REG.NO.:

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: F1

Programme Name & Branch	:	**B.Tech(ECE, BML)**
Course Code and Course Name	:	**BECE308L**
Faculty Name(s)	:	**Dr S Revathi, Dr A Jabeena & Dr A Sangeetha**
Class Number(s)	:	**VL2024250102779, VL2024250102784, VL2024250102782**
Date of Examination	:	**18.10.2024**
Exam Duration	:	**90 minutes** **Maximum Marks: 50**

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)
  CO3: Design the optical transmitters and receivers and evaluate their performances
  CO4: Estimate the system requirements for point to point communication

Q. No	Question	M	CO	BL
1.	a) Compute power internally generated within a double-heterojunction LED if it has internal quantum efficiency of 64.5 % and drive current of 40 mA with a peak emission wavelength of 0.82 μm.	5	3	4
	b) A planar LED is fabricated from GaAs is having a optical power emitted is 0.018% of optical power generated internally. When the optical power generated internally is 50% of the electric power supplied, determine the external power efficiency.	5		
2.	A DH injection laser has a GaAs active region with band gap energy of 1.43 eV and refractive index of active region at its emission wavelength is 3.4. It has an optical cavity of length 200 μm and width 80 μm. At normal operating temperature the loss coefficient is 12 / cm and the threshold current density for the device is 2.5×10^3A / cm^2. The mirror reflectivity at each end of the optical cavity is 0.35 and 0.6. It may be assumed that the current is confined to the optical cavity. Estimate the following; (i) the frequency and wavelength separation of the modes in the active cavity (ii) the gain factor (iii) the threshold current and threshold gain for the device.	10	3	4
3.	a)A pin photodiode has a quantum efficiency of 75% at a wavelength of 1.3 μm. Calculate: (i) its responsivity (ii) the received optical power if the mean photocurrent is 8.9×10^{-9} A.	5	3	4
	b) The Silicon APD has quantum efficiency of 55% at a wavelength of 0.85 μm. If the incident light power is 1.5 μW, the output current of the device after avalanche is 25 μA. Calculate the multiplication factor M after avalanche gain.	5		

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4.	Consider an InGaAs APD with a figure of merit M^x where x= 0.7 is biased to operate at M=10. The unmultiplied dark current is 10 nA at a bandwidth of 700 MHz. Assuming surface leakage and thermal noise currents negligible, (i) What is the APD noise current per square root of bandwidth? (ii) What is the APD noise current for a Bandwidth of 700 MHz? (iii) If the responsivity (at M=1) is 0.8, what is the minimum optical power for an SNR of 10?	10	3	4
5.	Estimate the maximum attenuation-limited transmission distance of the following system operating at 100 Mb/s: System operating at 850 nm with system margin of 6 dB. (i) GaAlAs laser diode: 1mW of power is fiber coupled (ii) Silicon avalanche photodiode: –50 dBm sensitivity (iii) Graded-index fiber: 3.5 dB/km attenuation at 850 nm. (iv) Connector loss: 1 dB/connector. Also find the maximum attenuation-limited transmission distance, if the source power is doubled with attenuation per km is halved for the transmission fiber.	10	4	4

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