}} = 50$

iii) power gain, $A_P = A_V \times A_I$
$= 40\times50 = 2000$

OR

Q 2.a. with the neat circuit diagram, explain the working operation of a full wave bridge rectifier. (8m).

Ans: In bridge fullwave rectifier four diodes are used in which two diodes are conducting in each half cycle. A bridge full wave rectifier circuit is shown in fig.



Following fig shows bridge rectifier circuit with diodes replaced by four switches.

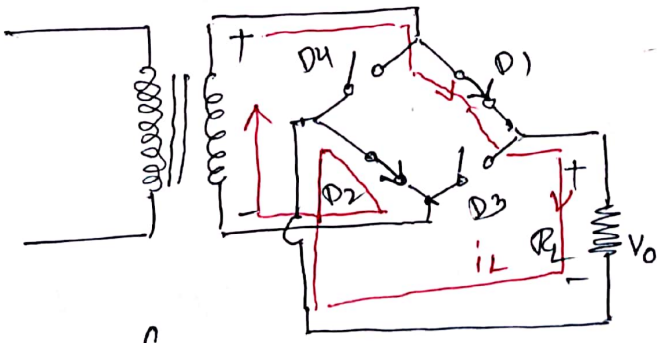


fig.a.

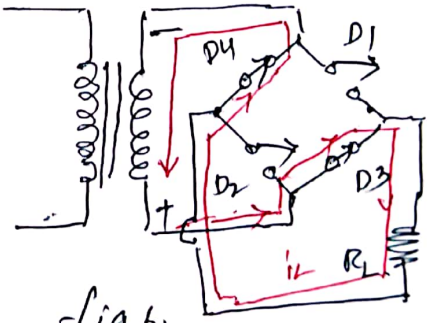
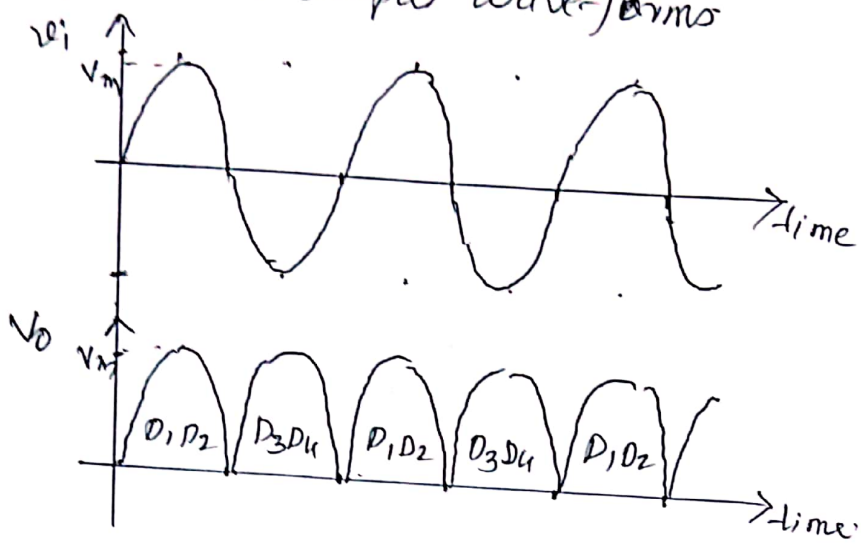


fig b.

In fig a, diode D_1 and D_2 are conducting during +ve half cycle. while in fig b. diodes D_3 and D_4 are conducting during -ve half cycle. in both the cases current through R_L is flowing in same direction Hence output is rectified.

* input and output wave-forms



Q 2.b. Draw the circuit diagram of voltage doubler and explain the working. (6m)

Ans: Refer Question paper DEC2024/JAN 2025 Q.no. 1.b. BESCK104C.

Q.2.c. Discuss briefly a negative feedback amplifier with block diagram. (6m).

Ans: Refer Question paper DEC2024/JAN 2025 Q,2.c BESCK104C.

Module - 2

Q.3.a. With a circuit diagram explain the operation of an wein bridge oscillator. (8m)

Ans: Refer Question paper DEC 2024/JAN 2025 Q.no. 3.b.

Q.3.b. Define the following operational amplifier Parameter value

i) open loop voltage gain.
ii) output resistance
iii) Slew rate.

