ENGINEERING PHYSICS

Subject code: PH102BS

Regulations: R18-JNTUH

Class: I Year B. Tech CE & ME I Sem

Department of Science and Humanities

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

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ENGINEERING PHYSICS (PH102BS)

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 inthis 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:

- The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses.

- Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, Waves in one dimension, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics.
- The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits.
- Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his carrier.

IV. COURSE OUTCOMES:

Out come	Knowledge Level (Blooms Level)
The knowledge of Physics relevant to engineering is critical for converting ideas into technology	**Remember**
An understanding of Physics also helps engineers understand the working and limitations of existing devices and techniques, which eventually leads to new innovations and improvements.	**Understand, Apply, Create**
In the present course, the students can gain knowledge on the mechanism of physical bodies upon the action of forces on them, the generation, transmission and the detection of the waves, Optical Phenomena like Interference, diffraction, the principles of lasers and Fibre Optics.	**Remember, Understand**
Various chapters establish a strong foundation on the different kinds of characters of several materials and pave a way for them to use in at various technical and engineering applications.	**Analyse, Evaluate**

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.	2	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.	1	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	2	Assignments/ Case Studies

	safety, and the cultural, societal, and environmental considerations.		
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.	1	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.	1	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.	-	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.	1	Projects/ Case Studies

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

CO's	Program Outcomes (PO's)											
	PO 1	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1.	2	1	2	1	2	-	-	-	-	-	-	1
CO2.	2	1	3	1	2	-	-	-	-	-	-	1
CO3.	2	1	3	1	1	-	-	-	-	-	-	1
CO4.	2	2	2	1	1	-	-	-	-	-	-	1
CO5.	1	-	2	-	1	-	-	-	-	-	-	1
Average (Rounded)	2	1	2	1	1	-	-	-	-	-	-	1

SYLLABUS:

UNIT-I: Introduction to Mechanics

Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton's laws and its completeness in describing particle motion, Form invariance of Newton's second law, Solving Newton's equations of motion in polar coordinates, Problems including constraints and friction, Extension to cylindrical and spherical coordinates.

UNIT-II: Harmonic Oscillations

Mechanical and electrical simple harmonic oscillators, Complex number notation and phasor representation of simple harmonic motion, Damped harmonic oscillator: heavy, critical and light damping, Energy decay in a damped harmonic oscillator, Quality factor, Mechanical and electrical oscillators, Mechanical and electrical impedance, Steady state motion of forced damped harmonic oscillator, Power observed by oscillator.

UNIT-III: Waves in one dimension

Transverse wave on a string , The wave equation on a string , Harmonic waves, Reflection and transmission of waves at a boundary, Impedance matching , Standing waves and their Eigen frequencies , Longitudinal waves and the wave equations for them, Acoustic waves and speed of sound, Standing sound waves.

UNIT-IV: Wave Optics

Huygen's principle, Superposition of waves and interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Michelson's interferometer, Mach-Zehnder interferometer, Frunhofer diffraction from a single slit and circular aperture, Diffraction grating- resolving power.

UNIT-V: 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.

SUGGESTED BOOKS:

TEXT BOOKS:

1. Engineering Mechanics, 2nd ed.- MK Harbola, Cengage Learning
2. I. G. Main, "Vibrations and waves in physics', 3rd Edn, Cambridge University Press, 2018.
3. Ajoy Ghatak, " Optics", McGraw Hill Education, 2012

REFERENCE BOOKS:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006
2. O. Svelto, "Principles of Lasers"
3. "Introduction to Mechanics", M.K.Verma, Universities Press

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 : Introduction to Mechanics				**Book 1,2,3**
1	1	Introduction to **Mechanics**	Remember the basics of Mechanics	
2		Vectors and Scalars	Remember Vectors and Scalars	
3		Transformation of Scalars and Vectors under rotational transformation	Derive the expression for the transformation of vectors under rotation	
4		Forces in nature	Understand thew	

