B TECH
(SEM I) THEORY EXAMINATION 2022-23
FUNDAMENTALS OF ELECTRONICS ENGINEERING

Tin. : 3 Hours

Total Marks: 70

समय:) घण्टे

पूर्णांक: 70

Note:
1. Attempt all Sections. If require any missing data; then choose suitably.
2. The question paper may be answered in Hindi Language, English Language or in the mixed language of Hindi and English, as per convenience.

नोट: 1. सभी प्रश्नों का उत्तर दीजिए। किसी भी प्रश्न में, आवश्यक डेटा का उल्लेख न होने की स्थिति में उपयुक्त डेटा चुनें। मानकर प्रश्न को हल करें।

2. प्रश्नों का उत्तर देने हेतु सुविधानुसार हिन्दी भाषा, अंग्रेजी भाषा अथवा हिंदी एवं अंग्रेजी की मिश्रित भाषा का प्रयोग किया जा सकता है।

SECTION A

1. Attempt *all* questions in brief.

   निम्न सभी प्रश्नों का उत्तर संक्षेप में उत्तर दीजिए।

   2 x 7 = 14

a.	Compare between Avalanche breakdown and Zener breakdown
	अवलान्चि (Avalanche)ब्रेकडाउन और जेनर (Zener) ब्रेकडाउन के बीच तुलना करें
b.	Why Varactor diode is also called Varicap? Explain.
	Varactor डायोड को Varicap भी क्यों कहते हैं? व्याख्या कीजिए।
c.	Define Pinch-off voltage for JFET.
	JFET के लिए पिंच-ऑफ़ (Pinch-off) वोल्टेज को परिभाषित करें।
d.	For a transistor $I_E = 10$ mA and $\alpha = 0.987$. Find I_C and I_B
	एक ट्रांजिस्टर के लिए $I_E = 10$ mA और $\alpha = 0.987$ है। I_C और I_B का मान ज्ञात कीजिए।
e.	Define CMRR and Slew rate of Op-Amp
	Op-Amp के CMRR और Slew rate को परिभाषित करें
f.	Explain Voltage Follower circuit using Op-Amp.
	Op-Amp का प्रयोग करते हुए वोल्टेज फालोअर सर्किट को समझाइए।
g.	500 watt carrier power is modulated to depth of 90%, calculate the total power in the modulated wave.
	500 वाट वाहक शक्ति को 90% की गहराई तक संशोधित किया जाता है। संशोधित तरंग में कुल शक्ति की गणना करें।

SECTION B

2. Attempt any *three* of the following:

   निम्न में से किसी तीन प्रश्नों का उत्तर दीजिए।

   7 x 3 = 21

a.	Explain the working of p-n junction diode and draw its V-I Characteristics.
	p-n संधि डायोड की कार्यप्रणाली समझाइए तथा इसके V-I अभिलक्षण को रेखाचित्र से प्रदर्शित कीजिए।
b.	Draw a neat circuit diagram of bridge rectifier and explain its operation with output waveforms. Drive the average value of current and voltage.

ब्रिज रेक्टिफायर का स्वच्छ परिपथ आरेख बनाइए तथा आउटपुट वेवफॉर्म के साथ इसकी कार्यप्रणाली समझाइए। करेन्ट और वोल्टेज के औसत मान को व्युत्पन्न कीजिए।

c.	Calculate the output voltage V_0 of the circuit shown in fig 1
	चित्र 1 में दिखाए गए सर्किट के आउटपुट वोल्टेज V_0 की गणना करें।

Fig No 1

d.	Define Universal Gates. Implement AND, OR, NOR by using NAND gates only.
	यूनिवर्सल गेट को परिभाषित कीजिए। केवल NAND गेट का उपयोग करके AND, OR और NOR गेट लागू करें।
e.	An audio frequency signal 20 Sin 2 π x 500 t is used to amplitude modulated a carrier of 40 Sin 2 π x 10^5 t. Calculate : (i) Modulation Index (ii) Sideband Frequency (iii) Amplitude of each sideband (iv) Bandwidth required (v) Total power delivered to the load of 2 KΩ
	एक ऑडियो आवृत्ति सिग्नल 20 sin 2 π x 500 t का उपयोग एक वाहक 40 sin 2 π x 105 t के को आयाम माड्यूलेशन करने के लिए किया जाता है।गणना करें: (i) मॉड्यूलेशन इंडेक्स (ii) साइडबैंड फ्रीकेंसी (iii) प्रत्येक साइडबैंड का आयाम (iv) आवश्यक बैंडविड्थ (v) 2 KΩ के भार पर खर्च होने वाली कुल शक्ति (Total power)

