APPLIED PHYSICS

Subject Code : AP102BS
Regulations : R18 - JNTUH
Class : I Year B.Tech II Semester

Department of Science and Humanities

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

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APPLIED PHYSICS(AP102BS)

I. COURSE OVERVIEW:

The Course begins with introduction to quantum physics with emphasis on black body radiation, and dual nature of radiation along with wave – particle duality that lead to the development of quantum mechanics. The significance of wave function, the Schrodinger independent wave equation and its application is also part of this unit.

Semiconductor physics and semiconductor devices are dealt in unit II. Types of semiconductors and carrier concentration in them are part of this unit. The Hall effect, the formation of PN junction diode and V – I characteristics PN diode and Zener diode are emphasized more. The Bipolar junction transistor and its operation is also discussed in this unit.

Unit III deals with the Opto – electronics that contains the radiative recombination mechanism in semiconductors. The materials used in the development of LED and semiconductor lasers and their structures are detailed in this unit. The study of semiconductor materials such as photo detectors, solar cell Pin and avalanche diode are also part of this unit.

The Lasers and Fiber optics is unit IV. It covers the properties, principle and mechanism to produce a LASER and types & applications of Lasers. The introduction to fiber optics, the principle and working of optical fibers and their types and the losses associated with them are also dealt in this unit.

The fundamentals of Electrostatics along with Maxwell's equations with dielectric and magnetic properties of materials are dealt in unit V.

II. PREREQUISITE(S):

Before attending a session in engineering physics, the student is expected to know all the fundamental laws in physics. They are also supposed to have thorough back ground of the concept that is to be dealt in the class which they are already familiar with in their earlier classes.

III. COURSE OBJECTIVES:

- Students will demonstrate skills in scientific inquiry, problem solving and laboratory techniques.
- Students will be able to demonstrate competency and understanding of the concepts found in Quantum Mechanics, Fiber optics and lasers, Semiconductor physics and Electromagnetic theory and a broad base of knowledge in physics.
- The graduates will be able to solve non-traditional problems that potentially draw on knowledge in multiple areas of physics.
- To study applications in engineering like memory devices, transformer core and electromagnetic machinery.

IV. COURSE OUTCOMES:

Outcome	Knowledge Level (Blooms Level)
The student would be able to learn the fundamental concepts on Quantum behavior of matter in its micro state.	**Remember**
The knowledge of fundamentals of Semiconductor physics, Optoelectronics, Lasers and fibre optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.	**Understand, Apply**
Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.	**Create**
The course also helps the students to be exposed to the phenomena of electromagnetism and also to have exposure on magnetic materials and dielectric materials.	**Analyze**

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Problem based Assignments/ Exam
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Assignments/ Exam/ Case Studies
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2.5	Assignments/ Case Studies
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Assignments/ Case Studies
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	Problem based Assignments/ Exam
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	-	-
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics**: Apply ethical principles and commit to	-	-

	professional ethics and responsibilities and norms of the engineering practice.		
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Assignments
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	-	Assignments/ Exams/ Seminars
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	-
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Projects/ Case Studies

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

CO's	Program Outcomes (PO's)											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3		2		-	-	-		-	-	2
CO2	3	3	2		2	-	-	-	2	-	-	
CO3	3		3	2	2	-	-	-	2	-	-	2
CO4	3	3		2		-	-	-		-	-	2
Average (Rounded)	3	3	2.5	2	2	-	-	-	2	-	-	2

VII. SYLLABUS:

UNIT-I: Quantum Mechanics

Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

UNIT-II: Semiconductor Physics

Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, Hall effect, p-n junction diode, Zener diode and their V-I Characteristics, Bipolar Junction Transistor (BJT): Construction, Principle of operation.

UNIT-III: Optoelectronics

Radiative and non-radiative recombination mechanisms in semiconductors, LED and semiconductor lasers: Device structure, Materials, Characteristics and figures of merit, Semiconductor photodetectors: Solar cell, PIN and Avalanche and their structure, Materials, working principle and Characteristics.

UNIT-IV: Lasers and Fibre Optics

Lasers: Introduction to interaction of radiation with matter, Coherence, Principle and working of Laser, Population inversion, Pumping, Types of Lasers: Ruby laser, Carbon dioxide (CO_2) laser, He-Ne laser, Applications of laser. Fibre Optics: Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, Applications of optical fibres.

