

2018**M.Sc. 4th Semester Examination****PHYSICS****PAPER—PHS-403****Subject Code—33***Full Marks : 40**Time : 2 Hours**The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Illustrate the answers wherever necessary.***Use separate Answer-scripts for Group-A & Group-B****Group-A****[Marks : 20]**

Answer Q. No. 1 & 2 and any one from the rest.

1. Answer any *two* questions : 2×2

- (i) Explain with band diagram the origin of negative differential mobility in GaAs.

(Turn Over)

- (ii) Find the dependence of mobility on temperature for a nondegenerate semiconductor assuming impurity scattering predominates.
- (iii) Explain the principle of operation of SCR.
2. Find an expression of channel current in a MOSFET pointing the principle of its operation. What is meant by Threshold voltage ? 6+2
3. Assuming Boltzmann transport equation find an expression of conductivity in a non-degenerate semiconductor ? Find an expression of current in p-n-p-n diode using two transistor analogy ? 6+2
4. Explain the operation of semiconductor laser assuming a quantum well structure. Find an expression of drain current in a FET assuming large drain voltage. 3+5
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Group-B

[Marks : 20]

Answer Q. No. 1 & 2 and any one from the rest.

1. Answer any *two* of the followings : 2×2
- (a) What are virtual and real images in relation to the reconstruction of the image from a hologram ?
 - (b) How is optical trinary state generated ?
 - (c) What do you mean by 'multipath broadening' in an optical fiber ?
2. Answer any *two* of the followings : 3×2
- (a) Obtain the expression for multipath broadening of a laser pulse in a optical fibre.
 - (b) What is basic holography equation ?
 - (c) Explain 'index ellipsoid' in connection to the second harmonic generation using a non-linear material.
3. Answer any *one* of the followings : 10×1
- (a) Show how can you obtain all optical XOR and AND gates in practice. Derive an expression to determine self fo-

cusing length in a non-linear material. Construct tristate NOT gate and show its truth table. Write down four applications of NLO materials. $3+3+2+2$

- (b) What are the advantages and disadvantages of optical fibre communication over traditional wire communication? Show that the ray path in a graded index optical fibre is sinusoidal. What is V-parameter of an optical fibre and what is its physical significance?

$2+4+(2+2)$
