DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
FIRST SESSIONAL
SUBJECT: PHYSICS (BSC 101)

Examination	**: B.Tech. Semester- II (CE/IT/EC)**	**Seat No.**	: CE031
Date	**: 21/03/2023**	**Day**	**: Tuesday**
Time	**: 4:00 to 5:15 PM**	**Max. Marks**	**: 36**

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly. **($K = 1.380649 \times 10^{-23}$ joule per kelvin, Temp. T =300 K, h= 6.626×10^{-34} J Hz^{-1}, q = $1.602176634 \times 10^{-19}$ coulomb, C=3×10^{8} m/sec)**
4. Draw neat sketches wherever necessary.

Q.1 **Do as directed.** **[12]**

CO1 U (a) With the same secondary voltage and capacitor filter, ____________ has the most ripple and __________ produces the least load voltage. **[1]**
a) Half-wave rectifier, Bridge rectifier
b) Center-tapped Full wave rectifier, Bridge rectifier
c) Half-wave rectifier, Center-tapped Full wave rectifier
d) Half-wave rectifier , Half-wave rectifier

CO1 A (b) Calculate the DC load voltage in the half wave rectifier if the secondary voltage of a transformer is 20V rms. Consider Germanium diode with second approximation. **[2]**

CO1 A (c) A designer will be using a silicon diode over a temperature range of 0^0C to 75^0C. Consider that diode is having barrier potential of 0.7V at 25^0C. What are the minimum and maximum values of the barrier potential? **[2]**

CO1 A (d) A silicon diode has a saturation current of 10 nA at 25^0C. What is the value of the saturation current at 88^0C? **[1]**

CO4 E (e) Silicon and germanium semiconductors are not suitable for the manufacturing of LED. Justify the statement. **[2]**

CO4 N (f) Differentiate between spontaneous emission and stimulated emission. **[2]**

CO4 A (g) The radiative and non-radiative recombination life times of minority carriers in the active region of a double heterojunction LED are 60 nsec and 90 nsec respectively. Determine the total carrier recombination life time and internal quantum efficiency. **[2]**

Q.2 Attempt ***Any TWO*** from the following questions. **[12]**

CO1 C (a) A bridge rectifier circuit with a capacitor filer across the load resistor is designed to meet the following specifications: **[6]**

- DC load voltage = 9.9V
- DC load current =19.8mA
- Peak-to-peak ripple voltage = 35mV.

The primary coil of a transformer is connected to a 120 V rms , 60 Hz AC source. Consider the silicon diodes with second approximation. Determine (1) the value of the load resistance (2) The value of capacitance required (3) Peak secondary transformer voltage and (4) turns ratio required for the transformer. Draw a schematic of the designed circuit.

CO1 C (b) Consider a center tapped full wave rectifier with 500Ω load resistor and a DC load voltage of 24.3V. Input of 220V rms,60Hz is applied to the primary coil of the transformer. Also, consider silicon diodes with second approximation. Determine (1) The peak output voltage (2) DC load current (3) Peak Secondary voltage (4) turns ratio required for the transformer. Draw a schematic of the designed circuit. **[6]**

CO1	E	(c)	For the circuit shown in the **Fig.-1** calculate the following: (1) Secondary peak voltage (2) DC load voltage (3) DC load current (4) peak to peak ripple voltage. Sketch the input and output waveforms. Consider Germanium diode with ideal approximation. What happens to the peak to peak ripple voltage, if capacitance is reduced to half? Explain.	[6]

Q.3			Attempt the following questions.	[12]
CO4	E	(a)	Derive the equation used for finding the flux absorption in a given semiconductor material with absorption coefficient α and thickness x. A 0.45 μm thick sample of GaAs is illuminated by a monochromatic light of photon energy 3 eV. The incident power on the sample is 15mW. If the absorption coefficient is 50000/cm, determine i. The total energy absorbed by the sample per second and also the rate of excess thermal energy given up by the electrons to the lattice before recombination. ii. The number of photons given off from recombination. Assume perfect quantum efficiency. Consider Energy band gap for GaAs=1.43eV/Photon.	[6]
CO1	E	(b)	A diode is connected in series with a DC supply voltage of 12V and Load resistance of 17Ω. The diode is operating in forward bias. Calculate the load current, load voltage and diode power for this circuit. Assume bulk resistance of the diode RB=0.23Ω. Consider silicon diode with third approximation	[4]
CO1	U	(c)	Compare and contrast n-Type Semiconductor and p-Type Semiconductor	[2]

OR

Q.3			Attempt the following questions.	[12]
CO4	E	(a)	i. The visible spectrum wavelength range is: 0.4μm - 0.7μm. The wavelength of the violet light is the shortest and the wavelength of the red light is the longest. Calculate: The frequency range of the visible spectrum and the amount of the photon's energy associated with the violet light compared to the photon energy of the red light.	[4]
			ii. Calculate the modulation bandwidth of a GaAs based LED with τ = 400ps.	[2]
CO1	E	(b)	A diode is connected in series with a DC supply voltage Vs and Resistance R_1. The diode is operating in forward bias. **Fig.-2** shows the diode curve and the load line for this circuit. Determine (1) Q point (2) Supply Voltage Vs (3) Resistance R1 (4) Power decapitated by the diode.	[4]
CO1	U	(c)	Describe (1) Surface leakage current (2) Transient current.	[2]

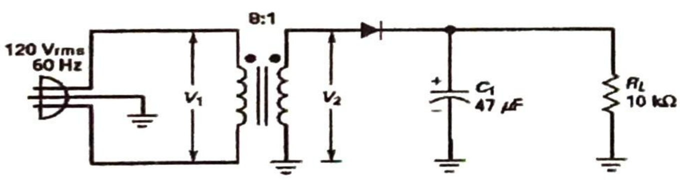

Fig.-1 (Q.2(c))

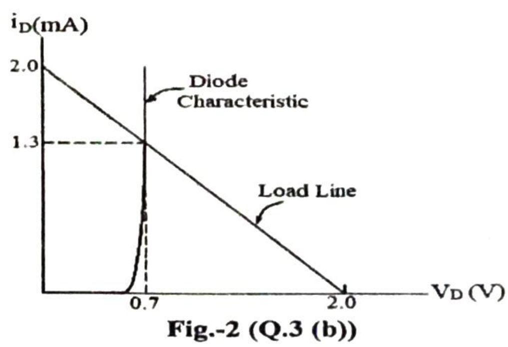

Fig.-2 (Q.3 (b))

Blooms Taxonomy levels : R-Remembering, U- Understanding, A-Applying, N-Analyzing, E- Evaluating, C-Creating