UNIT-V: Electromagnetism and Magnetic Properties of Materials

Laws of electrostatics, Electric current and the continuity equation, Ampere's and Faraday's laws, Maxwell's equations, Polarisation, Permittivity and Dielectric constant, Internal fields in a solid, Clausius-Mossotti equation, Ferroelectrics and Piezoelectrics. Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, Applications of magnetic materials

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SUGGESTED BOOKS:

TEXT BOOKS:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi - CengageLearing.
2. Halliday and Resnick, Physics - Wiley.
3. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand

REFERENCE BOOKS:

1. Richard Robinett, Quantum Mechanics
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill inc. (1995).
3. Online Course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptha on NPTEL
4.

GATE SYLLABUS : NA

IES SYLLABUS : NA

VIII. COURSE PLAN(Week-wise):

The course will proceed as follows for all sections. Please note that the week and the classes in each week are relative to each section.

Lecture	Week	Topic	Course Learning outcomes	Text Books
Unit – I : Principles of Quantum Mechanics				
1	1	Introduction to **Quantum Mechanics**	Remember the basics of quantum mechanics	**Book 1,2,3**
2		Black body radiation, Planck's radiation law	Define black body radiation	
3		Expression for energy density	Derive the expression for energy density of Planck's resonators	
4		Photo electric effect - Derivation	Derive photo electric equation	
5	2	Compton effect and experiment	Define Compton wavelength,	
6		Expression for Compton wavelength	Derive expression for Compton shift	
7		De – Broglie hypothesis, Wave particle duality	Explain wave matter duality	
8		Davisson and Germer experiment	Evaluate the wave particle duality	
9	3	Heisenberg uncertainty principle and illustrations	Understand Heisen berg Principle with examples	
10		Physical significance of wave function – Born's interpretation	Learn the importance of the wave function	
11		Schrodinger time independent wave equation	DeriveSchrodinger time independent wave equation	
12		Particle in 1-D potential box	ApplySchrodinger time independent wave equation for the energies of a particle in a 1D box	
		Mock - Test – I		
Unit – II : Semiconductor Physics				
13	4	Intrinsic and extrinsic semiconductors	Analyze the types of semiconductors	
14		Intrinsic carrier concentration – Fermi level	Derive the expression for Intrinsic carrier concentration, Deduct	
15		Extrinsic carrier concentration – Fermi level	Derive the expression for Extrinsic carrier concentration,	
16		Carrier generation and recombination	Remember the basics of recombination	
		Bridge Class I		
17	5	Carrier transport phenomena: Drift and diffusion	Remember the basics of transport phenomena,	

			Derive continuity equation	
18		Hall effect – Definition and experiment	Remember Hall effect,	
19		Expression for Hall coefficient	Derive Hall coeffiecient	
20		Formation of PN junction,	Understand the Theory of formation of PN junction	
		Bridge Class II		
21	6	PN diode and its V - I characteristics	Apply the theory of PN junction to study the VI characteristics	
22		Zener diode and its V - I characteristics	Apply the theory of PN junction to study the VI characteristics of Zener diode	
23		Construction of bipolar junction transistor	Explain the construction of a BJT	
24		Operation of BJT	Understand the working of BJT	
		Bridge Class III		
UNIT – III : Optoelectronics				
25	7	Radiative and non – radiative recombination in semiconductors	Discuss the Theory of radiative recombination	
26		Direct and indirect band gap semiconductors	Evaluate the differences between direct and indirect band gap semiconductors	
27		LED – device structure	Analyse the structure of LED	
28		semiconductor Lasers - structure	Analysethe structure of LASER	
		Bridge Class IV		
29	8	Characteristics and figure of merit for LED materials	Analyze the characteristics of LED	
30		Characteristics and figure of merit for laser materials	Analyze the characteristics of LASER materials	
31		Solar cell principle, working and characteristics	Remember the principle of Solar Cell and Analysecharacteristics Solar cell	
32		Solar cell materials and their structure	Analyse characteristics Solar cell materials	
		Bridge Class V		
Mid I Examinations				
UNIT – III : Optoelectronics Contd.				
33	9	PIN diode principle, working and characteristics	Remember the principle of PIN diode,	

