Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: 23ES1002

1st Semester Regular/Back Examination: 2024-25
SUBJECT: BASIC ELECTRONICS
BRANCH(S): CE, CHEM, BIOTECH, BIOMED, AE, CSIT, AERO, AEIE, AME, AUTO, CSE, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CST, ECE, ETC, EE, EEE, ELECTRICAL & C.E, ELECTRICAL, IT, ME, MECH, METTA, MINING, MINERAL, MME, EEVDT, CSEIOT
Time: 3 Hours
Max Marks: 100
Q.Code: R583

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

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Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is a p-n junction diode? How does a barrier field appear across a p-n junction?
b) Explain the necessity of a parallel resistor in clamper circuit.
c) Compare between a FET and a BJT.
d) Why the field - effect transistor is called a unipolar transistor?
e) Mention advantages and limitations of integrated circuits.
f) State the characteristic an ideal Op-Amp.
g) Discuss the concept of “Virtual ground” in Op-Amp.
h) Determine the binary equivalent of 26.25.
i) State and prove De Morgan’s theorem.
j) Perform the binary addition
100101 + 101 + 1101 + 100

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) The reverse saturation current of a Si p-n junction is 5 nA at 27°C. What are the static and dynamic resistances of the junction for an applied forward bias of 0.6 V?
b) Discuss the concept of Zener and avalanche breakdown.
c) Draw the common base circuit of a junction transistor. Sketch its output characteristics. Explain the active, saturation, and cutoff regions.
d) Explain the term transistor biasing. What are the factors determining the choice of the Q-point? Draw the circuit diagrams of fixed-bias and voltage divider bias arrangement of an n-p-n transistor in CE configuration. Mention the limitations and advantages of both arrangements.
e) When the channel of a JFET is said to be pinched off? Define the pinch-off voltage. What is the pinch off current? By applying Shockley’s current expression, draw the transfer characteristic curve of an n-channel JFET.

f) Draw the circuit diagram of a common emitter n-p-n transistor with the following parameters: V_{BB} = 5V, R_B = 100 KΩ, R_C = 1 KΩ, V_{CC} = 10V, V_{BE} = 0.7 V, I_{CO} = 0, β = 100. Find I_B and I_C. Is the transistor operating in the saturation region? Justify.

g) Explain the principle of operation of a digital inverter.

h) Draw a non-inverting configuration using Op-Amp. Calculate the output voltage of the circuit for υ_i = 150 mV rms, R_f = 75 KΩ and R_i = 36 KΩ.

i) Calculate the output voltage for the circuit shown in figure-1 with inputs of V_1 = 40 mV rms and V_2 = 20 mV rms.

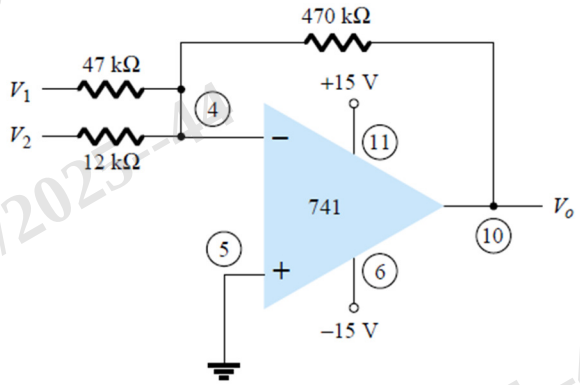

Figure-1

j) What is the difference between signed and unsigned numbers? Discuss the three different methods used for representing signed numbers in binary. Support each method by a suitable example.

k) Simplify the Boolean expressions to a minimum number of variables

I. $xy + x(wz + w\bar{z})$

II. $(x + \bar{y} + \bar{z})(\bar{x} + \bar{z})$

III. $\bar{A}B + \bar{A}\bar{C} + BC + A\bar{B}C$

l)

I. Show that an EX-OR gate can be built with NOR gates.

II. How can the NAND gates be combined to perform the NOR operation?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Draw the circuit diagram of (i) a half-wave rectifier and (ii) a full-wave rectifier. Explain the principle of operation of each circuit by applying a sinusoidal wave at the input of the rectifier. **(16)**

Q4 What are different types of MOSFETs? Explain with a neat sketch, the structure and the working of an n-channel enhancement type MOSFET. Draw its drain and transfer characteristic curve. **(16)**

Q5 Describe the use of operational amplifier as an integrator and differentiator. **(16)**

Q6 $f_1 = AB + A\bar{C} + C + A\bar{B}C + ABC$ **(10 + 3 + 3)**

$f_2 = \bar{B} + ABC$

(i) Simplify the above functions. Draw the original and simplified circuit.

(ii) Express f_1 *and* f_2 in standard SOP form.

(iii) Express f_1 *and* f_2 in standard POS form.