

Question Paper

Exam Date & Time: 25-Apr-2023 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

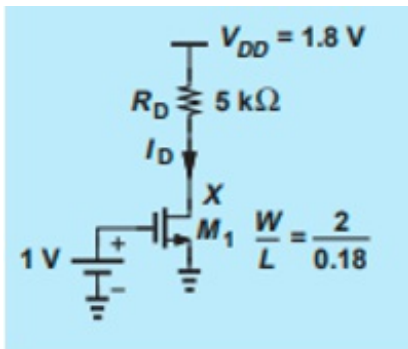
FIRST SEMESTER B.TECH. EXAMINATIONS - APRIL 2023
SUBJECT: ECE-1071 / ECE -1051 - BASIC ELECTRONICS

Marks: 50

Duration: 180 mins.

Answer all the questions.

- 1A) A germanium diode carries a current of 10mA when a forward bias of 0.2 V is applied across it at 27°C. (4)
(i) Find the reverse saturation current.
(ii) Calculate the bias voltage needed if the diode current is decreased to 1 mA.
(iii) Find the diode current for a bias voltage of 0.2V if the temperature is increased to 67°C.
- 1B) Sketch the piece-wise linear characteristics of a practical PN junction diode and draw its equivalent circuit. Explain the different types of breakdowns that can occur in a PN junction diode. (3)
- 1C) Calculate the bias current of M1 shown in the figure shown below. Assume $\mu_n C_{ox} = 100 \mu\text{A/V}^2$ and $V_{TH} = 0.4 \text{ V}$. If the gate voltage increases by 10 mV in Q1, what is the change in the drain voltage? (3)



- 2A) 120V, 60Hz is applied to the primary of a transformer with a turns ratio of 5:1. Secondary of the transformer is connected to a center-tapped full wave rectifier employing two identical diodes with a cut-in voltage of 0.6V and forward resistance of 15Ω. Calculate the average and RMS load voltage, efficiency, and frequency of the output waveform assuming a load resistance of 500Ω connected across the circuit. (4)
- 2B) Draw the circuit of a Zener voltage regulator and label all the components. The Zener diode in a regulator circuit has a breakdown voltage of 15V and a power rating of 0.5W. If the input voltage applied is 40V, what is the minimum value of series resistance that prevents the Zener diode from being destroyed? (3)
- 2C) With a neat circuit diagram, explain the working of a half-wave rectifier with a capacitor filter. Draw the corresponding input and output waveforms. (3)
- 3A) Subtract $(37.25)_{10}$ from $(2A.8)_{16}$ using 2's complement subtraction. (2)
- i)
- ii) Implement OR gate using discrete components. With the help of the truth-table, explain its working. (2)
- 3B) Draw the circuit diagram of a two-input inverting adder using an op-amp with $V_{cc} = \pm 15\text{V}$. Given the (3)

voltage gain of the adder is 10. Find the output voltage for the following sets of input voltages V_1 and V_2 as shown in the Table below:

V_1 (volts)	V_2 (volts)	V_o (volts)
0.5	0.8	
1	1	

- 3C) In the OPAMP square wave generator, all resistors are $1k\Omega$ and $C = 0.1\mu F$ and $\pm V_{sat} = \pm 12V$. Determine the frequency of oscillation of the output signal. Also, draw the circuit and plot the voltage waveforms across the capacitor and the output by marking all the timing and voltage levels. (3)
- 4A) Realize the full adder circuit using 2 half adders and 1 OR gate with the truth table. Also, Implement the circuit using only NAND gates. (4)
- 4B) Draw the logic circuit of ripple counter that count from 000 to 111 using positive edge triggered T flip flop. Also sketch the timing diagram for the same. (3)
- 4C) Explain an edge triggered JK Flip flop using NAND gates with a neat circuit diagram along with the truth table. (3)
- 5A) Given a frequency modulated signal $V(t) = 10\sin(4\pi 10^6 t + 5\sin(30\pi 10^3 t))$, Determine the Modulation index, Modulating frequency, Frequency deviation and Frequency sensitivity factor. (4)
- 5B) The total power radiated by an AM wave is 10KW and carrier is simultaneously modulated by two audio waves with percentage modulation of 50 and 65 respectively. Find the total modulation index, unmodulated carrier power radiated and power in each sideband. Assume $R_L = 1k\Omega$. (3)
- 5C) Sketch ASK, FSK and PSK signals for the binary data 101101. (3)

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