34		PIN diode materials and their structure	Analyse characteristics PIN diode materials	
35		Avalanche diode principle, working and characteristics	Remember the principle of Avalanche diode,Analyse characteristics Avalanche diode materialscharateristics	
36		Avalanche diode materials and their structure	AnalyzeAvalanche diode materials and their structure	
		Bridge Class VI		
UNIT – IV : Lasers and Fiber Optics				
37	10	Interaction of radiation with matter – Einstein coefficients	Understand the interaction of matter with radiation	
38		Characteristics of Lasers, Principle, working and Laser schemes	Evaluate the charateristics of LASER	
39		Pumping, population inversion	Remember the phenomena of LASER production	
40		Ruby Laser	Analyse the working of a RUBY laser	
		Bridge Class VII		
41	11	CO_2 Laser	Analyse the working of a CO_2 laser	
42		He – Ne Laser, Applications of Lasers	Analyse the working of a He - Ne laser	
43		Introduction to fiber optics	Remember the fundamentals of optical fibers	
		Mock - Test – II		
		Bridge Class VIII		
44	12	Optical fiber definition and usage as a wave guide	Analyze the usage of optical fiber as a wave guide	
45		Principle of Optical Fiber – Total internal reflection	Remember principle of optcal fibre	
46		Acceptance angle, acceptance cone, Numerical aperture	Derive the expression for acceptance angle, Numerical aperture	
47		Types of optical fibers based on mode and RI profile	Evaluate the different types of optical fibers	
		Bridge Class IX		
UNIT – V : Electromagnetism and Magnetic Properties of Materials				
48	13	Step index fiber - characteristics	Analyze the characteristics of SI fiber	
49		Transmission of signal through SI fiber,	Evaluate the usage of GI	

		Transmission of signal through GI fiber	fiber for communication	
50		Graded index fiber - characteristics	Analyze the characteristics of GI fiber	
51		Losses in Optical fibers, Applications of optical fibers	Understand the various types of losses	
		Bridge Class X		
52	14	Laws of electrostatics	Remember the laws of electroststics	
53		Electric current and equation of continuity	Remember electric current Derive the continuity equation	
54		Ampere's law and Faraday's laws of electromagnetism	Understand Ampere's law and Derive Faraday's laws of electromagnetism	
55		Maxwell equations	Derive Maxwell's equations	
		Bridge Class XI		
56	15	Concept of dielectric polarisation	Remember the concept of polarisation	
57		Fundamental definitions in dielectrics	Remember the basics of dieelctrics	
58		Internal fields in solids, Clausius – Mossotti relation	Remember internal fields in solids and DeriveClausius – Mossotti relation	
59		Piezo, pyro and ferroelectricity	Analyze various types of polarization phenomena	
		Bridge Class XII		
60	16	Fundamental definitions in magnetism	Remember basics of magnetism	
61		Classification of magnetic materials based on magnetic moment	Analyze the different types of magnetic materials	
62		Ferro magnetism theory, magnetic domains	Understand the Theory of ferro magnetism, Analyze	
63		Hysteresis and application of magnetic materials	Apply the theory of ferromagnetism to understand Hysteresis.	
		Bridge Class XIII		
	Mid II Examinations			

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

X. QUESTION BANK: (JNTUH)

Definitions of the different levels of cognitive skills in Bloom's taxonomy marked in descriptive questions (where the highest level in question bits is only marked) are as follows:

BLOOMS LEVEL	COGNITIVE SKILL	DEFINITION
Level–1 (L1) :REMEMBER	Knowledge	Recalling/Retrieving relevant terminology, specific facts, or different procedures related to information and/or course topics. (At this level, student remembers something, but may not really understand it fully.)
Level–2 (L2) :UNDERSTAND	Comprehension	Determining the meaning of instructional messages (facts, definitions, concepts, graphics etc.)
Level–3 (L3) : APPLY	Application	Carrying out or use previously learned information in another familiar situations or in problem solving
Level–4 (L4) :ANALYZE	Analysis	Breaking information into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose. Analysis refers to the process of examining information in order to make conclusions regarding cause and effect, interpreting motives, making inferences, or finding evidence to support statements/arguments
Level–5 (L5) :EVALUATE	Evaluation	Making judgment's based on criteria and standards, personal values or opinions
Level–6 (L6) : CREATE	Synthesis	Create or uniquely apply prior knowledge and/or skills to form a novel, coherent whole or original product or produce new and original thoughts, ideas, processes,...

