

Q.P. Code – 42550

**Fifth Semester B.Sc. Degree Examination,
October/November 2019**

(CBCS Scheme)

Electronics

Paper VI - PHOTONIC DEVICES AND POWER ELECTRONICS

Time : 3 Hours]

[Max. Marks : 90

Instructions to Candidates : Answer any **TEN** questions from Part A, any **FIVE** questions from Part B any **FIVE** questions from Part C and any **FIVE** questions from Part D.

PART - A

Answer any **TEN** questions :

(10 × 1 = 10)

1. Give one example for indirect band gap semiconducting material.
2. What is radiative transition?
3. Define cutoff wavelength.
4. Name the type of photodiode which provide internal gain.
5. Name a material used for construction of LDR.
6. What is the use of optical splice in OFC link?
7. Define holding current.
8. What is the value of maximum firing angle obtained using R-triggering circuit?
9. Draw the equivalent circuit of Triac using two SCRs.
10. Define safe operating area.
11. Name any two types of forced commutation.
12. What are inverters?



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PART - B

Answer any **FIVE** questions :

(5 × 8 = 40)

13. (a) Write a note on interaction of microwave and x-ray radiations on matter.
(b) With diagram, discuss the VI characteristics of LED for different colours. Name the material used for IR LED. (4 + 4)
14. (a) With construction diagram, explain the working of semiconductor laser diode.
(b) With suitable diagram, explain the working of photomultiplier tube. (4 + 4)
15. (a) With diagram, explain the construction and working of solar cell.
(b) What are liquid crystals? Name different types of liquid crystals and explain any one. (4 + 4)
16. (a) With relevant diagrams derive the expression for acceptance angle.
(b) What is index profile? Discuss the classification of optical fibers based on index profile. (4 + 4)
17. (a) Draw two transistor equivalent model of SCR and derive the expression for anode current.
(b) Draw and explain, output and transfer characteristics of MOSFET. (4 + 4)
18. (a) Using schematic diagram, explain the working of TRIAC in any two modes.
(b) What is triggering? Explain in brief any two types of triggering methods for SCR. (4 + 4)
19. (a) Draw the switching characteristics of IGBT. Explain turnoff time.
(b) Draw the circuit of SCR half wave rectifier and derive an expression for average output voltage. (4 + 4)
20. (a) Differentiate between self and forced commutation. Discuss class F commutation technique for resistive load.
(b) With circuit diagram and waveform, explain the operation of half bridge inverter using SCR. (4 + 4)

PART - C

Answer any **FIVE** questions :**(5 × 6 = 30)**

21. An optical light having an intensity of 100 lumens with a power of 40 mw, incidents on a semiconducting material whose energy gap is 1.2 eV. Given the absorption coefficient of material is $0.8 \times 10^6 / \text{m}$. Calculate :
- Cutoff wave length
 - Cutoff frequency
 - Intensity of light at a depth of $2 \mu \text{m}$
 - Optical power at a depth of $2 \mu \text{m}$.
22. A phototransistor has a efficiency of 25% and gain of 300. Determine collector current when photo transistor is illuminated with light of wave length $1.1 \mu \text{m}$ with incident optical power of $80 \mu \text{w}$.
23. An optical fiber is made with core glass of refractive index 1.6 and fractional index difference of 0.05. Find
- Cladding index
 - Critical internal angle
 - Acceptance angle and
 - Numerical aperture, if the launching takes place from air.
24. (a) When light of optical power $0.6 \mu \text{w}$ incidents on a avalanche photodiode, the output current from the device is $10 \mu \text{A}$. Determine multiplication factor of avalanche photodiode, if responsivity of the device is 0.5 AW^{-1} .
- (b) A depletion type MOSFET has $I_D = 3.1 \text{ mA}$ and $I_{DSS} = 10 \text{ mA}$. Calculate the value of V_{GS} if pinchoff voltage is -4V . **(3+3)**
25. For an SCR, the gate cathods characteristics has a straight line slope of 110Ω . For the trigger source voltage of 20 V and allowable gate power dissipation of 0.4 watts , calculate the gate source resistance.
26. The circuit of SCR full wave rectifier is adjusted so that when the gate current is 1 mA . The forward breakdown voltage is 150 V . If peak secondary voltage of centre tapped transformer is 300 V . Find :
- Firing angle
 - Conduction angle
 - Average current and voltage, if load resistance if $1 \text{ k}\Omega$.

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27. A single phase full bridge inverter is operated from a 60 V battery and is supplying power to a pure resistive load of 20Ω . Determine :
- Fundamental output voltage and first three harmonics
 - rms output voltage
 - rms output power and fundamental output power.

PART - D

Answer any **FIVE** questions :

(5 × 2 = 10)

- Among Red & Blue colours, which one will have high absorption co-efficient in the given material? Justify.
 - S_i and G_e are not used for LED construction. Why?
 - Why sensitivity of PIN diode is higher than PN photodiode?
 - Name the optical source and detector used in OFC for long distance communication.
 - Triac is an abbreviation for 'Triode as Switch'. Explain.
 - What is the difference between PN junction diodes and SCRs?
 - What is the difference between voltage fed and current fed inverters?
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