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7
निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a)	(i) Draw the circuit diagram of voltage tripler circuit?
	(ii) Explain Zener diode as a voltage regulator.
	(i) वोल्टेज ट्रिपलर सर्किट का सर्किट आरेख बनाएं?
	(ii) वोल्टेज रेगुलेटर के रूप में जेनर डायोड का उपयोग समझाइए।
(b)	Explain the working of following with the help of suitable diagram.
	(i) LED
	(ii) Photodiodes.
	उपयुक्त आरेख की सहायता से निम्नलिखित की कार्यप्रणाली समझाइए।
	(i) एलईडी (LED)
	(ii) फोटोडायोड्स(Photodiodes)

7 x 1 = 7

4. Attempt any *one* part of the following:
निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a)	Draw the circuit of NPN transistor in common base configuration and discuss its working. Draw input-output characteristic.

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	उभ्यनिष्ठ आधार (common base) विन्यास में NPN ट्रान्जिस्टर का परिपथ बनाइए तथा इसकी कार्यप्रणाली की विवेचना कीजिए। इसकी इनपुट-आउटपुट विशेषता को रेखचित्र से प्रदर्शित करें।
(b)	Explain working principle of Depletion type MOSFET (n-channel). Draw & Explain its characteristics.
	डिप्लेशन टाइप MOSFET (n-channel) के कार्य सिद्धांत की व्याख्या करें। चित्र बनाइए और इसकी विशेषताओं को समझाइए। 7 x 1 = 7

5. **Attempt any *one* part of the following:**
निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a)	Draw the block diagram of Op-Amp and list all the ideal characteristics of op-amp.
	Op-Amp का ब्लॉक आरेख बनाएं और op-amp की सभी आदर्श विशेषताओं को सूचीबद्ध करें।
(b)	Explain the working of op-amp as a Integrator and drive its output equation.
	इंटीग्रेटर के रूप में Op-Amp की कार्यप्रणाली समझाइए और इसके आउटपुट समीकरण को व्युत्पन्न कीजिए। 7 x 1 = 7

6. **Attempt any *one* part of the following:**
निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a)	Minimize using K-map and realize output using gates. $F(A, B, C, D) = \Sigma m(1, 4, 8, 12, 13, 15) + d(3, 14)$
	के-मैप (K-map) का उपयोग हुए निम्न फंक्शन का सरलतम रूप ज्ञात करें और गेट्स का उपयोग करके आउटपुट प्राप्त करें। $F(A, B, C, D) = \Sigma m(1, 4, 8, 12, 13, 15) + d(3, 14)$
(b)	Convert the following: i) $(53.625)_{10}$ to $(?)_2$ ii) Find the base x if $(211)_x = (152)_8$ iii) Subtract using 1's complement: $(10111)_2 - (110011)_2$ iv) find the 1's and 2's compliment of $(010100)_2$
	निम्नलिखित को रूपांतरित करें: i) $(53.625)_{10}$ से $(?)_2$ ii) यदि $(211)_x = (152)_8$ है तो आधार x ज्ञात कीजिए। iii) 1's complement का उपयोग करके घटाएं: $(10111)_2 - (110011)_2$ iv) $(010100)_2$ के लिए 1's and 2's compliment लिखें।

7. **Attempt any *one* part of the following:** 7 x 1 = 7
निम्न में से किसी एक प्रश्न का उत्तर दीजिए।

(a)	(i) Describe AM modulator with adequate diagram. (ii) Explain the elements of communication system with the help of block diagram.
	(i) AM मॉड्यूलेटर का उचित आरेख के साथ वर्णन कीजिए। (ii) आरेख की सहायता से संचार तंत्र के तत्वों की व्याख्या कीजिए।
(b)	Explain the satellite and radar system using proper block diagram.
	समुचित रेखाचित्र की सहायता से उपग्रह और रडार सिस्टम की व्याख्या करें।

MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Sessional Examination – I (Set-B) : Odd Semester 2022-23

(300)

Course/Branch	: B Tech (CC2, CC4, CC6, CC6, CC10, ⬜⬜⬜)	Semester	: I 8/12/22
Subject Name	: Fundamentals of Electronics Engineering	Max. Marks	: 60
Subject Code	: BEC101	Time	: 120 min

CO-1 : *Describe the concept of PN Junction and devices.*
CO-2 : *Explain the concept of BJT, FET and MOFET.*

Section – A (CO - 1) # Attempt both the questions # 30 Marks

Q.1 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.   (2 x 6 = 12 Marks)

a) Differentiate (at least 2) between clipper and clamper circuit.

b) What do you mean by doping? Describe its need.

c) Differentiate (any 4) between avalanche and Zener breakdown.

d) A Ge diode carries a current of 1 mA at room temperature when a forward bias of 0.15 V is applied. Estimate the reverse saturation current at room temperature.

e) Define depletion layer in a diode.

f) Explain the principle of operation of LED.

g) Explain Varactor diode.

Q.2 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) Draw & explain the V-I characteristic of a P-N junction diode. Also describe the effect of temperature on the V-I characteristic of a P-N junction diode.

b) For a Zener Voltage regulator, determine the range of R_L and I_L that will result in V_O being maintained at 10V. Given V_{in} = 50V, R_s = 1K Ω, I_{ZM} =32mA.

c) Draw and explain the working of bridge rectifier with input and output waveforms. Also calculate its efficiency.

d) Sketch the output for the given clamper circuit with shown in figure below.

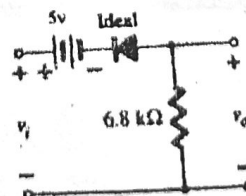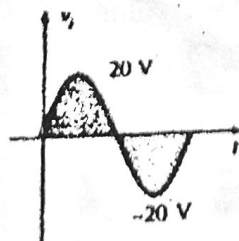e) Determine and sketch V_O for the given network shown in Fig.

Figure 1

Section – B (CO - 2) # Attempt both the questions # 30 Marks

Q.3 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.   (2 x 6 = 12 Marks)

a) Explain Why BJT's are called Bipolar and FET's are Unipolar?

b) Describe doping profile and physical appearance of Emitter, base and collector of a transistor?

c) List the Differences between JFET and BJT?
d) Determine β, if $I_E = 5$ mA, $I_C = 4.95$ mA.
e) Derive the relationship between α, β and γ.
f) Define transconductance of JFET.
g) What is Pinch off Condition in FET?

Q.4 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) Define α, β and γ with respect to BJT. A transistor having $\alpha = 0.975$ and reverse saturation current $I_{CBO} = 10\mu A$ is operated in CE mode. If the base current is 250μA. Calculate I_E and I_C.

b) Draw and explain common base N-P-N Transistor with its input and output characteristic graph. Also write an expression for output current.

c) Explain the construction & working of enhancement type MOSFET along with their characteristics.

d) Describe the construction and working of P-Channel Depletion MOSFET, with characteristic graph.

e) Explain the construction & working of N channel JFET, with its characteristics.

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MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

NH-58, Delhi-Roorkee Highway, Baghpat Road, Meerut – 250005 U.P.

Sessional Examination – II : Odd Semester 2022-23

18|1|23

555

Course/Branch	: B Tech (OC-1,2,4,5,6,7,8,9,10,11,12)
Subject Name	: Fundamentals of Electronics Engineering
Subject Code	: BEC101

Semester : I
Max. Marks : 60
Time : 120 min

CO-3 : Apply the concept of Operational amplifier to design linear and non-linear applications.
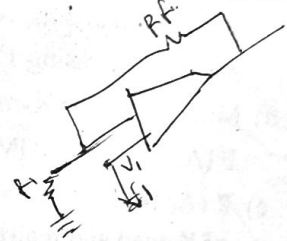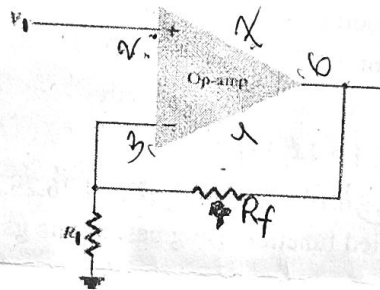CO-4 : Perform number systems conversions, binary arithmetic and minimize logic functions.

