

Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

● Optical receivers - 3

● Optical receiver design

● Noise Analysis

● Sensor Performance characteristics

 Quiz : Assignment 3

● Optical Fiber Sensors : Week 3 Feedback Form

● Assignment 3 solutions

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Download Videos

Live Session

Text Transcripts

Assignment 3

The due date for submitting this assignment has passed.

Due on 2021-02-10, 23:59 IST.

As per our records you have not submitted this assignment.

 1) For lower values of multiplication factor M, APD will act as _____. The value of excess noise factor for $K_A = 1$ scales as _____ **1 point**

- PIN, F_A
- PIN, M
- APD, M
- APD, F_A

No, the answer is incorrect. Score: 0

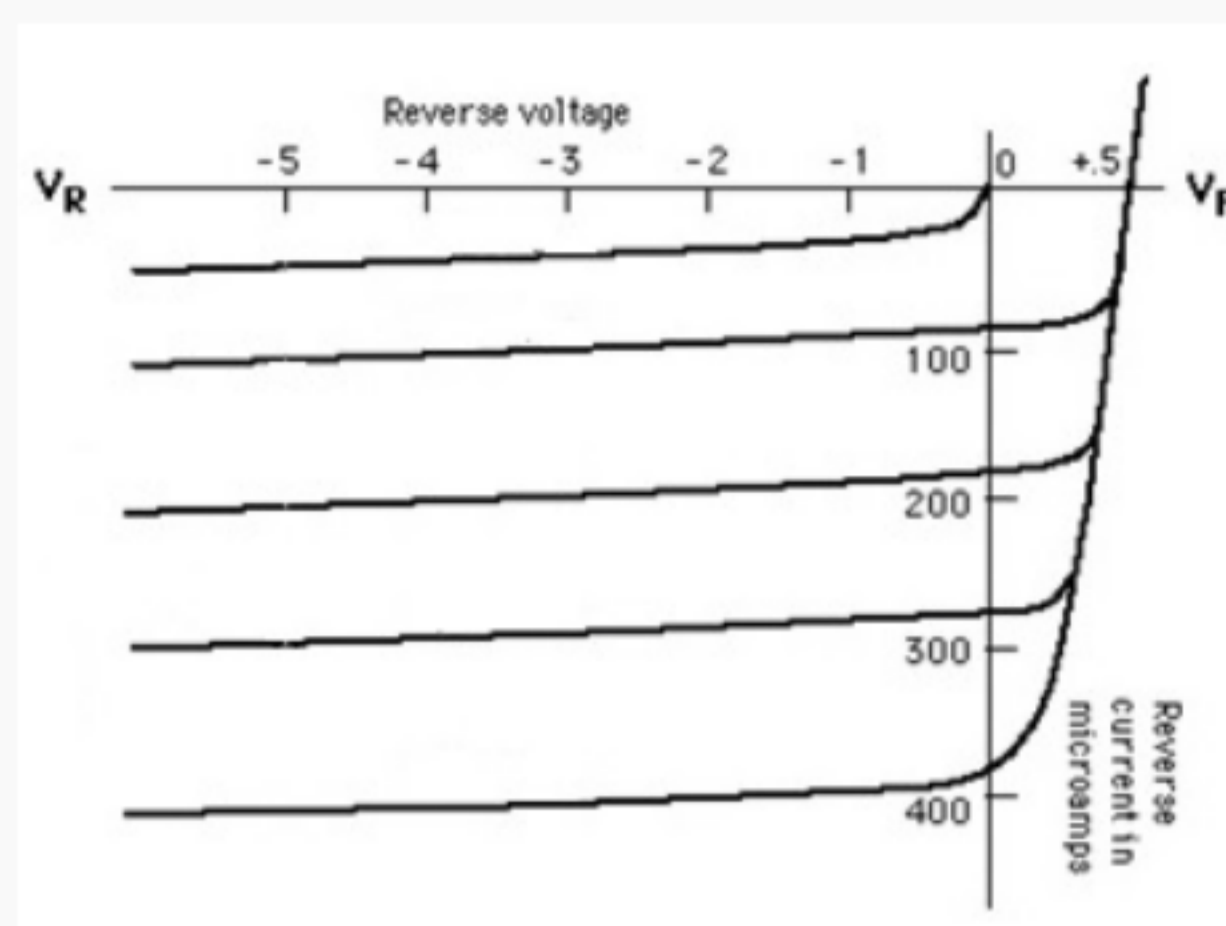
Accepted Answers: PIN, M

 2) For a Si APD with ionization ratio of 0.1, and multiplication time of 100 ps, the highest achievable 3 dB bandwidth is _____ Hz (use scientific notation) **1 point**