			Theory of Forces	
5	2	Newton's laws of motion.	Remember the Newton's laws of motion	
6		Invariance of Newton's second law	Apply the transformation for the invariance of Newton's laws	
7		Newton's laws of motion in polar coordinates	Deduce the Laws of motion in Polar coordinates	
8		Newton's laws of motion in polar coordinates Continued	Deduce the Laws of motion in Polar coordinates	
9	3	Problems involving constraints	Apply the laws of motion for friction	
10		Problems involving Friction	Apply the laws of motion for friction	
11		Newton's laws of motion in spherical coordinates	Deduce the Laws of motion in Spherical coordinates	
12		Newton's laws of motion in cylindrical coordinates	Deduce the Laws of motion in Cylindrical coordinates	
		Mock - Test – I		
Unit – II : Harmonic Oscillations				
13	4	Mechanical and electrical simple harmonic oscillators	Remember the harmonic oscillator problem	
14		Complex number notation	Understand the theory of complex number notation	

15		Phasor notation of SHM	Understand the theory of phasor notation	
16		Damped harmonic oscillator	Understand the Theory damping	
		Bridge Class I		
17	5	Types of damping	Analyze various types of damping	
18		Mathematical treatment for damping	Derive the expression for frequency and time period	
19		Decay of energy in a damped harmonic oscillator	Derive the expression for loss of energy in a damped harmonic oscillator	
20		Resonance in Mechanical oscillator	Remember the concept of mechanical resonance	
		Bridge Class II		
21	6	Resonance in Electrical oscillator	Remember the concept of electrical resonance	
22		Mechanical and electrical impedance	Remember the concept of impedance	
23		Forced damped harmonic oscillator	Understand forced harmonic oscillator,	
24		Damped harmonic oscillator - equation	Derive equation for the damped harmonic oscillator	
		Bridge Class III		
UNIT – III : Waves in one dimension				
25	7	Power in an oscillator	Understand the concept of power in a	

			oscillator	
26		Transverse vibrations on a string - introduction	Remember the tranverse vibrations	
27		Expression for fundamental frequency	Derive the expression for the fundamental frequency	
28		The wave equation – Harmonic waves	Deduce the equations of harmonic waves	
		Bridge Class IV		
29	8	Solution for the wave equation - problems	Apply the harmonic wave equation for numericals	
30		Reflection and transmission at a boundary	Analyze the harmonic wave to understand transmission at a boundary	
31		Reflection and transmission at a boundary continued	Analyze the harmonic wave to understand reflection at a boundary	
32		Impedance matching	Analyze the wave equation to compare impedance	
		Bridge Class V		
Mid I Examinations				
UNIT – III : Waves in one dimension Contd.				
33	9	Standing waves and frequencies	Understand the laws of transverse vibrations	
34		Equations for longitudinal waves	Derive the wave equation for a longitudinal wave	

35		Acoustic waves	Understand the concept of acoustic waves	
36		Stationary sound waves	Understand the stationary waves	
		Bridge Class VI		
UNIT – IV : Wave Optics				
53	10	Huygen's wave principle, Superposition of waves	Understand the Theory of Superposition of waves	
54		Interference by division of wavefront	Understand the idea of interference by division of wavefront	
55		Young's double slit experiment, Lloyd's mirror, bi-prism	Evaluate the Young's double slit experiment and understand methods of producing interference	
56		**Mock - Test – II**		
		Bridge Class VII		
57	11	Interference by division of Amplitude – Stoke's law	Understand the concept of division of amplitude	
58		Path difference for a plane parallel film and wedge	Derive the path difference for a plane parallel film and wedge	
59		Newton's rings	Understand the formation of Newton's rings	
60		Michelson interferometer	Understand the working of Michelson's interferometer	