Ans: i) open Loop voltage gain $A_{V_{OL}}$

The open loop voltage gain of an op-amp is defined as the ratio of output voltage to input voltage measured with no feedback applied.

i,e $A_{V_{OL}} = \frac{V_o}{V_i}$

when expressed in dB.

$$A_{V_{OL}} = 20 \log_{10} \left(\frac{V_o}{V_i}\right) . dB.$$

ii) Output Resistance (R_o)

The output resistance of an op-amp is defined as the ratio of open circuit voltage at output to short circuit output current expressed in ohms

i,e $R_o = \frac{V_{o(oc)}}{I_{o(sc)}}$ ohms.

iii) Slew rate

Slew rate is the rate of change of output voltage with time.

$\therefore$ Slew rate $= \frac{\Delta V_{out}}{\Delta t}$ V/μs.

Q.3.c. Draw the circuit diagram and input and output waveforms of the following op-amp circuits
i) Differentiator ii) Integrator. (6M)

Ans: i) Differentiator.

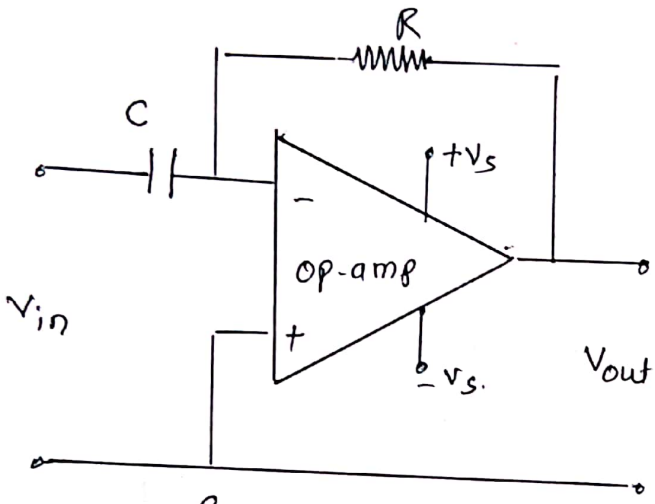
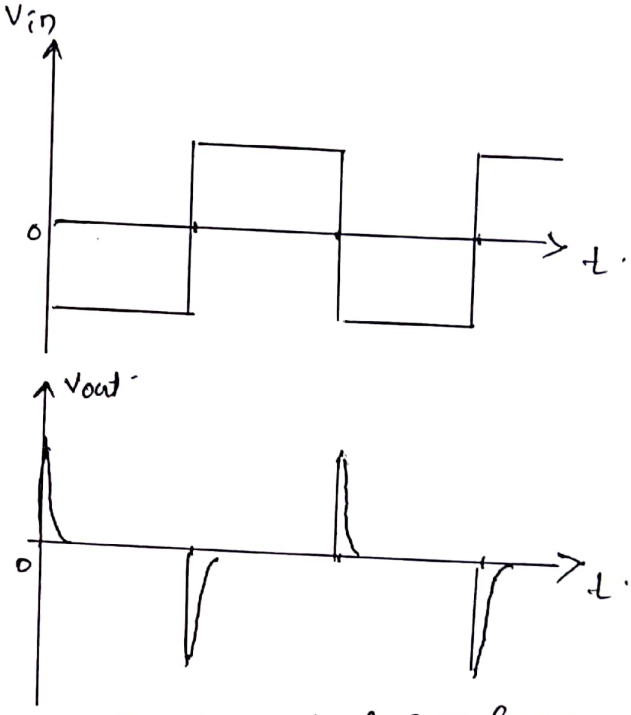


fig. differentiator.



input & output waveforms

$$V_{out} = -CR\frac{dv_{in}}{dt}.$$

output voltage is differentiation of input voltage.

ii) Integrator.