- 60 GHz
- 16 GHz
- 26 GHz
- 36 GHz

No, the answer is incorrect. Score: 0

Accepted Answers: 16 GHz

 3) I-V characteristics of a photodiode is shown in figure. What is the value of photocurrent without any illumination for 5 V reverse bias. **1 point**


- 50 μA
- 50 μA
- 0 μA
- 100 μA

No, the answer is incorrect. Score: 0

 Accepted Answers: -50 μA

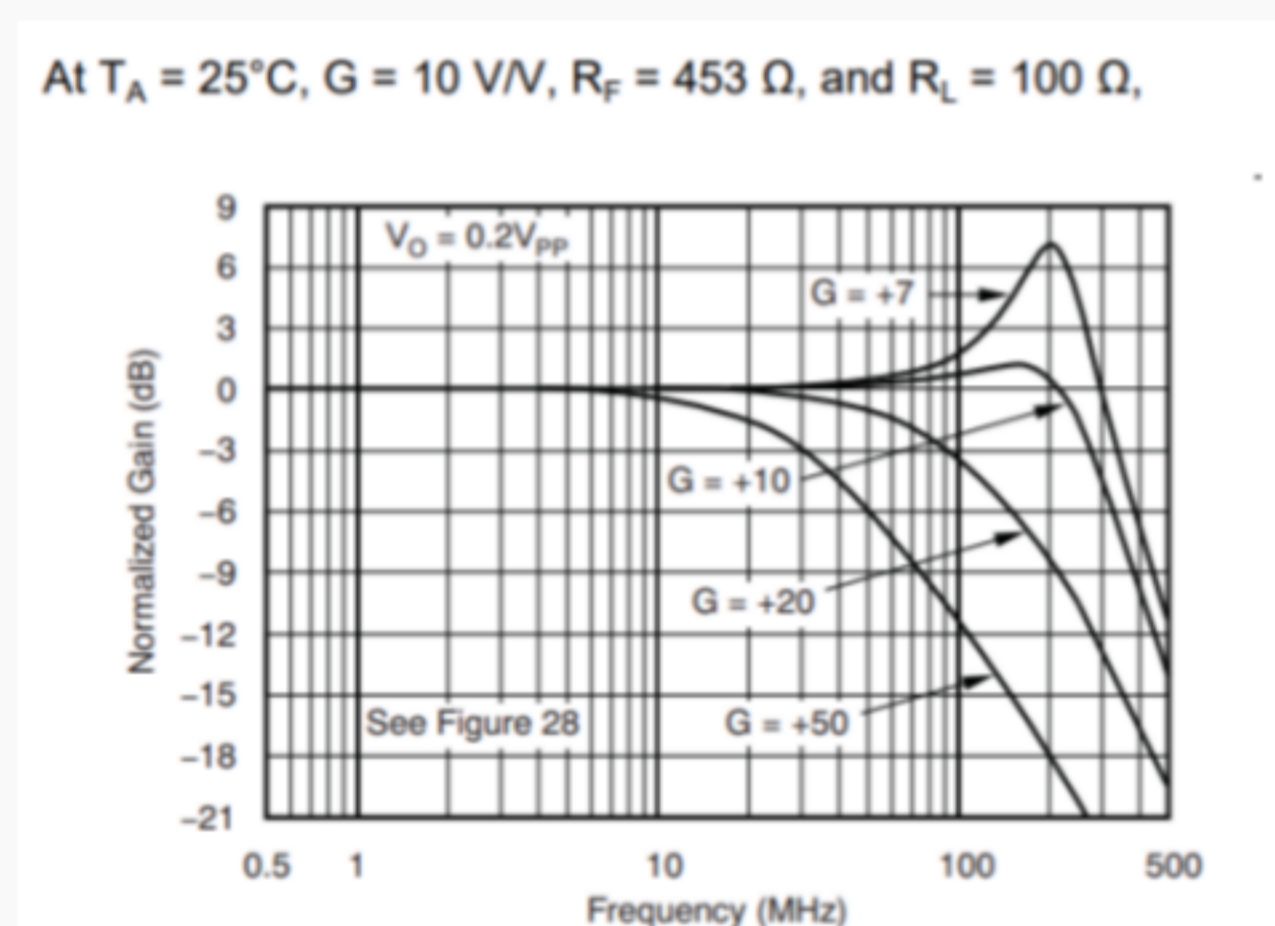
 4) For a direct load configuration with transimpedance gain of $10^6 \Omega$ and total capacitance of 4.5 pF, the 3 dB frequency is _____ Hz (scientific notation) **1 point**

