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

Examination	**: B.Tech. Semester- II (CE/IT/EC)**	**Seat No.**	**:**
Date	**: 25/04/2023**	**Day**	**: Tuesday**
Time	**: 08:30 to 09:45 AM**	**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, $h = 6.626 \times 10^{-34}$ J Hz^{-1}, $q = 1.602176634 \times 10^{-19}$ coulomb)**
4. Draw neat sketches wherever necessary.

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

CO1 U (a) Draw the schematic diagram of common anode seven segment display for displaying numerical digit 2. **[2]**

CO2 A (b) Consider the following specification for the base biased CE configuration, $V_{CE(Cut\text{-}off)}$ = 15 V and $I_{C(Sat)}$ = 5 mA, Calculate the value of Collector Resistance (R_C). **[2]**

CO1 U (c) Which of the following is true for LASER, **[1]**
(I)It produces coherent light (II) It produces light waves which are in phase with each other (III) It produces Intense focused beam of light (IV) All of above

CO2 U (d) The fact that there are many free electrons in a transistor emitter region means the emitter is _____. **[1]**
(I) Lightly Doped (II) Heavily Doped (III) Un-doped (IV) Less Area

CO4 U (e) Why does responsivity get reduce above cut-off wavelength in photo-detectors? **[2]**

CO5 U (f) How fiber optic communication is advantageous over microwave communication? **[2]**

CO5 U (g) Why does repeater required in optical fiber communication? **[2]**

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

CO2 E (a) Draw the schematic of base biased CE configuration with the following specifications: R_B=700KΩ, R_C=2KΩ, VCC=12V, VBB=10V, β_{dc}=100. Calculate (I) I_C (II) V_{CE} (III) Sketch Load line for the same. (IV) Comment on the location of Q-Point on load line with the following options (Almost at the middle of load line, Towards cutoff point, Towards saturation point). **[6]**
(Note: Consider Second approximation of silicon NPN transistor)

CO2 E (b) Consider a base biased BJT circuit with VBB=15V, VCC=25V, R_B=23KΩ, R_C=2.3KΩ, β_{dc}=110. Determine whether the transistor is saturated? Use (1) Saturation current method and (2) Collector –Voltage method to recognize the saturation. Also, calculate the saturated current gain. Consider the silicon NPN transistor with second approximation. **[6]**

CO2 E (c) Draw the schematic of emitter biased CE configuration with the following specifications: R_E=1.8KΩ, R_C=1KΩ, VCC=12V, VBB=5V, β_{dc}=50. Calculate (I) I_C (II) V_{CE} (III) Sketch Load line for the same. (IV) Comment on the location of Q-Point on load line with the following options (Almost at the middle of load line, Towards cutoff point, Towards saturation point). **[6]**
(Note: Consider Second approximation of silicon NPN transistor)

Q.3 Attempt the following questions. **[12]**

CO4 N (a) A p-i-n photo-diode, on an average, generates one- EHP per two incident photons at a wavelength of 0.85 μm. Assuming all the photo-generated electrons are collected, calculate **[6]**
(i) the quantum efficiency of the diode;
(ii) the maximum possible band gap energy in eV of the semiconductor, assuming the incident wavelength to be a long wavelength cut-off and
(iii) the mean output photo current when the incident optical power is 10 μW.

CO1 E (b) For the circuit shown in **Fig-1** (I) Is the zener diode operating in breakdown region? (II) Calculate Zener Current (III) Calculate Load Current (Note: Consider Zener Diode with Ideal Approximation) [4]

CO2 A (c) State True/False with mathematical equation "The slope of load line for emitter biased CE configuration is directly proportional to $\frac{1}{R_C + R_E}$". [2]

OR

Q.3 Attempt the following questions. [12]

CO4 N (a) (I) An APD has a quantum efficiency of 40% at 1.3 μm when illuminated with optical power of 0.3 μW at this wavelength, it produces an output photo current of 6 μA after avalanche gain. Calculate the multiplication factor of the diode. [4]

(II) Calculate the responsivity of an ideal p-n photo diode at 1.55 μm wavelengths. (consider quantum efficiency = 1) [2]

CO1 E (b) For the circuit shown in **Fig-2** (I) Is the zener diode operating in breakdown region? (II) Calculate Zener Current (III) Calculate Load Current (Note: Consider Zener Diode with Ideal Approximation) [4]

CO2 A (c) Derive the relationship between dc alpha (α) and Current gain (β) for BJT. [2]

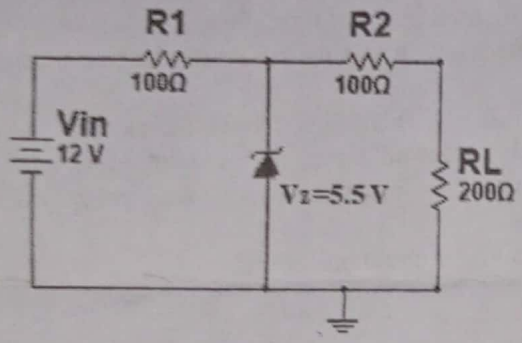

Fig.-1 (Q.3(b))

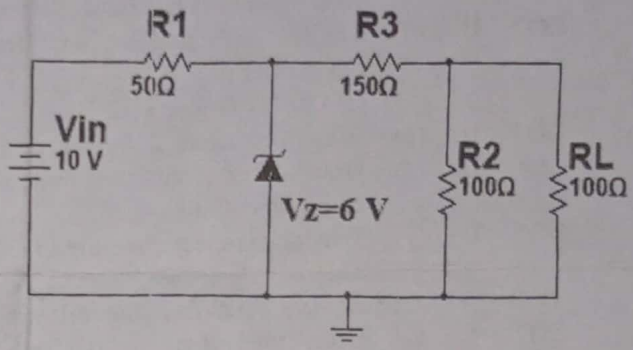

Fig.-2 (Q.3 (b) OR)

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