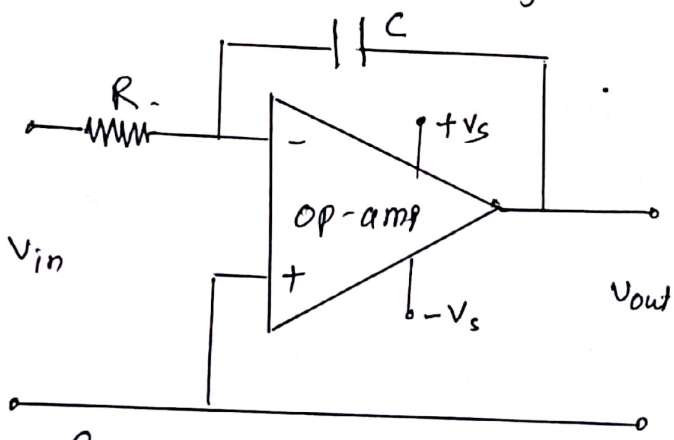
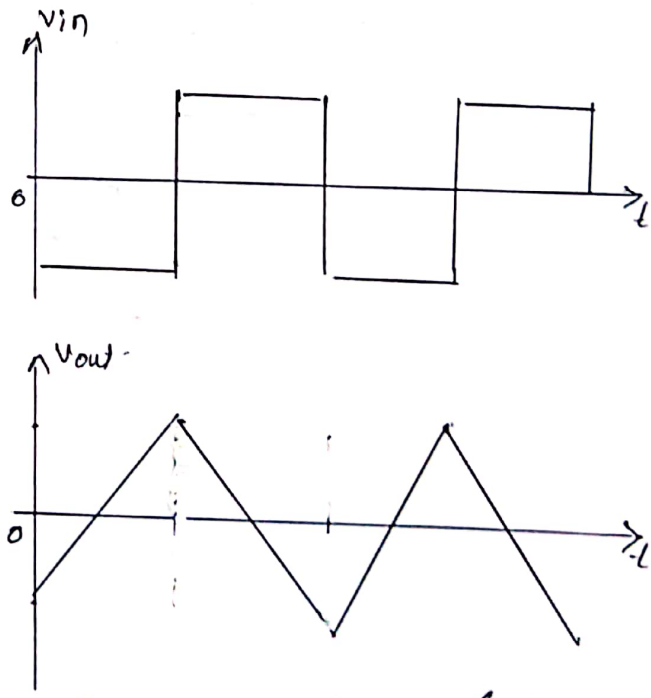


fig. Integrator.



Input & output wave forms.

$$V_{out} = -\frac{1}{RC}\int_0^t v_{in}\,dt.$$

output voltage is integration of input voltage.

OR.

Q.4.a. Explain the single stage astable oscillator with circuit diagram. (8m)

Ans: Refer Question paper Dec 2024/Jan 2025 Q.no. 3.c. BESCK104C

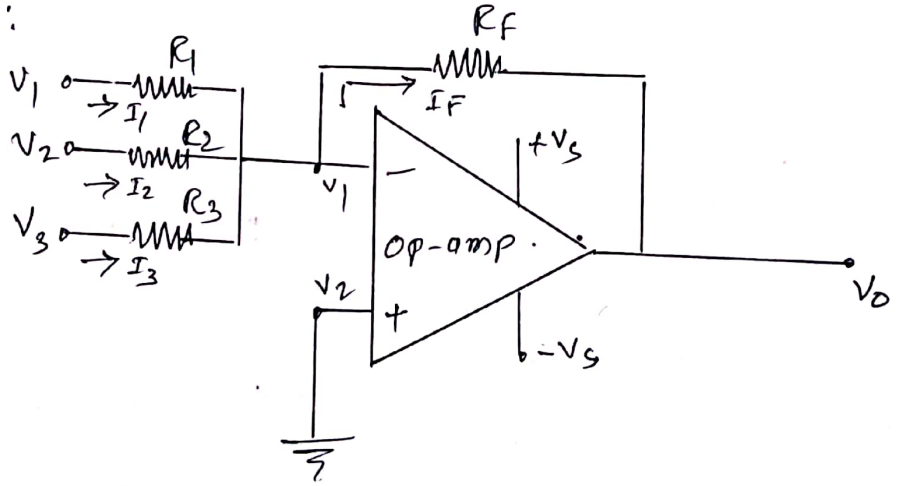
Q4.b. What is oscillator? mention condition for oscillation (6m)

Ans: An oscillator is a circuit which produces a continuous, repeated, alternating wave form (ac) without any input.

for conditions of oscillations refer Q.P. Dec 2024/Jan 2025 Q.no. 3.a.

Q.4.c. Explain the operation of summing amplifier using operational amplifier and write the output equation.

Ans:



Summing amplifier (adder) for three inputs is as shown in fig.

from the concept of virtual ground

$$V_1 = V_2 = 0$$

Applying KCL at node V_1

$$I_1 + I_2 + I_3 = I_f.$$

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$$\frac{V_1-0}{R_1}+\frac{V_2-0}{R_2}+\frac{V_3-0}{R_3}=\frac{0-V_0}{R_F}$$

$$\therefore \quad V_0=-\left[\frac{R_F}{R_1}V_1+\frac{R_F}{R_2}V_2+\frac{R_F}{R_3}V_3\right]$$

if, $R_F=R_1=R_2=R_3$.