		Bridge Class VIII		
61	12	Mach Zehnder interferometer	Understand the working of Mach Zehnder interferometer	
62		Fraunhofer Diffraction due to a single slit	Remember the basics of diffraction, Evaluate the path difference	
63		Fraunhofer Diffraction due to a circular aperture	Remember the basics of diffraction, Evaluate the path difference in case of circular aperture	
64		Diffraction grating – resolving power	Understand the basics of diffraction and apply it to find the resolving power	
		Bridge Class IX		
UNIT – V : Lasers and Fiber Optics				
37	13	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 X		
41	14	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	
		Optical fiber definition and usage as a wave guide	Analyze the usage of optical fiber as a wave guide	
		Bridge Class XI		
45	15	Principle of Optical Fiber – Total internal reflection	Remember principle of optcalfibre	
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	
48		Step index fiber - characteristics	Analyze the characteristics of SI fiber	
		Bridge Class XII		
49	16	Transmission of signal through SI fiber, Transmission of signal through GI fiber	Evaluate the usage of GI 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	
52		Revision		
		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 scalars and vectors.	**Remember**	**1**
2	What is rotation transformation?	**Remember**	**1**
3	Write a note on completeness of Newton's laws in describing motion of a particle.	**Understand**	**2**
4	State Newton's second law of motion.	**Remember**	**1**
5	Explain the types of friction with examples?	**Analyze**	**4**
6	Define the following: (i) Angle of Repose (ii) Coefficient of frictions (iii) Angle of Friction.	**Remember**	**1**
7	What are the effects of friction? State the laws of solid friction.	**Remember**	**3**
8	Differentiate between static and dynamic friction?	**Analyze**	**4**

Long Answer Questions-

S.No	**Question**	Blooms Taxonomy Level	**Course Outcome**
1	Show that Newton's laws of motion are invariant.	**Evaluate**	**4**
2	Derive Newton's laws of motion in polar coordinates.	**Derive**	**4**
3	Explain the use of spherical coordinates in describing the motion of a particle.	**Understand**	**2**
4	Write the equations of equilibrium when the body is in space.	**Remember, Analyze**	**3**
5	Derive the least inclined force required to drag body resting on a horizontal plane in terms of weight of the body, angle of the inclined force and angle of friction.	**Evaluate**	**4**
6	A body weighing 50N is just pulled upon inclined plane of 30°by a force of 40 N applied at 30° above the plane. Find the coefficient of friction.	**Apply**	**2**
7	What is angle of repose? Prove that angle of repose is equal to the angle of friction.	**Remember, Analyze**	**3,4**
8	A block lying over a 10° wedge on a horizontal floor and leaning against a vertical wall and weighing 1500 N is to be raised by applying horizontal force to the wedge. Assume the coefficient of friction between all the surfaces in contact to be 0.3. Determine the minimum horizontal force to be applied to raise the block.	**Apply**	**2**

UNIT II

Short Answer Questions-

S.No	**Question**	Blooms Taxonomy Level	**Course Outcome**
1	What are the characteristics of a simple harmonic wave?	**Remember**	**1**

2	Write a note on damped harmonic oscillator.	**Remember**	**1**
3	The time period of a simple pendulum is 1sec. Find the length of the pendulum.	**Apply**	**2**
4	A simple harmonic motion is defined by the expression a = -25s, determine its period and frequency.	**Apply**	**2**
5	What is resonance? Define quality factor.	**Remember**	**1**
6	What is mechanical impedance?	**Remember**	**1**

Long Answer Questions-

S.No	**Question**	Blooms Taxonomy Level	**Course Outcome**
1	The amplitude of a particle in simple harmonic motion is 0.75m and the perios is 1.2 sec. Find the maximum velocity and maximum acceleration. Find also the displacement , velocity and acceleration after 0.5secs.	**Apply**	**2**
2	What is a simple pendulum? Derive an equation for the time period	**Remember**	**3**
3	Explain mathematically the effect of variations in g **(**acceleration due to gravity) on the oscillations of a simple pendulum.	**Evaluate**	**4**
4	Deduce a differential equation of a damped harmonic oscillator.	**Evaluate**	**4**
5	Derive the expression for the decay of energy in a damped harmonic oscillator.	**Evaluate**	**4**

UNIT III

Short Answer Questions-

S.No	**Question**	Blooms Taxonomy Level	**Course Outcome**
1	Define transverse wave.	**Remember**	**1**
2	Distinguish between transverse and longitudinal waves.	**Analyze**	**4**
3	Write a short note on transverse vibrations on strings.	**Understand**	**2**
4	What is impedance matching?	**Remember**	**1**
5	What are the characteristics of a standing wave?	**Remember**	**1**
6	What are acoustic waves?	**Remember**	**1**

Long Answer Questions-

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	What are transverse waves derive the expression for the fundamental frequency.	**Remember, Evluate**	**3,4**
2	Derive the expression for reflection and transmission coeffiecient at the boundary of a harmonic wave.	**Evaluate**	**4**
3	What is a stationary wave? Obtain the differential equation for the standing wave.	**Remember, Apply**	**1,2**
4	Define longitudinal waves. Derive the differential equation for longitudinal waves on a stretched string.	**Remember, Evaluate**	**3,4**