- 5 KHz
- 15 KHz
- 25 KHz
- 35 KHz

No, the answer is incorrect. Score: 0

Accepted Answers: 35 KHz

For a TIA photo-detection configuration comprises with Op-amp OPA657 having small signal frequency response as:



5) For gain=50, 3 dB bandwidth of the op-amp is _____ MHz

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 29,31

1 point

 6) For $R_f = 453 \Omega$ and $C_f = C_d = 0.5 pF$, the 3 dB bandwidth of the TIA configuration is _____ MHz.

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 724,726

0 points

 7) Minimum detectable limit of a thermally cooled photo detector is primarily influenced by _____ and maximum detectable limit is primarily influenced by _____. **1 point**

- Dark current noise, Shot noise
- Dark current noise, Pink noise
- White noise, Shot noise
- Shot noise, Dark current noise

No, the answer is incorrect. Score: 0

Accepted Answers: Dark current noise, Shot noise

Suppose an optical power of -30 dBm is incident on a PIN photodetector whose dark current is 1 nA and the responsivity is 0.9 A/W.

 8) If the trans-impedance gain of the detector is $10^6 \Omega$, and the receiver bandwidth is 1 MHz, the RMS signal to noise ratio for direct load configuration at room temperature (300K) is _____.

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 1600,1650

1 point

 9) If the trans-impedance gain of the detector is $10^6 \Omega$, the input voltage and current noise density values are $4.8 nV/\sqrt{Hz}$ and $1.3 fA/\sqrt{Hz}$, and the receiver bandwidth is 6 MHz, the RMS signal to noise ratio for the trans-impedance configuration at room temperature (300K) is _____.

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 662,668

0 points

 10) Suppose you are given a PIN-based receiver with a trans-impedance gain of $10^6 \Omega$ and responsivity of 0.85 A/W, the value of incident optical power at which the shot noise is 1000 times that of thermal noise is _____ W (use scientific notation) **1 point**

- 40 μW
- 60 μW
- 60 nW
- 40 nW

No, the answer is incorrect. Score: 0

Accepted Answers: 60 nW

11) For an APD with a multiplicative gain of 10 and responsivity of 0.95 A/W, if optical power of 1 nW is incident on it at a wavelength of 1550 nm, the value of photocurrent generated by the APD is _____ nA (use scientific notation)

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 9,10

1 point

 12) Suppose you are provided an APD-based receiver at room temperature (300K) consisting of an APD with impact ionization ratio of 0.2 and multiplication factor of 10, trans-impedance gain of $10^6 \Omega$ receiver bandwidth of 6 MHz, and op-amp voltage and current noise density of $4.8 nV/\sqrt{Hz}$ and $1.3 fA/\sqrt{Hz}$ respectively. The rms noise gain at the output of the receiver is _____ mV

No, the answer is incorrect. Score: 0

Accepted Answers: (Type: Range) 23,25

0 points

 13) The precision of any sensor where the perturbation is static in nature may be improved simply by **1 point**

- Lock-in detection
- Filtering
- Averaging
- Calibration

No, the answer is incorrect. Score: 0

Accepted Answers: Averaging