KUMARAGURU
college of technology
character is life

B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Second Semester

COMMON TO AUTO / ECE / CIVIL / ISE / IT / MECH / MCE

U18PHI2202**:** Engineering Physics

COURSE OUTCOMES

CO1: Enhance the fundamental knowledge in properties of matter and its real time. applications relevant to various streams of Engineering and Technology.

CO2: Understand the phenomenon of heat and its transfer mechanism in Engineering systems.

CO3: Acquire essential knowledge in the concepts of quantum mechanics and its impact on electron microscopy

CO4: Analyse the concept of lasers, optical fibers, and their importance in diverse fields of engineering.

CO5: Apply the principles of acoustic and ultrasonic techniques for engineering practice.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions: -
PART A (10 x 1 = 10 Marks)

1. Match List I with List II and select the correct answer using codes given below   CO1   [K$_1$]

List I	List II
A. Ratio of lateral contraction to linear strain	i. I shape girders
B. Reciprocal of Bulk modulus	ii. Poisson's ratio
C. Structural stability and strength	iii. Young's modulus
D. Reciprocal of Longitudinal strain	iv. Compressibility

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	i	iii
d)	iii	i	ii	iv

2. A wire of length L and r is fixed at one end and a force F applied to the other end produces an   CO1   [K$_2$] extension *l*. The extension produced in another wire of the same material of length 2L and radius 2r by a force 2F is

a) *l*   b) 2 *l*

c) *l/2*   d) 4 *l*

3. Consider the following statements. CO2 [K$_1$]

    1. Aluminium has the highest thermal conductivity than silver.
    2. The coefficient of thermal expansion is highest in crystals with covalent bond.
    3. Perspex is the most suitable material for thermal insulation than glass.
    4. The rate of heat transfer from one end of a rod to the other end is greater in a thicker rod than a thinner rod.
    Which of these statements are correct?
    a) 2,3   b) 3,4
    c) 1,2   d) 1,4

4. The type of expansion joint used in fire protection system is CO2 [K$_1$]

    a) Rubber expansion joint   b) Teflon expansion joint
    c) Toroidal Expansion Joints   d) Metallic expansion joint

5. **Assertion (A):** In transmission electron microscope, the amplitude contrast image is increased by eliminating diffracted image. CO3 [K$_1$]
    Reason (R): The diffracted image is eliminated by magnetic projector lens and aperture
    a) Both A and R are Individually true and   b) Both A and R are Individually true but
        R is the correct explanation of A   R is not the correct explanation of A
    c) A is true but R is false   d) A is false but R is true

6. The condition for normalization of wave function is CO3 [K$_1$]

    a) $$\int_{-\infty}^{\infty} \Psi \, d\tau = 1$$ b) $\int_{-\infty}^{\infty} \Psi^2 d\tau = 0$

    c) $\int_{-\infty}^{\infty} \Psi^2 d\tau = 1$ d) $$\int_{-\infty}^{\infty} \Psi \, d\tau = 0$$

7. Sequence the following with respect to fiber optic communication system. CO4 [K$_1$]
    1) Optical fiber acts as a Waveguide and transmits optical pulses.
    2) Amplified signals are decoded.
    3) Signals are transformed into an optical signal.
    4) The drive circuit transfers the electric input signal into digital pulses.
    a) 2-3-4-1   b) 1-3-2-4
    c) 4-3-1-2   d) 4-1-3-2

8. The maximum angle for entrance of light if the fiber is placed in air and has core and cladding refractive indices as 1.5 and 1.48 is CO4 [K$_2$]
    a) 14°   b) 17°
    c) 21°   d) 28°

9. **Assertion (A):** Acoustical diffraction method is used to find the wavelength and velocity of ultrasonic waves in liquids. CO5 [K$_1$]
    Reason (R): When ultrasonic waves are passed through liquids causes local boiling of the liquid accompanied by the bubble growth and collapse.
    a) Both A and R are Individually true and   b) Both A and R are Individually true but
        R is the correct explanation of A   R is not the correct explanation of A
    c) A is true but R is false   d) A is false but R is true

10. The increase in the acoustic intensity level when the sound intensity is doubled is CO5 [K$_2$]
    a) 0.92 dB   b) 3.01 dB

c) 16.23 dB d) 21.8 dB

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Calculate the force required to stretch a steel wire to double its length when its area of cross-section is 2.5 sq.cm and Young's modulus 2×10^{11} Nm^{-2}.   CO1 [K$_2$]

12. Outline the significance of a stress-strain diagram in material testing and engineering analysis.   CO1 [K$_2$]

13. Compute the steady state heat transfer rate through a sheet of copper of 10 mm thick if there is temperature drop from 823 K to 773 K across the sheet. The thermal conductivity of copper is 371 Jm^{-1}s^{-1}K^{-1}.   CO2 [K$_2$]

14. List the applications of bimetallic strips in everyday devices.   CO2 [K$_1$]

15. The mass of a proton is 1.67×10^{-27} Kg. Determine the de-Broglie wavelength associated with a proton moving with a velocity equal to the 1/20th of the velocity of light.   CO3 [K$_2$]

16. State the principle of scanning electron microscope.   CO3 [K$_1$]

17. Explain the importance of holographic storage.   CO4 [K$_1$]

18. Define Numerical aperture of an optical fiber.   CO4 [K$_1$]

19. A window whose area is 1.4 m^2 opens on a street where the street noise results in an intensity level at the window of 60 decibels. The standard intensity level is 10^{-16} Watt/cm^2. How much acoustic power enters the window through the sound waves.   CO5 [K$_2$]

20. List the techniques employed for detecting ultrasonic waves.   CO5 [K$_1$]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 350 words)

21. a) Explain the concept of stress distribution in a cantilever structure and develop an expression for the depression produced due to the load applied at the free end.   10   CO1 [K$_3$]

    b) The end of a rectangular cantilever beam depresses 10 mm under a certain load. Calculate the depression under the same load for another cantilever of same material, 2 times in length, 2 times in width and 3 times in thickness.   4   CO1 [K$_3$]

22. a) Develop an expression for the rectilinear flow of heat through a rod of uniform cross section.   10   CO2 [K$_3$]

    b) A rod of Aluminium 0.35 m long is heated from 288 K to 358 K while its ends are maintained rigid. The thermal expansion coefficient and the Young's modulus of Aluminium are 2.36×10^{-6} K^{-1} and 69 GPa respectively. Estimate the magnitude of stress developed.   4   CO2 [K$_2$]

23.		Explain Compton effect and derive an expression for the wavelength of the scattered photon in terms of wavelength of incident radiation and scattering angle.	14	CO3	[K$_3$]
24.	a)	Describe the construction and working of Nd-YAG laser with a neat diagram.	8	CO4	[K$_2$]
	b)	Compare the performance characteristics of single-mode and multi-mode optical fibers for a high-speed data communication system.	6	CO4	[K$_2$]
25.		Derive an expression for the reverberation period of an auditorium and discuss how the volume of a room affects the reverberation time according to Sabine's equation.	14	CO5	[K$_3$]
26.	a)	Solve Schrodinger time independent wave equation.	7	CO3	[K$_2$]
	b)	Explain with neat sketch the construction and production of ultrasonic waves by Piezoelectric method.	7	CO4	[K$_2$]

****