Total No. of Questions – [10]

Total No. of Printed Pages: 2

G.R. No.	

Paper Code - Regular - UI19-104NCB (ESE)
Backlog - UI19-104NCB (BE-FS)

DECEMBER 2019 / END-SEM

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

COURSE NAME: Engineering Physics (NCB)

COURSE CODE:ES10184-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 wherever required.**
5) $h = 6.63 \times 10^{-34} Js, c = 3 \times 10^{8}\, m/s,\ e = 1.6 \times 10^{19} C,$ $k = 1.38 \times 10^{-23}\, J/K$ *or* $k = 8.6 \times 10^{-5} eV/K$

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

OR

Q1(b) Draw neat and labeled graph showing deformation response factor and forced angular frequency. Explain its significance. **[4]**

Q2(a) After how many oscillations will the amplitude decrease below 3.4 mm if the first amplitude is 197.2 mm and the damping ratio is 7.9%. **[4]**

OR

Q2(b) Why it is required to optimize reverberation time for an auditorium? Discuss any two factors affecting it? **[4]**

Q3(a) Using X-ray diffraction technique, explain how the analysis is done for (i) phase purity (ii) crystalline size (iii) ideal density. **[6]**

OR

Q3(b) With the help of ray diagram, explain the image formation on retina. Derive expression for magnification of a simple microscope. **[6]**

Q4(a) For a random sample distribution, derive the expression for standard deviation of the mean to show that it is inversely proportional to the square root of number of observations. **[5]**

Q4(b) The velocity of sound in fluid is given by the formula **[5]**

$$v_p = \sqrt{\frac{B}{\rho}}$$

For glycerine, the values of B and ρ are 0.455×10^{10} N/m² and 1261kg/m³, respectively. If the errors ΔB and Δρ are 1.5×10^{7} N/m² and 20kg/m³, then what is the error in the velocity?

OR

Q5(a) Find the relative error $\frac{\Delta\sigma}{\sigma}$ in the conductivity $\sigma = CT^{3/2}e^{-\frac{E_g}{2kT}}$ for a semiconductor if the error in the measurement of T is ΔT. **[5]**

Q5(b) Find the values of the slope and intercept for the following data using least squares method: **[5]**

X	0	1	2	3	4	5	6	7	8	9
Y	1600	1480	1370	1145	949	781	590	426	263	77

Q6(a) Discuss classification of sensors on the basis of (i) reference required (ii) number of transducers. **[5]**

Q6(b) With the help of neat diagrams, derive an expression for output voltage for a displacement of Δd in the differential capacitor method. **[5]**

OR

Q7(a) Discuss with the help of diagrams, the principle on which accelerometers work? Discuss two applications in brief. **[5]**

Q7(b) Discuss in brief any five characteristics of a sensor. **[5]**

Q8(a) Explain with the help of neat diagrams principle, construction and working of a carbon dioxide laser. **[5]**

Q8(b) Find the relative population of the two states in a ruby laser that produces light of wavelength 6943 Å at 320 K and 510 K. **[5]**

OR

Q9(a) With the help of labeled diagram, discuss (i) spontaneous emission (ii) stimulated emission. Explain in brief their role in lasing action. **[5]**

Q9(b) What is the diffraction limited beam divergence of Nd:YAG laser (λ=1.06 μm) having an output aperture of 1.5 inch? **[5]**

Q10(a) Thermocouple is a **[1]**

(i) direct sensor
(ii) temperature sensor
(iii) relative sensor
(iv) all of the above

Q10(b) Orifice flow meter uses two **[1]**

(i) pressure sensors
(ii) temperature sensors
(iii) velocity sensors
(iv) accelerometers

Q10(c) For a displacement sensor using a parallel plate capacitor with a gap of d between the plates, displacement is given as **[1]**

(i) $\Delta d = d\frac{\Delta C}{C}$

(ii) $\Delta d = -d\frac{\Delta C}{C}$

(iii) $\Delta d = -d\frac{C}{\Delta C}$

(iv) $\Delta d = d\frac{C}{\Delta C}$

Q10(d) Which of the following lasers with the same output power will have the largest number of photons? **[1]**

(i) CO_2 (λ=10.6μm) (ii) Nd:YAG (λ=1.06μm)
(iii) diode laser (λ=6500Å) (iv) He-Ne (λ=6328Å)

Q10(e) Which of the following is not used as a pumping mechanism **[1]**

(i) optical (ii)electric discharge
(iii) forward current (iv) Heat

Q10(f) A metastable state has a life time of the order of **[1]**

(i) milliseconds (ii) nanoseconds
(iii) infinity (iv) zero