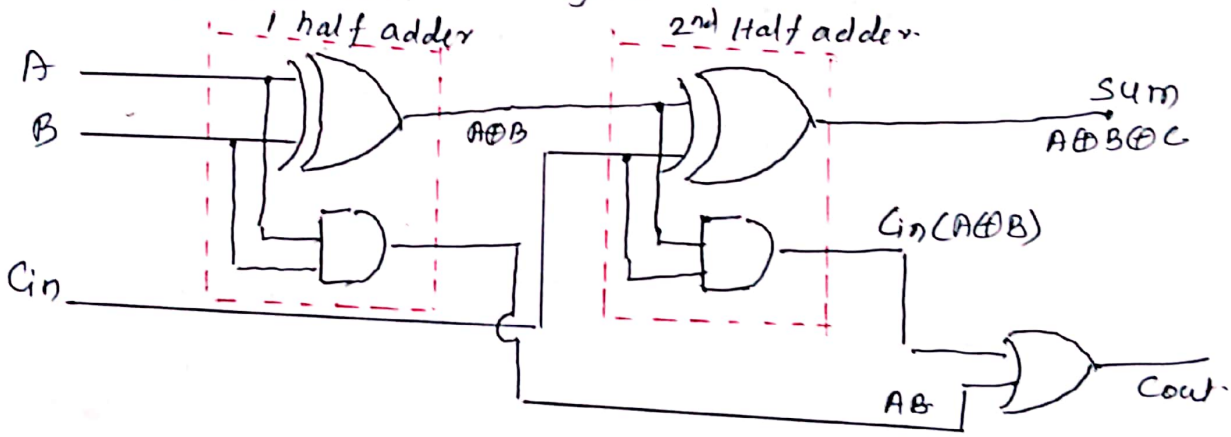
Then.

$$V_0=-\left[V_1+V_2+V_3\right]$$

Module - 3.

Q.5.a. Implement full adder using two half adders and one OR gate. Write the equations for sum and Cout. (8M)

Ans: Implementation of full adder using two half adders and OR gate.



The sum of 2nd half adder is the X-OR of Cin and the output of first half adder. giving

$$\text{Sum} = C_{in}\oplus(A\oplus B)$$
$$= A\oplus B\oplus C_{in} \quad \Leftarrow \text{Ans.}$$

& Carry output is

$$C_{out} = AB+C_{in}(A\oplus B) = AB+C_{in}(A\bar{B}+\bar{A}B)$$
$$= AB+A\bar{B}C_{in}+\bar{A}BC_{in}, \text{ after simplification}$$
$$C_{out} = AB+BC_{in}+AC_{in}. \quad \Leftarrow \text{Ans.}$$

Q. 5. b. Convert the following numbers to its equivalent numbers and show the steps.

i) $(10110001101011.111100000)_2 = (?)_8$

ii) $(10110001101011.11110010)_2 = (?)_{16}$

iii) $(1010.011)_2 = (?)_{10}$

Soln:

i) $(10110001101011.111100000)_2 = (?)_8$

using grouping in to 3 bits.

$$\underbrace{010}_{2}\,\underbrace{110}_{6}\,\underbrace{001}_{1}\,\underbrace{101}_{5}\,\underbrace{011}_{3}\,.\,\underbrace{111}_{7}\,\underbrace{100}_{4}\,\underbrace{000}_{0}$$

$= (26153.740)_8$ ⇐ Ans.

ii) grouping in to 4-bits.

$$\underbrace{0010}_{2}\,\underbrace{1100}_{C}\,\underbrace{0110}_{6}\,\underbrace{1011}_{B}\,.\,\underbrace{1111}_{F}\,\underbrace{0010}_{2}$$

$= (2C6B.F2)_{16}$ ⇐ Ans.

iii) using sum of weights method.

$(1010.011)_2$

$= 1\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0 + 0\times2^{-1} + 1\times2^{-2} + 1\times2^{-3}$

$= 8 + 0 + 2 + 0 + 0 + 0.25 + 0.125$

$= (10.375)_{10}$ ⇐ Ans.

