R25 Regulation *Subject code:5BS1AL*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech I Semester Regular Examinations, January 2026

ADVANCED ENGINEERING PHYSICS

(Common to CSE & CSE(AI&ML))

Maximum Marks: 60 Date:21.01.2026 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (5X2M=10Marks)		Marks	CO	BTL
1.a	What is the physical significance of the wave function?	2M	1	1
b	Draw the crystal planes with Miller indices (100) and (001).	2M	2	1
c	Name any two basic single-qubit quantum gates.	2M	3	1
d	What are dielectric materials? Give any two examples.	2M	4	1
e	Why is population inversion necessary for laser action?	2M	5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Derive the de-Broglie wavelength of matter waves and explain wave–particle duality with suitable examples.	5M	1	2
	b) Solve the Schrödinger time-independent wave equation for a free particle in a constant potential region.	5M		3
	OR			
3	a) With the help of E–k diagrams, describe how the periodic lattice potential causes the splitting of electron energy levels in the Kronig–Penney model.	5M	1	4
	b) Discuss how band theory is used to distinguish between conductors, semiconductors, and insulators. Illustrate with suitable band structure diagrams.	5M		2
4	a) Describe different crystal systems with fourteen Bravais lattices.	5M	2	2
	b) Derive expressions for atomic packing factor of Face-Centered Cubic (FCC) structures. Compare their packing factor.	5M		3
	OR			
5	a) Explain the principle of the Debye–Scherrer method and derive the formula for crystallite size estimation.	5M		2

	b) With a neat block diagram, explain the construction and working principle of a Scanning Electron Microscope (SEM).	5M	2	4
6	a) Explain Dirac's bra and ket notation and discuss their properties. b) Describe multiple qubit systems and explain how their state space grows with the number of qubits.	5M 5M	3	2 2
	OR			
7	a) Discuss the principle of quantum entanglement and explain its importance in quantum information processing applications. b) Explain the Deutsch–Jozsa algorithm and analyze how it achieves quantum speed-up over classical algorithms.	4M 6M	3	2 2
8	a) Classify magnetic materials into diamagnetic, paramagnetic, and ferromagnetic materials with suitable examples. b) Differentiate between soft and hard magnetic materials. Mention their important applications.	5M 5M	4	4 4
	OR			
9	a) Explain the different types of polarization in dielectrics with suitable examples. b) Discuss the applications of ferroelectric, piezoelectric, and pyroelectric materials with suitable examples.	5M 5M	4	2 2
10	a) What is a Laser? Explain the important characteristics of laser light such as monochromaticity, directionality, coherence and high intensity. b) Describe the construction and working of a Ruby laser with a neat energy level diagram. Mention its applications.	5M 5M	5	2 3
	OR			
11	a) Derive expressions for acceptance angle and numerical aperture of an optical fiber. b) Explain the classification of optical fibers with respect to the refractive index profile.	5M 5M	5	3 2