R22 Regulation *Subject code:4B2AN*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech II Semester Supplementary Examinations, January 2026

APPLIED PHYSICS

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

Maximum Marks: 60 Date: 27.01.2026 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 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 (10X1M=10 Marks)		Marks	CO	BTL
1.a	What is de-Broglie's hypothesis?	1M	1	1
b	State Heisenberg's uncertainty principle.	1M	1	1
c	Define density of states.	1M	2	1
d	What is the energy gap?	1M	2	1
e	Give an example of an extrinsic semiconductor.	1M	3	1
f	List any two applications of the Hall effect.	1M	3	1
g	What is the main advantage of using an APD?	1M	4	1
h	Define dielectric constant.	1M	4	1
i	What do you mean by a single-mode fiber?	1M	5	1
j	Write the general form of a qubit in Dirac notation.	1M	5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Explain the concept of wave-particle duality with suitable examples. b) Discuss the construction, working, and observations of the Davisson and Germer experiment in detail.	5M 5M	1 1	2 3
	OR			
3	a) Explain the physical significance of wave function and its characteristics. b) Solve the Schrödinger equation for a particle in a one-dimensional infinite potential well.	3M 7M	1 1	2 3
4	a) Discuss the classical free electron theory and its limitations. b) Discuss the Kronig-Penney model and show how energy bands and band gaps are formed.	3M 7M	2 2	2 2
	OR			
5	a) Explain the concept of effective mass and its relation to the E-k diagram of an electron in a crystal. b) Describe how band theory explains the classification of materials as conductors, semiconductors, and insulators.	5M 5M	2 2	2 2

6	a) Differentiate between intrinsic and extrinsic semiconductors with suitable examples. b) Derive the expression for electron concentration in an n-type semiconductor.	4M 6M	3 3	2 3
	OR			
7	a) Describe the formation of a PN junction and explain the concept of the depletion region. b) Explain how the Hall effect helps in determining the type of charge carriers in a semiconductor material.	4M 6M	3 3	2 2
8	a) Differentiate between direct and indirect band gap semiconductors with suitable band diagrams. b) With a neat diagram, explain the structure and operation of a Light Emitting Diode (LED).	4M 6M	4 4	4 2
	OR			
9	a) Describe the different types of polarization in dielectric materials with a qualitative explanation. b) What are ferroelectric, piezoelectric, and pyroelectric materials? Explain each with suitable examples and applications.	4M 6M	4 4	2 3
10	a) Explain the working principle of an optical fiber and describe its construction with a labeled diagram. b) Obtain the expression for numerical aperture and show how it determines the acceptance angle in an optical fiber.	4M 6M	5 5	2 3
	OR			
11	a) What is a quantum state vector? Explain how it represents the state of a quantum system. b) Describe the role of single qubit gates in quantum computing with examples.	4M 6M	5 5	2 2