Q.5.c. using basic boolean theorems prove.

i) $(x+y)(x+z) = x+yz$ ii) $xy+xz+y\bar{z} = xz+y\bar{z}$

(6m)

Ans:

i) $(x+y)(x+z)$

$= xx + xz + xy + yz.$

$= x + xz + xy + yz.$

$= x(1+z+y) + yz.$

$= x.(1) + yz \quad \because 1+x = 1$

$= x + yz$ // Ans

ii) $xy + xz + y\bar{z}$

$= xy(z+\bar{z}) + xz + y\bar{z} \quad \because z+\bar{z} = 1$

$= xyz + xy\bar{z} + xz + y\bar{z}$

$= xyz + xz + y\bar{z}(x+1)$

$= xz(y+1) + y\bar{z}(x+1) \quad \because x+1=1, \; y+1=1$

$= xz + y\bar{z}$ // Ans.

OR

Q.6.a. Express the boolean function

i) $F = A + \bar{B}C$ in sum of minterms.

ii) $F = xy + \bar{x}z$ in a product of max terms.

(8m)

Soln:

i) $F = A + \bar{B}C$

in this first term is missing two variables and 2nd term missing one variable.

$\therefore F = A(B+\bar{B})(C+\bar{C}) + \bar{B}C(A+\bar{A})$

$= (AB + A\bar{B})(C+\bar{C}) + A\bar{B}C + \bar{A}\bar{B}C.$

$= ABC + AB\bar{C} + \underline{A\bar{B}C} + A\bar{B}\bar{C} + \underline{A\bar{B}C} + \bar{A}\bar{B}C$

$$F = ABC + AB\bar{C} + A\bar{B}C + A\bar{B}\bar{C} + \bar{A}\bar{B}C$$
$$= m_7 + m_6 + m_5 + m_4 + m_1$$

$$\therefore F(A,B,C) = \Sigma(1,4,5,6,7)$$

ii) $F = xy + x'z$
$$= (xy + x')(xy + z)$$
$$= (x + x')(y + x')(x + z)(y + z)$$
$$= (x' + y)(x + z)(y + z) \quad \because x + x' = 1$$

$$(x' + y) = x' + y + zz' = (x' + y + z)(x' + y + z')$$
$$(x + z) = x + z + yy' = (x + z + y)(x + z + y')$$
$$(y + z) = y + z + xx' = (x + y + z)(y + z + x')$$

$$\therefore F = (x + y + z)(x' + y + z')(x + z + y')(y + z + x')$$
$$= m_0 m_5 m_2 m_4$$
$$= m_0 m_2 m_4 m_5$$

$$\therefore F(x,y,z) = \Pi(0,2,4,5)$$

Q 6.b. Subtract the following using 10's complement (6m)

i) $(72532 - 3250)_{10}$ ii) $(3250 - 72532)_{10}$

Ans: i) $(72532 - 3250)_{10}$

Step. a) Taking 10's complement of 03250

$$\begin{array}{r} 99999 \\ -\ 03250 \\ \hline 96749 \\ +1 \\ \hline 96750 \end{array}$$ ← 9's Complement

b) adding 10's complement with 72532

$$\begin{array}{r} 72532 \\ +\ 96750 \\ \hline 1\,69282 \end{array}$$

discard carry

c) $(69282)_{10}$ ← Ans.

ii) (3250 − 72532)

step a) Take 10's complement 72532.

$$\begin{array}{r} 99999 \\ -\ 72532 \\ \hline 27467 \\ +\ 1 \\ \hline 27468 \end{array}$$

← 9's complement

Step b) Adding with 03250

$$\begin{array}{r} 03250 \\ +\ 27468 \\ \hline 30718 \end{array}$$

Step c) Taking 10's complement of above and attaching −ve sign.

$$\begin{array}{r} 99999 \\ -\ 30718 \\ \hline 69281 \\ +\ 1 \\ \hline 69282 \end{array}$$

$-(69282)_{10}$ ← Ans.

Q 6. C. Write the step by step procedure to design combinational circuit. (6M)

Ans: Steps.

1) The problem is stated.
2) The number of available input variables and required output variable is determined.
3) The input and output variables are assigned letter symbols.
4) The truth table that defines the required relationship between inputs and outputs is desired.
5) The simplified boolean function for each output is obtained.
6) The logic diagram is drawn using gates.

Module - 4.