DESCRIPTIVE QUESTIONS: (WITH BLOOMS PHRASES)

UNIT I

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Define black body radiation	**Remember**	**1**
2	State the Planck's law	**Remember**	**1**
3	What is photo-electric effect?	**Remember**	**1**
4	What is Compton effect?	**Remember**	**1**
5	State de – Broglie's hypothesis	**Remember**	**1**
6	Write a short note on wave – particle duality	**Remember**	**1**
7	Explain Heisenberg uncertainty principle.	**Understanding**	**4**
8	Define the wave function	**Remember**	**1**
9	Mention the physical significance of a wave function.	**Apply**	**2**
10	Write down the Schrodinger's time independent wave equation.	**Remember**	**1**

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Deduce the expression of Planck's quantum theory of radiation.	**Evaluate**	**4**
2	Discuss the photoelectric effect and explain how a change in frequency and intensity affects the kinetic energy of electrons on the basis of Einstein's theory.	**Create**	**3**
3	What is Compton effect? Prove that the Compton shift is given by $\Delta\lambda = \frac{h}{m_0 c}(1-\cos\theta)$	**Remember**	**1**
4	Explain de Broglie's concept of matter waves.	**Evaluate**	**3**
5	Describe the Davisson and Germer experiment for the existence of matter waves.	**Analyse**	**4**
6	What is Heisenberg uncertainty principle? Explain how it is the outcome of the wave description of a particle.	**Remember**	**4**
7	Derive the Schrödinger time independent wave equation for matter waves.	**Understanding**	**4**
8	Explain the Bohr's interpretation of the wave function.	**Understanding**	**4**
9	Show that the energies of a particle in a potential box are quantized.	**Apply**	**2**
10	What is the significance of matter waves? Explain.	**Remember**	**4**

UNIT II

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	List out the properties of semiconductor.	**Analyze**	**4**
2	What is meant by doping? Explain the types of doping.	**Remember**	**1**
3	Distinguish between intrinsic and extrinsic semiconductor.	**Analyze**	**4**
4	Define Fermi level.	**Remember**	**1**
5	Name the majority and minority charge carriers in n-type and p-type semiconductor?	**Analyze**	**4**
6	Define recombination.	**Remember**	**1**
7	State Hall effect.	**Remember**	**1**
8	Draw the energy band diagram for the p-n junction diode in equilibrium position.	**Create**	**3**
9	What is meant by diffusion and drift in carrier transport?	**Remember**	**1**
10	What is depletion region in p-n junction?	**Remember**	**1**
11	What happens to the width of the depletion layer of a p-n junction when it is (i) forward biased? (ii) reverse biased?	**Understanding**	**4**
12	Draw the V -I characteristics of a zener diode.	**Create**	**3**
13	Why an ordinary transistor is called bipolar?	**Remember**	**1**

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Obtain the expression for Fermi energy for intrinsic semiconductor.	**Evaluate**	**4**
2	Draw a neat energy band diagram of intrinsic semiconductor. Label the various energy level. Prove that the Fermi level lies at the middle of the band gap.	**Create**	**3**
3	How does the Fermi level change with increasing temperature in intrinsic and extrinsic semiconductor? Sketch diagram.	**Apply**	**2**
4	Explain the formation of depletion region in p-n junction.	**Evaluate**	**4**
5	Draw neat energy band diagrams for unbiased, forward biased and reverse biased pn junction.	**Create**	**3**
6	Explain the various processes of carrier generation and recombination.	**Remember**	**1**
7	What is Hall effect and give its importance in the field of semiconductors.	**Understanding**	**4**
8	Obtain the expression of hall coefficient for n-type semiconductor.	**Evaluate**	**4**
9	Explain the working of zener diode with their V-I characteristics.	**Remember**	**1,4**
10	Explain the construction and working of BJT.	**Evaluate**	**1**

UNIT III

Short Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain radiative recombination.	**Remember**	**1**
2	What is the principle of working of an LED	**Remember**	**1**
3	What are photo-detectors? Give examples.	**Remember**	**1**
4	What are direct and indirect band gap semiconductors?	**Remember**	**1**
5	Write down the differences between Avalanche and PIN diodes	**Analyze**	**4**

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain the construction and working of a solar cell.	**Evaluate**	**4**
2	Explain the working of a PIN diode by drawing the VI characteristics.	**Evaluate**	**4**
3	What is an avalanche diode. Explain its working by plotting the VI characteristics graph.	**Remember, Evaluate**	**1,4**