Section – A (CO - 3) # Attempt both the questions # 30 Marks

Q.1 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks.　(2 x 6 = 12 Marks)

a) Define Op-amp. Why it is called Operational Amplifier?

b) Draw the block diagram of an Op-amp.

c) Define Slew Rate.

d) Draw the Pin Diagram of 741 IC.

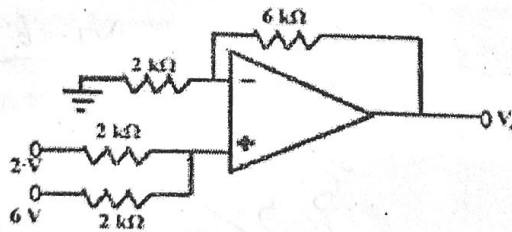e) Calculate the output voltage of given figure for values of $V_1 = 2$ V, $R_f = 500$ kΩ, and $R_1 = 100$ kΩ.

f) A differential amplifier has an output of 1V with a differential input of 10 mV and an output of 5 mV with a common-mode input of 10 mV. Find the CMRR in dB.
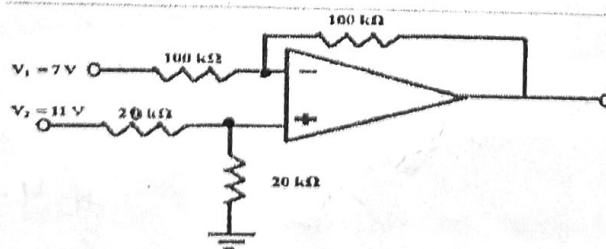
g) Enlist the characteristics of an ideal OPAMP.

Q.2 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

a) Explain the concept of virtual ground in OP-AMP. Determine output Voltage for given network.

b) Find the output voltage of the following op-amp circuit shown in the Fig below.

c) With help of the circuit diagram, explain the working of OPAMP as an Integrator.

d) Explain CMRR. Determine the output voltage of an OPAMP for the input voltage of V1=150μV and V2=140μV. The amplifier has differential gain Ad=4000 and CMRR is 100.

e) Derive the expression for gain of OP-AMP as non-inverting amplifier.

Q.3 : Attempt any **SIX** questions (Short Answer Type). Each question is of two marks. (2 x 6 = 12 Marks)

   a) Draw the Symbol and truth table of EX-OR and EX-NOR gates.

   b) Implement an OR gate using NAND gates.

   c) State DeMorgan's Theorem.

   d) Evaluate: $(637)_9 = (?)_5$.

   e) Evaluate: $(BC64)_{16} = ($ $)_{10}$

   f) Convert the given expression into canonical SOP form: F = A+ AB+ABC

   g) Perform M-N and M+N if M=10101 and N=1111.

Q.4 : Attempt any **THREE** questions (Medium Answer Type). Each question is of 6 marks. (3 x 6 = 18 Marks)

   a) Simplify the Boolean function using Boolean Algebra theorems:

      (i) A'B'C' + A'BC' + AB'C' + ABC'

      (ii)(A + B + C) (A +B'+C') (A + B+C')(A + B'+ C).

   b) (i) What are universal gates? Why are they called so?

      (ii) Draw the logic diagram of Ex-OR gate using Universal gate (NAND and NOR).

   c) Determine base of the following:

      (i) $(345)_{10} = (531)_x$

      (ii) $(2374)_{16} = (9076)_x$

      (iii) Subtract using 10's complement: $(9754)_{10} - (364)_{10}$

      (iv) Subtract using 1's complement: $(10111)_2 - (110011)_2$.

   d) Minimize using K-map and realize using NOR gates only.