Q. 7. a. What is an embedded system? Compare embedded systems with general computer systems. (8M)

Ans: Refer Question paper - Dec2024 / Jan 2025 Q.no. 7.a. BESCK104C

Q. 7. b. Mention the classification of embedded system based on complexity and performance. (6M)

Ans: Refer Question paper June/July 2024 Q.no. 7.a BESCK 204C (only first classification)

Q 7. c. Write a short note on 7-segment LED Display (6M)

Ans: Refer Question paper June/July 2024 Q.no. 8.c BESCK204C (only 7-segment LED display).

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OR

Q.8.a. Discuss the typical embedded system elements. (8m)

Ans: Refer Question paper Dec 2024 / Jan 2025 Q.no. 7.b. BESCK104C

Q.8.b. What is the difference between RISC and CISC processors. (6m)

Ans: Refer Question paper Dec 2024 / Jan 2025 Qno. 7.c. BESCK104C.

[ii) RISC Vs CISC].

Q.8.c. Write short notes on.
i) Transducer. ii) Sensor.

Ans: i) Transducers

Transducer are devices that convert energy in the form of sound, light, heat in to an equivalent electrical signal or vice versa.

Transducers may be used both as inputs to electronic circuits and outputs from them.

Two types of Transducers.

1) Input transducers.
Ex: microphone, thermocouple, rotary potentiometer etc.

2) Output Transducers
Ex: Loud speakers, heating element etc.

ii) Sensors.

A sensor is a special kind of transducer that is used to generate an input signal to a measurement, instrumentation or control signal.

Sensors can be categorized as
- active or passive.
- digital or analog.

Module - 5.

Q.9. a. Draw the block diagram of basic communication system and briefly explain individual blocks. (10m)

Ans: Refer Question paper Dec 2024/Jan 2025 BESKC104C Q.no. 9.a.

Q 9.b. Discuss the types of Communication Systems. (5m)

Ans. Refer Question paper June/July 2024 Q. no. 10.a. (only types of Communication Systems)

Q 9.c. List the advantages of digital communication over analog communication. (5m)

Ans: Refer Question paper Dec 2024/Jan 2025 Q.no. 10.c. BESCK104C

OR.

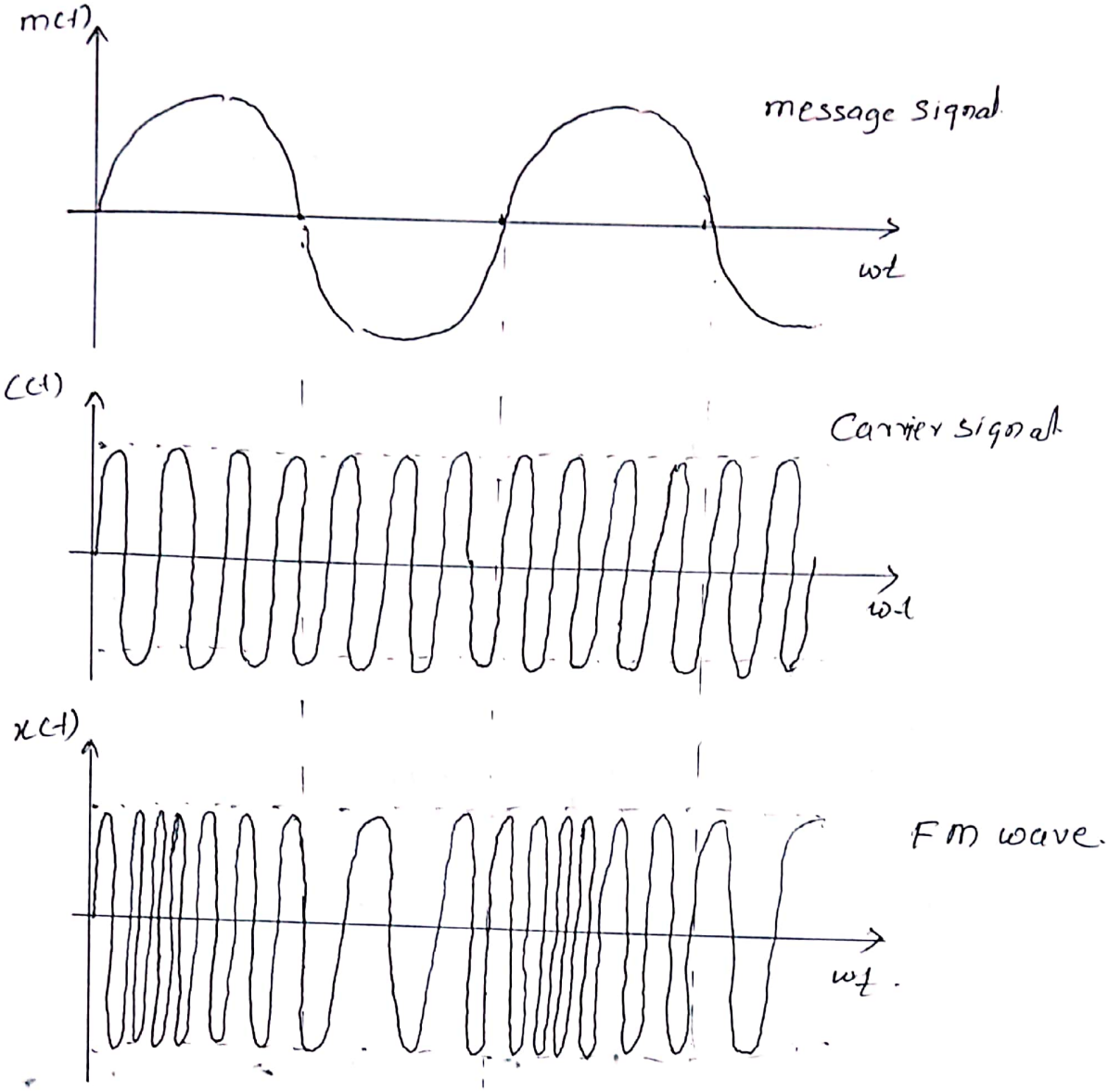
Q.10.a Define Amplitude and frequency modulation. Sketch AM and FM waveforms. (10m)

