Total No. of Questions – [10]

Total No. of Printed Pages: 2

G.R. No.	

Paper Code – U18-104 NCB (CBE-FF)

MAY 2019 / BACKLOG

F. Y. B.TECH. (COMMON) (SEMESTER - I)

COURSE NAME: Engineering Physics (NCB)

COURSE CODE: ES10184A-NCB

(PATTERN 2018)

Time: [2 Hours]

[Max. Marks: 50]

Instructions to candidates:

1) **Attempt Q.1, Q.2, Q.3, Q.4 OR Q.5, Q.6 OR Q.7,Q.8 OR Q.9 and Q.10**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed.**
4) **Use suitable data where ever required.**

Q1(a) Derive root mean square value for $u(t) = u_0 \sin(\omega t + \varphi)$. **[4]**

OR

Q1(b) Define logarithmic decrement δ for an under-damped free oscillator and derive an expression for δ using the expression $\omega_D = \omega_n\sqrt{1-\zeta^2}$. **[4]**

Q2(a) Calculate the velocity for primary and secondary sound waves in diamond. Given, for diamond, $B = 53 \times 10^{10}\, N/m^2$, $S = 44 \times 10^{10}\, N/m^2$, $\rho = 3540 kg/m^3$ **[4]**

OR

Q2(b) Find the reverberation time of a hall with l × b × h = 27m × 21m × 12m which has 20 windows with an area of 2m × 1 m each. Assume apparent absorption coefficient of all the surfaces to be 0.2 OWU. **[4]**

Q3(a) With the help of a neat diagram show that interplanar distance d for (hkl) planes is **[6]**

$$\frac{1}{d^2} = \left(\frac{h}{a}\right)^2 + \left(\frac{k}{b}\right)^2 + \left(\frac{l}{c}\right)^2$$

for an orthorhombic structure with lattice parameters a, b and c.

OR

Q3(b) With the help of a neat diagram, derive the expression for resolving power of a microscope. Discuss Abbe's empirical formula for resolving power in terms of numerical aperture. **[6]**

Q4(a) If $Z = \frac{A}{B}$, show that $\left(\frac{\Delta Z}{Z}\right)^2 = \left(\frac{\Delta A}{A}\right)^2 + \left(\frac{\Delta B}{B}\right)^2$ **[6]**

Q4(b) Draw the band diagram of an avalanche photo diode and hence discuss mechanism of internal gain. **[4]**

OR

Q5(a) Discuss three types of intrinsic noise associated with a resistor with appropriate formulae. **[6]**

Q5(b) If $Z = Ae^{B}$, then calculate $Z \pm \Delta Z$ if $A \pm \Delta A = 47.4 \pm 0.4$ and $B \pm \Delta B = 2.4 \pm 0.3$. **[4]**

Q6(a) With the help of a diagram of transfer function, explain linearity, sensitivity, input range and output range. **[6]**

Q6(b) Discuss in brief four applications of an accelerometer. **[4]**

OR

Q7(a) With the help of a diagram derive an expression for flow rate in a orifice type flowmeter. **[6]**

Q7(b) For a Silicon strain gauge with gauge factor is 40 and Poisson ratio of 0.265, calculate piezo-resistivity $\frac{\Delta\rho}{\rho}$ for a strain of 10^{-5}. **[4]**

Q8(a) Explain with the help of neat diagrams principle, construction and working of a Nd:YAG laser. **[6]**

Q8(b) What is the diffraction limited beam divergence in degrees of CO_2 laser (λ=10.6μm) having an output aperture of 0.1 inch? **[4]**

OR

Q9(a) Explain laser characteristics like monochromaticity, coherence, directionality, intensity. **[6]**

Q9(b) Find the intensity of a laser beam of 120 mW power, having a beam diameter of 2.1 mm. Assume, intensity to be uniform across the beam. **[4]**

Q10(a) If $Z = \frac{A}{B}$ then $\left(\frac{\Delta Z}{Z}\right)^2$ is **[1]**

(i) $\frac{\Delta A}{A} + \frac{\Delta B}{B}$ (ii) $\frac{\Delta A}{A} - \frac{\Delta B}{B}$

(iii) $\left(\frac{\Delta A}{A}\right)^2 + \left(\frac{\Delta B}{B}\right)^2$ (iv) $\left(\frac{\Delta A}{A}\right)^2 - \left(\frac{\Delta B}{B}\right)^2$

Q10(b) Which of the following errors is statistical error **[1]**
(i) random error (ii) human error
(iii) systematic error (iv) all of the above

Q10(c) Pink noise voltage is related with temperature T as proportional to **[1]**
(i) T (ii)T^2 (iii)$T^{1/2}$ (iv) $T^{-1/2}$

Q10(d) Lasers have high coherence because they are **[1]**
(i) monochromatic (ii) intense
(iii) directional (iv) efficient

Q10(e) The lasing in CO_2 laser correspond is due to transitions between **[1]**
(i) electronic levels
(ii) vibrational levels
(iii) both of the above
(iv) None of the above

Q10(f) Life time of a metastable state is **[1]**
(i) nanosecond (ii) millisecond
(iii) infinity (iv) zero