



DK-003-001402

Seat No. \_\_\_\_\_

**B. Sc. (Sem. IV) Examination**

April / May - 2015

**Physics : Paper - 401**

**Faculty Code : 003**

**Subject Code : 001402**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) Write MCQ answers in main answer book.  
(2) All questions are Compulsory.  
(3) Symbols have their usual meaning.  
(4) Marks of each question are indicated on right side.

**SECTION - A**

1 Choose the correct option for the following MCQs : **20**

- (1) When light is refracted, which of the following does not change ?  
(a) wavelength (b) frequency  
(c) velocity (d) amplitude
- (2) The focal length of a zone plate is given by the relation.

(a)  $f = \frac{r_n^2}{n\lambda^2}$  (b)  $f = \frac{r_n}{n\lambda}$

(c)  $f = \frac{r_n^2}{n\lambda}$  (d)  $f = \frac{r_n^2}{n^2\lambda}$

- (3) A grating having constant 0.0003, what is the wavelength of line situated at a diffraction angle  $30^\circ$  ?  
(a) 6840 Å (b) 8000 Å  
(c) 10000 Å (d) 15000 Å

- (4) Which of the following is not a property of laser ?
- directionality
  - monochromaticity
  - coherence
  - spreading of light in all directions
- (5) To increase stimulated emission \_\_\_\_\_ must be large.
- $B_{21}/A_{12} \& \rho(f)$
  - $A_{21}/B_{12} \& \rho(f)$
  - $B_{21}/A_{21} \& \rho(f)$
  - $B_{12}/A_{21} \& \rho(f)$
- (6) In Nd-YAG laser, \_\_\_\_\_ is the active centre.
- $Nd^{+3}$
  - $Al^{+3}$
  - $Cr^{+3}$
  - $Y^{+3}$
- (7) What is the equation of numerical aperture ?
- $NA = n_2 \sqrt{2\Delta}$
  - $NA = n_1 \sqrt{\Delta}$
  - $NA = n_2 \sqrt{\Delta}$
  - $NA = n_1 \sqrt{2\Delta}$
- (8) According to distribution of refractive index, multimode fibres are classified into \_\_\_\_\_ types.
- one
  - two
  - three
  - four
- (9) The operating frequency of a Wein bridge oscillator is \_\_\_\_\_ .
- $\frac{1}{2\pi\sqrt{LC}}$
  - $\frac{1}{4\pi\sqrt{LC}}$
  - $\frac{1}{2\pi RC}$
  - $\frac{1}{29RC}$

(10) In Colpitt's oscillator, feedback is obtained \_\_\_\_\_.

- (a) by tickler coil
- (b) from the centre of split capacitor
- (c) by magnetic induction
- (d) none of the above

(11) In frequency modulation, the \_\_\_\_\_ of the carrier is varied according to strength of the signal.

- (a) amplitude
- (b) phase
- (c) frequency
- (d) magnitude

(12) When signal amplitude is half than that of carrier amplitude, the amplitude of modulated wave varies between \_\_\_\_\_.

- (a)  $3A/2$  to  $A/2$
- (b)  $2A$  to  $A$
- (c)  $A$  to  $A/2$
- (d)  $2A$  to *Zero*

(13) Superheterodyne principle refers to \_\_\_\_\_.

- (a) using a large number of amplifier stages
- (b) using a push pull circuit
- (c) obtaining lower fixed intermediate frequency
- (d) none of the above.

(14) A gain of JFET is characterized by \_\_\_\_\_.

- (a) current gain
- (b) voltage gain
- (c) power gain
- (d) transconductance

(15) A MOSFET can be operated with \_\_\_\_\_.

- (a) negative gate voltage only
- (b) positive gate voltage only
- (c) negative as well as positive gate voltage
- (d) zero gate voltage

(16) The intrinsic stand off ratio ( $n$ ) of UJT is given by \_\_\_\_\_.

- (a)  $R_{B_1} + R_{B_2}$
- (b)  $\frac{R_{B_1}}{R_{B_1} + R_{B_2}}$
- (c)  $\frac{R_{B_1} + R_{B_2}}{R_{B_1}}$
- (d)  $\frac{R_{B_1} + R_{B_2}}{R_{B_2}}$

(17) A circuit which converts binary to decimal is known as \_\_\_\_\_.

- (a) decoder
- (b) encoder
- (c) modulator
- (d) regulator

(18) According to DeMorgan's theorem,  $\overline{A \cdot B} = ?$

- (a)  $\bar{A} \cdot \bar{B}$
- (b)  $\bar{A} - \bar{B}$
- (c)  $\bar{B} \cdot \bar{A}$
- (d)  $\bar{A} + \bar{B}$

(19) In a field effect LCD, the front and back polarisers are placed at \_\_\_\_\_ angle to each.

- (a)  $90^\circ$
- (b)  $180^\circ$
- (c)  $270^\circ$
- (d)  $360^\circ$

(20) In LDR the electrons are excited by \_\_\_\_\_ as well as \_\_\_\_\_.

- (a) protons, pressure
- (b) neutrons, temperature
- (c) photons, temperature
- (d) none of these

2 (A) Answer the following questions in short : **(any three)** 6

- (1) Write difference between Fresnel diffraction and Fraunhofer diffraction (at least two)
- (2) Define transmission grating.
- (3) What is metastable states ?
- (4) Define population inversion in semiconductors.
- (5) Define numerical aperture for fibre.
- (6) What is LC oscillator ?

(B) Answer the following questions **(any three)** 9

- (1) Write the comparison between zone plate and convex lens.
- (2) A zone plate has a focal length of 80 cm at a wavelength  $6000 \text{ \AA}$ ; what is its focal length at  $\lambda = 8000 \text{ \AA}$ .
- (3) Explain optical resonance cavity.
- (4) Explain the condition for stimulated emission to dominate spontaneous emission.
- (5) Describe step index multimode fibre.
- (6) Describe the Barkhausen criterion.

(C) Answer the following questions in detail : **(any two)** 10

- (1) Describe Fresnel's explanation of the rectilinear propagation of light.
- (2) Derive Einstein relation between Einstein co-efficients.
- (3) Explain the principle and working of He-Ne laser.
- (4) What is acceptance angle for an optical fibre ? Derive its expression.
- (5) Explain the construction and working of Wein-bridge oscillator.

3 (A) Answer the following questions in short : **(any three)** 6

- (1) Explain essentials in demodulation.
- (2) For a given JFET if a-c drain resistance is  $30\text{ k}\Omega$  and transconductance is  $3000\text{ }\mu\text{mho}$  then what will be the value of amplification factor ?
- (3) Write short note on "Thermistor".
- (4) Convert the decimal number  $(23)_{10}$  in to binary.
- (5) Define NOR gate.
- (6) Draw the symbols of phototransistor and solar cell.

(B) Answer the following questions : **(any three)** 9

- (1) Explain the working of a transistor amplitude modulator.
- (2) Define parameters of JFET .
- (3) Explain the function of AND gate with its circuit, symbol and truth table.

- (4) Prove that  $AB + \overline{AC} + A\overline{BC} (AB + C) = 1$  with the help of truth table.
- (5) Explain the function of phototransistor with its characteristics.
- (6) Explain the action of LDR.
- (C) Answer the following questions in detail : (any two) **10**
- (1) What is demodulation ? Explain AM diode detector in detail.
- (2) Write short notes on :
- (a) Straight radio receiver.
- (b) Superheterodyne receiver.
- (3) Explain construction and working of UJT
- (4) Discuss encoder and decoder in detail.
- (5) Prove that NAND gate as universal gate.
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