Ans: modulation is the process in which any one of the parameters (amplitude, frequency, or phase) of the high frequency carrier signal is varied according to the amplitude of the low frequency information or message signal. keeping other parameters constant.

for AM refer Q.P. Dec 2024/Jan 2025 Q.no. 9.b. BESCK104C

* Frequency modulation. (FM)

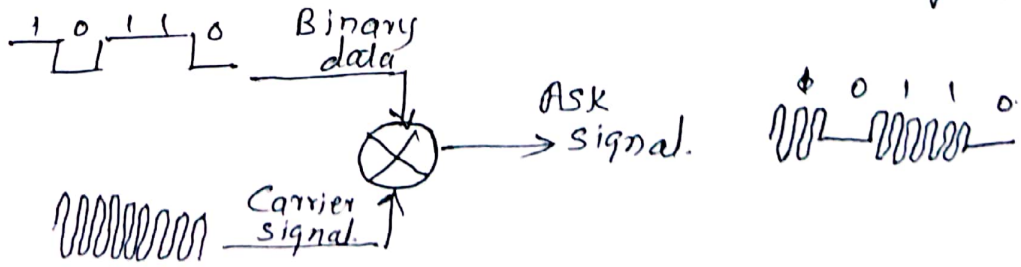
FM is the process in which frequency of the carrier is varied in accordance with the amplitude of the message signal whereas the amplitude and phase are kept constant.



Q. 10.b. Write a short note on: Amplitude shift keying (ASK) modulator and Demodulator. (10m)

Ans: ASK Modulator.

ASK represents digital data as variations in the amplitude of a carrier wave. ASK signal can be generated when the incoming binary data and the sinusoidal carrier are applied to a product modulator as inputs



* ASK Demodulator.

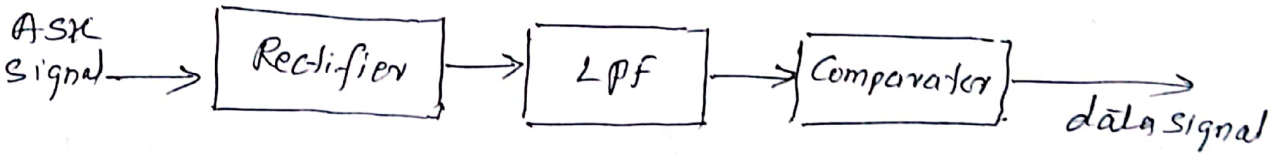
(not in the syllabus)

There are two types of ASK Demodulation techniques.

- Asynchronous ASK Demodulation
- Synchronous ASK Demodulation

* Asynchronous ASK Demodulator.

The asynchronous ASK detector consists of half wave rectifier, a low pass filter and a comparator.



* Synchronous ASK Demodulator.