UNIT IV

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What are stimulated and spontaneous emissions?	**Remember**	**1**
2	Explain the characteristics of LASER light.	**Understanding**	**4**
3	What is population inversion?	**Remember**	**1**
4	Mention the methods of pumping.	**Remember**	**1**
5	Mention a few applications of Lasers.	**Remember**	**1**
6	Describe an Optical fiber.	**Create**	**3**
7	Define Total internal reflection.	**Remember**	**1**
8	What is acceptance angle?	**Remember**	**1**
9	Define Numerical aperture.	**Remember**	**1**
10	Define attenuation in optical fibers.	**Remember**	**1**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Derive the Einstein coefficients.	**Evaluate**	**4**
2	What is population inversion? Explain how it is achieved in a He – Ne LASER	**Remember**	**1**
3	Explain the construction and working of a Ruby LASER.	**Evaluate**	**4**
4	Explain the working of Carbon dioxide LASER.	**Evaluate**	**4**
5	What are the applications of LASERS in engineering and technology?	**Remember**	**1,2**
6	What is FIBRE? Explain principle in optical fibre and their applications.	**Remember, Evaluate**	**1,3**
7	Explain construction of a fibre.	**Understanding**	**4**
8	Give an expression for Acceptance angle, cone and Numerical aperture.	**Evaluate**	**3**
9	Explain the various types of fibers and optical fibers in Communication systems.	**Remember**	**1**
10	Explain the optical fiber communication system.	**Evaluate**	**3**
11	Mention the applications of optical fibers in medicine.	**Remember**	**4**
12	What are the various types of losses in optical fibers? Explain Bending losses.	**Remember**	**1,4**

UNIT V

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	State and explain coulombs inverse square law.	**Remember**	**1**
2	State Gauss's law in electrostatics.	**Remember**	**1**
3	What is electric current?	**Remember**	**1**
4	State ampere's circuital law.	**Remember**	**1**
5	Explain Faraday's law of electromagnetic induction.	**Evaluate**	**1**
6	What is dielectric polarization?	**Remember**	**1,4**

7	Define dielectric constant.	**Remember**	**1**
8	What are internal fields?	**Remember**	**1**
9	Write notes on Piezoand Ferroelectricity with suitable examples.	**Remember**	**1**
10	Define magnetization.	**Remember**	**1**
11	What is magnetic hysteresis?	**Remember**	**1**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	State and explain continuity equation	**Remember, Evaluate**	**1,4**
2	Derive Maxwell's equations	**Evaluate**	**1**
3	Explain the concept of internal field in solids. Derive an expression for it & hence obtain Clausius – Mossotti relation.	**Evaluate**	**1**
4	Define the terms a)Permeability b) Magnetisation c)Magnetic susceptibility d) Magnetic induction e) Relative permeability	**Remember**	**1**
5	What is Bohr Magneton. Explain the origin of Magnetic moment.	**Remember**	**1**
6	How materials are classified as dia ,para& ferromagnetic give a comparison of their of their properties.	**Understanding**	**4**
7	Explain the factors leading to the origin of magnetic moments. What is Bohr magneton?	**Evaluate**	**4**
8	Explain the domain theory of ferromagnetism & explain hysteresis?	**Evaluate**	**4**

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT I

1. The value of Planck's constant is _____.
2. The quantum of electromagnetic energy is called _____.
3. The emission of electrons when a light of suitable wavelength falls on a metal plate is called _____
4. The expression of Compton shift is given by _____.
5. The de – Broglie's matter waves are also called _____ waves
6. Velocity of matter waves is always _____ than em radiation.
7. Wave nature and particle nature called dual nature is exhibited by _____
8. The Davisson – Germer experiment proves that electrons behave as _____
9. According to Heisenberg's uncertainty principle, the relation between energy and time is given by _____
10. The wave function is defined as _____.
11. The eigen energies for a particle in a box are given by E_n = _____.

UNIT II

1. When the band gap is in the order of 1eV in a solid it behaves as _____
2. Fermi level is the energy of the electron at _____.
3. The semiconductor in its pure form is called _____.
4. The process of adding impurity in semiconductor is called _____.
5. The direct band gap semiconductors has a large probability of _____.
6. An example of indirect band gap semiconductor is _____.
7. The P – Type semiconductor is formed by doping a _____ impurity.
8. Addition of pentavalent impurity results in _____ semiconductor.
9. PN junction is formed by _____.
10. For an N – type semiconductor, the Fermi level lies _____.