UNIT IV

Short Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Explain is principle of superposition.	**Understand**	**2**
2	What is coherence?	**Remember**	**1**
3	What is the difference between interference and diffraction.	**Analyze**	**4**
4	Discuss the principle of an interferometer.	**Create**	**2**
5	What is the difference between Fresnel and Fraunhoferdiffraction?	**Analyze**	**4**
6	Define Diffraction Grating.	**Remember**	**1**

Long Answer Questions

S.No	Question	Blooms Taxonomy Level	Course Outcome
1	Describe the interference pattern obtained due to the superposition of two coherent waves?	**Create**	**2**
2	Give the analytical treatment of the interference of light and hence obtain the condition for maximum and minimum intensity?	**Evaluate**	**4**
3	Derive an expression for fringe width in interference pattern and show that the fringes are uniformly spaced with relevant ray diagram?	**Analyze**	**4**
4	Explain how Newton's rings are formed in the reflected light?	**Understand**	**3**
5	Derive the expression for the diameter of dark and bright rings?	**Analyze**	**4**
6	Explain the principle and working of Michelson's	**Remember**	**3**

	interferometer.		
7	Explain the construction and working of Mach Zehnder interferometer.	**Remember**	**3**
8	Obtain the condition for primary maxima in Fraunhofer diffraction due to a single slit and derive an expression for width of the central maxima?	**Analyze**	**4**
9	Give the theory of Fraunhofer diffraction due to a double slit and compare the results obtained with that due to single slit?	**Remember, Analyze**	**3,4**
10	Explain with theory the diffraction due to Fraunhofer diffraction of 'n' slits?	**Understand**	**3**
11	Explain the formation of Newton's rings and describe an experiment to find the wavelength of a monochromatic source of light.	**Understand, Analyze**	**3,4**
12	Obtain the expression for resolving power of the diffraction grating.	**Evaluate**	**4**

UNIT V

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	**Evaluate**	**3**

	Numerical aperture.		
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**

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT I

1. Which of the following statement is correct?
   (a) A force is an agent which produces or tends to produce motion.
   (b) A force is an agent which stops or tends to stop motion.
   (c) A force may balance a given number of forces acting on a body.
   (d) Both (a) and (b).
2. If the arm of a couple is doubled, its moment will be _____.
   (a) be halved (b) remain the same (c) be doubled (d) none of these
3. A couple consists of _____.
   (a) two like parallel forces of same magnitude.
   (b) two like parallel forces of different magnitudes.
   (c) two unlike parallel forces of same magnitude.
1. (d) two unlike parallel forces of different magnitudes.
2. The friction experienced by a body, when in motion, is known as _____.
   (a) Rolling friction (b) dynamic friction (c) limiting friction (d) static friction

2. A body of weight W is required to move up on rough inclined plane whose angle of inclination with the horizontal is α. The effort applied parallel to the plane is given by _____. (where $\mu = \tan\varphi$ = Coefficient of friction between the plane and the body.
   (a) $P = W \tan\alpha$ (b) $P = W \tan(\alpha + \varphi)$
   (c) $P = W (\sin\alpha + \mu\cos\alpha)$ (d) $P = W (\cos\alpha + \mu\sin\alpha)$
3. Static friction is always _____ dynamic friction.
   (a) Equal to (b) Less than (c) Greater than (d) none of these
4. A body will begin to move down an inclined plane if the angle of inclination of the plane is _____ the angle of friction.
   (a) Equal to (b) Less than (c) Greater than (d) none of these
5. The maximum frictional force, which comes into play, when a body just begins to slide over the surface of the other body, is known as _____.
   (a) Static friction (b) Dynamic friction (c) Limiting friction (d) Coefficient of friction
6. The coefficient of friction depends on _____.