      F (A, B, C, D) = ΠM(3, 4, 5, 7, 9, 13, 14, 15). d(0, 2, 8)

   e) F (A, B, C, D, E) = Σm (0,1,2,4,5,6,10,13,14,18,21,22,24,26,29,30). Simplify the function with help of K-map and realize the simplified function using basic logic gates.

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$$\frac{6-V_1}{2} = \frac{V_1-2}{2}$$

$$12-2V_1 = 2V_1-4$$

$$\frac{2-V_1}{2} = \frac{V_1-6}{2}$$

$$12+4 = 2V_1+2V_1$$

$$16 = 4V_1$$

$$2+6 = V_1+V_1$$

$$8 = 2V_1 \quad \frac{+64}{4} = V_1.$$

$$\frac{8}{4}4 = V_1.$$

$$6-V_1 = V_1-2$$

$$6+2 = 2V_1$$

$$\frac{8}{7}4 = V_1.$$

Roll No. : ....

MEERUT INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Pre University Test (PUT) ; Odd Semester 2022-23

Course/Branch : B Tech	Semester : I
Subject Name : Fundamentals of Electronics Engineering	Max. Marks : 100
Subject Code : BEC101	Time : 180 min

CO-1 : *Describe the concept of PN Junction and devices.*
CO-2 : *Explain the concept of BJT, FET and MOFET.*
CO-3 : *Apply the concept of Operational amplifier to design linear and non-linear applications.*
CO-4 : *Perform number systems conversions, binary arithmetic and minimize logic functions.*
CO-5 : *Describe the fundamentals of communication technologies.*

Section – A # 20 Marks (Short Answer Type Questions)

Attempt ALL the questions. Each Question is of 2 marks (10 x 2 = 20 marks)

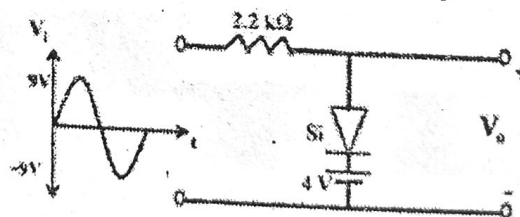| Q. No.	COx	Question Description # Attempt ALL the questions. Each Question is of 2 marks
1 A	CO1	Differentiate between Avalanche and Zener breakdown.
B	CO1	Why Bridge type full wave rectifier is preferred over centre tapped full wave rectifier. State 2 reasons. Output Voltage is twice, smaller size of choke
C	CO2	Differentiate (any 4) the BJT and JFET.
D	CO2	Determine I_E, α and β of CB transistor when I_C = 7mA, I_B = 0.1 mA?
E	CO3	Explain Input offset Voltage & Input bias current.
F	CO3	Enlist the characteristics (atleast 6) of ideal OP-Amp.
G	CO4	$(2ACD)_{16}$ = ( )$_8$ = ( )$_7$.
H	CO4	Subtract using 2's complement $(01001)_2 - (01011)_2$.
I	CO5	Define modulation. Why do we need modulation?
J	CO5	What is RADAR? Write down two applications of RADAR.

Section – B # 30 Marks (Long / Medium Answer Type Questions)

Attempt ALL the questions. Each Question is of 6 marks (5 x 6 = 30 marks)

Q.2 (CO-1): Draw the circuit and discuss the working of full wave bridge rectifier with suitable input -output waveforms. Also find out its efficiency.

OR

Differentiate between Clipper and Clamper circuit. Determine and draw output voltage for given network.

Q.3 (CO-2): Draw and explain common Emitter N-P-N Transistor with its input and output characteristic graph & mark all the regions of operations. Also write an expression for output current.

OR

Define α and β with respect to BJT and derive the relationship between them. A transistor having α = 0.975 and reverse saturation current I_{CBO}= 20µA is operated in CE mode. If the base current is 250µA. Calculate I_E and I_C.

Q.4 (CO-3): With help of the circuit diagram, explain the working of OPAMP as differentiator & Integrator.

OR

Explain CMRR & Slew Rate. Determine the output voltage of an op-amp for input voltages of V_{i1}= 100V and V_{i2} = 120V. The amplifier has a differential gain of Ad= 4000 and the value of CMRR is 150.