UNIT III

1. The wavelength emitted by a semiconductor Laser is _____
2. The LED works on the principle of _____.
3. The energy gap of an indirect band gap semiconductors lies between _____.
4. An example of indirect band gap semiconductor is _____.
5. GaAs is example of _____ semiconductor.
6. Fermi level is defined as _____.
7. The Hall coefficient of an N type semiconductor is _____.
8. The Hall coefficient is defined as _____.
9. The avalanche breakdown takes place at _____.
10. Zener diode is always operated in _____.

UNIT IV

1. Working of an optical fiber is based on _____.
    a. Total internal reflection
    b. Refraction
    c. Scattering
    d. None
2. The refractive index of the core is always greater than that of the cladding.
    a) True b) False c) Can't say d) Some times
3. The difference in the refractive indices of core and cladding must be _____.
    a. More
    b. Small
    c. uniform
    d. None
4. The refractive index profile for the step index fiber is _____.
    a. step wise increase
    b. radially increasing
    c. constant value
    d. none
5. For graded index fiber the refractive index profile is _____.
    a. simple harmonic

b. Step wise increase
c. Radially increases
d. None

6. In a graded index fiber, the refractive index gradually decreases from core to cladding.
   a) True b) False c) Can't say d) None
7. In a step index fiber, the difference in the refractive indices of core and cladding is __.
   a) Small b) Large c) Zero d) Unity
8. The refractive index difference in a step index fiber multi mode fiber is _____.
   a) Small b) Large c) Zero d) None
9. The inter-modal dispersion in an SI fiber is _____.
   a) Small b) Large c) Zero d) None
10. For small distance communication such as LAN _____ fibers are used.
    a. Single mode Step index
    b. Multi mode Step index
    c. Graded index
    d. None
11. For a graded index fiber the dispersion is _____.
    a) Small b) Large c) Zero d) None
12. Communication through the GI fiber is easier than in the SI fiber.
    a) True b) False c) Can't say d) None
13. Bending losses in optical fibers are due to _____.
14. Micro-bending losses arise due to _____.
15. Increase in the amplitude of a signal to maximum is called _____.
    a. attenuation
    b. amplification
    c. incremental amplitude
    d. None
16. For better signal transmission, the attenuation of the optical fiber must be _____.
    a. less
    b. more
    c. equal to average amplification
    d. None
17. Optical fibers absorb more in the _____ region of EM spectrum. (IR region)
    a. Visible
    b. UV
    c. IR
    d. Microwave

UNIT V

1. Electronic polarization _____ with increase in temperature.
2. Dielectrics are _____
3. The ratio of permittivity of medium to that of air is called _____
4. Two equal and opposite charges separated by a small distance constitutes a _____.
5. The ionic polarizability is _____ than electronic polarizability.
6. The orientationalpolarizability is strongly dependent on _____
7. The relationship between the dielectric constant and electronic polarizability is given by _____.
8. The temperature at which the transition of antiferro to paramagnetism takes place is called
9. Magnetic ceramics are _____ materials.
10. Every ferro magnetic materials contains regions of dipole moments called _____.
11. The value of Bohr magneton is _____.
12. The susceptibility of dia-magnetic materials is _____.
13. The relative permeability of ferro magnetic materials is _____.
14. The hysteresis is exhibited by _____ materials.

XII. GATE QUESTIONS: NA

XIII. WEBSITES:

1. www.motionmountain.com
2. www.einsteinhome.com
3. http://nptel.ac.in/

XIV. EXPERT DETAILS:

1. Prof. RavindranEthiraj, Retd Professor, Department of Physics, OU
2. Prof. P. Kishtaiah, Department of Physics, OU
3. Prof. D Linga Reddy, Department of Physics, OU
4. Prof. K. NarayanaRao, School of Physics , HCU
5.

XV. JOURNALS:

INTERNATIONAL

1. Journal of Physics (American Institute of Physics)

NATIONAL

2. Indian Journal for Pure and Applied Physics.

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Deductions from Planck's radiation law
2. Semiconducting materials
3. Semiconducting materials and their structures
4. Construction and working of an optical fiber
5. Magnetic Hysteresis

XVII. CASE STUDIES / SMALL PROJECTS:

1. Water level indicator.
2. Burgler alarm using photo detectors..
3. Study of the Characteristics of a Thermistor.
4. Constructing a circuit for LEDs of different colors to study IV characteristics.
5. Developing a prototype of a magnetically levitating train.
6. Switching devices using remote sensor using internet.
7. Using Solar cell for domestic applications.