(a) Area of contact (b) Shape of surfaces (c) Strength of surfaces (d) Nature of surface

7. Frictional force encountered after commencement of motion is called _____.
   (a) Post friction (b) Limiting friction(c) Kinematic friction (d) Frictional resistance
8. Coefficient of friction is the _____.
   (a) angle between normal reaction and the resultant of normal reaction and limiting frictio n
   (b) ratio of limiting friction and normal reaction
   (c) the friction force acting when the body is just about to move
   (d) the friction force acting when the body is in motion

UNIT II

1. Which of the following is not the unit of power?
   a) kW b) HP c) kcal/sec d) kg m/sec
2. In order to double the period of simple pendulum, the length of the string should be:
   a) Halved b) doubled c) quadrupled d) None of these
3. The maximum velocity of a particle moving with simple harmonic motion is _____.
   a) ω b) ωr c) $\omega^2 r$ d) ω/r
4. The time period of oscillation of a simple pendulum is given by _____
5. The expression for the decay of energy of a damped harmonic oscillator is _____
6. Critical damping is defined as _____.
7. The quality factor of an electrically resonant oscillator is _____
8. If the total impedance of an electrical circuit is maximum then the it is said to be at _____
9. A forced damped oscillator is defined as _____
10. The power in an oscillator circuit is given by _____

UNIT III

1. The standard wave equation is _____
2. The boundary condition for the reflection of a wave is _____.
3. The boundary condition for the transmission of a wave is _____.
4. An eigen frequency is defined as _____.
5. The general equation of a standing wave is given by _____.
6. If the direction of vibration is along the direction of propagation it is called _____.
7. Transverse waves are defined as _____.
8. The fundamental frequency of vibration is n = _____.
9. Sound waves may either _____ and _____.
10. Simple Harmonic motion is defined as _____.

UNIT IV

1. The contrast ratio for sustained interference is _____.
   a) Infinity b) zero c) maximum d) minimum

2. Which of the following can give sustained interference?

a) Two independent laser sources b) Two independent light bulbs

c) Two sources having larger width d) Two sources very far away from each other

3. Two waves are known to be coherent if they have _____.
   a) Same amplitude b) Same wavelength c) Same amplitude and wavelength

   d) Constant phase difference and same wavelength

4. In Fresnel's experiment, the width of the fringe depends upon the distance _____.
   a) Between the prism and the slit aperture

   b) Of the prism from the screen

   c) Of screen from the imaginary light sources

   d) Of the screen from the prism and the distance from the imaginary sources

5. In case of diffraction the minima is _____.
   a) completely dark b) partially dark

   c) Sometime dark and sometimes bright d) None

6. The fringe width of the diffraction fringes is _____.
   a) constant b) varying c) increasing d) decreasing

7. The similarity between the diffraction and an interference pattern on the screen is ___.
   a) Formation of alternate dark and bright bands of uniform width

   b) Formation of alternate dark and bright bands of uniform intensity

   c) Formation of alternate dark and bright bands of variable intensity

   d) None

8. In a double slit diffraction pattern, if the slit width is equal to the half the distance between the slits then the _____ ordered _____ fringes are missing.
   a) even, interference b) even, diffraction c) odd, interference d) odd, diffraction
9. In Fraunhofer diffraction, the source and the screen from the diffraction elements are at _____.
   a) the origin b) known distance c) infinite distance

   d) source is at finite distance and screen is at infinite distance
10. In Fresnel diffraction, the source and the screen from the diffraction elements are at:
    a) the origin b) known distance c) infinite distance
    d) source is at finite distance and screen is at infinite distance

UNIT V

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) Smallb) Largec) 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

XII. GATE QUESTIONS: NA

XIII. WEBSITES:

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

XIV. EXPERT DETAILS:

1. Prof. Ravindran Ethiraj, Retd Professor, Department of Physics, OU
2. Prof. P. Kishtaiah, Department of Physics, OU
3. Prof. Nagabhushanam, Department of Physics, OU
4. Prof. K. Narayana Rao, School of Physics , HCU

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. Use of constraints in solving problems in mechanics.
2. Energy is damped harmonic oscillator
3. Wave equation for a standing wave
4. Diffraction due to N - slits
5. Applications of Lasers and optical fibers

XVII. CASE STUDIES / SMALL PROJECTS:

1. Determination of Cauchy's Constants using optical parameters
2. Determination of RI of liquid using Newton's Rings setup
3. Understanding vibrations on stretched string - Sonometer
4. Understanding the properties of LASERs
5. Comparison between mechanical and electrical harmonic oscillator.