Q.5 (CO-4): (i) What are universal gates? Why are they called so?
(ii) Draw the logic diagram of AND, OR, Ex-OR & Ex-NOR gate using Universal gate NAND.

OR

Simplify the given boolean function F together with don't care conditions in POS:
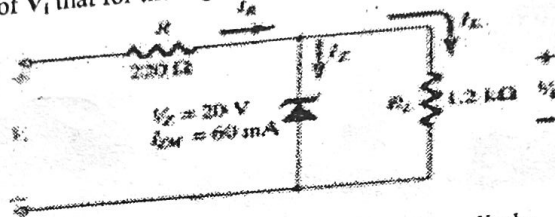$F(w,x,y,z)$= Sum(0,1,2,3,7,8,10)
$d(w,x,y,z)$= π(5,6,11,15)

Q.6 (CO-5): Explains the elements of communication system with the help of block diagram.

OR

Describe AM modulation and Demodulation technique with adequate diagram.

Section – C # 50 Marks (Medium / Long Answer Type Questions)
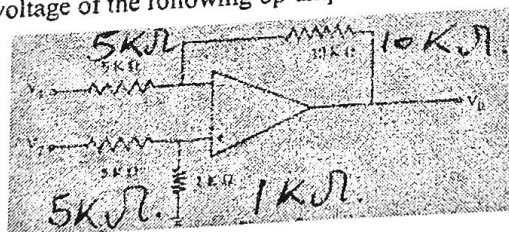Attempt ALL the questions. Each Question is of 10 marks (5 x 10 = 50 marks)

Q.7 (CO-1): Attempt any TWO questions. Each question is of 5 marks.
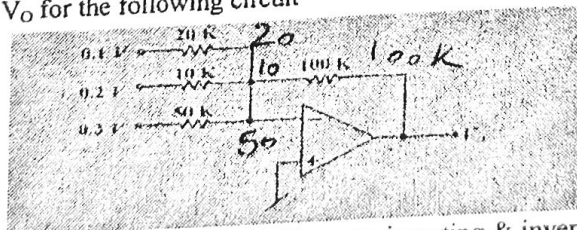a. Determine the range of V_i that for the Fig. that will maintain the Zener diode in on state:

b. Draw & explain the V-I characteristic of a P-N junction diode. Also describe the effect of temperature on the V-I characteristic of a P-N junction diode.

c. Write Short notes on any two of the following:
   (i) Tunnel Diode.
   (ii) LED.
   (iii) Full wave voltage doubler.
   (iv) Varactor Diode.

Q.8 (CO-2): Attempt any ONE question. Each question is of 10 marks.
a. Explain the Characteristics, Working and Construction of N-Channel Depletion type MOSFET?
b. Why JFET is called Voltage Controlled device? Draw & explain the structure and characteristics of N channel JFET indicate different regions and its significance?

Q.9 (CO-3): Attempt any TWO questions. Each question is of 5 marks.
a. Find the output voltage of the following op-amp circuit shown in the Fig below: Where $V_1 = 5V$ & $V_2 = 3V$.

b. Determine the V_O for the following circuit

c. Derive the expression for gain of OP-AMP as non-inverting & inverting amplifier.

Q.10 (CO-4): Attempt any ONE question. Each question is of 10 marks.
a. Simplify the boolean function F in sum of products using don't care conditions d with the help of K-map. Also implement the simplified function using basic gates only.
   $F = B'C'D' + BCD' + ABCD'$
   $d = B'CD' + A'BC'D$
b. $F (A, B, C, D, E) = \Sigma m (0,1,2,4,5,6,10,13,14,18,21,22,24,26,29,30)$. Simplify the function with help of K-map and realize the simplified function using only NOR gates.

Q.11 (CO-5): Attempt any ONE question. Each question is of 10 marks.
a. Explain amplitude modulation with the help of proper waveforms. Derive the expression for the total Power radiated by the modulated signal. Also calculate modulation efficiency. AM radio transmitter radiates 6 KW power when modulation percentage is 70 %. Determine the carrier power.
b. Write Short notes on any two of the following:
   i). Radar Communication.
   ii). Cellular Communication.
   iii). Wireless Communication.
   iv). Satellite Communication.