SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: PHYSICS (18HS0850)
Course & Branch: I B.Tech – Mechanical Engineering. **Year & Sem:** I-B.Tech & I-Sem
Regulation: R18

I. Two marks questions

1	Define displacement current and write its expression?	(2M)
2	Define Faradays First Law of electromagnetic induction?	(2M)
3	Write any two uses hard magnetic materials?	(2M)
4	Define magnetic susceptibility?	(2M)
5	Write examples for Dia and Ferro magnetic materials?	(2M)

II.Essay questions

UNIT –I - (ELECTROMAGNETISM AND MAGNETIC PROPERTIES OF MATERIALS)

1	a) State and explain coulomb's inverse square law in electricity?	(5M)
	b) State and explain Biot- Savart law?	(5M)
2	a) Derive and explain gauss's law in electrostatics. Write any two applications?	(6M)
	b) If a point charge q is placed at the center of a cube what is the flux linked with the cube and with the each face of the cube?	(4M)
3	a) State and explain Ampere's law in magneto statics?	(6M)
	b) State and explain Lenz's law magneto statics?	(4M)
4	a) Define electromagnetic breaking and write its applications?	(5M)
	b) State and explain the Faraday's laws of electromagnetic induction?	(5M)
5	a) Write Maxwell's equation in Integral form, and give its physical interpretation	(5M)
	b) What is meant by displacement current?	(5M)
6	a) State and write Maxwell's equation in differential form?	(5M)
	b) Derive the continuity equation and write its significance?	(5M)
7	a) Define i) magnetic moment ii) magnetic permeability	(4M)
	b) Explain the origin of magnetic moments?	(6M)
8	a) Define i) magnetization ii) magnetic flux density and iii) relative permeability.	(3M)
	b) Derive relation between μ_r and χ?	(5M)
	c) A magnetic material has a magnetization of 3300 A/m and flux density of 0.0044 Wb/m^2. Calculate the magnetizing force and relative permeability of the material?	(2M)
9	a) Describe the classification of magnetic materials based on spin magnetic moments?	(7M)
	b) Discuss the applications of soft magnetic materials?	(3M)
10	a) Explain B-H curve of ferromagnetic material?	(6M)
	b) What are soft and hard magnetic materials?	(4M)

UNIT –II – (ELECTROMAGNETIC WAVES)

I. Two marks questions

1 Mention any four radiations in electromagnetic spectrum? (2M)
2 Write the properties of electromagnetic wave? (2M)
3 Write any two uses of electromagnetic wave (spectrum)? (2M)
4 Write expression for electromagnetic wave equations for both E and B? (2M)
5 Define pointing vector? (2M)

II. Essay questions

1 a) Show that the electromagnetic waves are in transverse nature? (7M)
b) Define electromagnetic spectrum? (3M)
2 Derive the wave equation for E using Maxwell's electromagnetic equations and hence show that the velocity of the wave is $\frac{1}{\sqrt{(\mu_0 \varepsilon_0)}}$? (10M)
3 a) Derive the Maxwell's equations in vacuum? (4M)
b) Explain energy and momentum carried by an electromagnetic wave? (6M)
4 a) Deduce the relation between the Electric (E) and Magnetic field (B) of electromagnetic Waves? (6M)
b) Define electrostatic fields and magnotostatic fields. (4M)
5 Define the equation of electromagnetic wave and hence evaluate the velocity of light in free space? (10M)
6 a) Compare the electromagnetic wave and sound waves? (5M)
b) Explain the concept of radiation pressure of electromagnetic waves? (5M)
7 Write Maxwell's equations in differential and integral form derive an expression for energy flow by electromagnetic waves? (10M)
8 a) Explain the concept of radiation pressure of electromagnetic waves with example? (8M)
b) Write the expression for electromagnetic wave equation? (2M)
9 a) Explain the reflection and transmission of electromagnetic waves from a non conducting medium to vacuum interface for normal incidence? (10M)
10 a) State and write the expressions for Pointing vector, energy and momentum of electromagnetic waves? (6M)
b) What are the uses of various radiation of electromagnetic spectrum? (4M)

UNIT-III - (WAVES, OPTICS & ACOUSTICS)

I. Two marks questions

1 What are the characteristics of simple harmonic oscillation? (2M)
2 Define Damped harmonic vibrations? (2M)
3 Write necessary conditions for good interference? (2M)
4 A class room of volume 200 m^3 has a reverberation time 1.6 seconds. Calculate the total sound absorption coefficient of the class room? (2M)
5 Write the units for intensity of sound and pitch of sound? (2M)

II. Essay questions

1 a) Derive general differential equation of motion for a simple harmonic oscillator and obtain its solution? (7M)
b) Name the periodic motion which is not oscillatory? (3M)
2 a) Define damped harmonic oscillations. Write the differential equation for damped harmonic oscillator. And give its solution? (6M)
b) Discuss the special cases of oscillatory motion? (4M)
3 a) Discuss the theory of forced harmonic oscillations? (5M)
b) Define damped vibrations and forced vibrations? Giving one example of each? (5M)
4 a) Describe the formation of Newton's ring with necessary theory. (7M)
b) Explain how the wavelength of light sources is determined by forming Newton's ring? (3M)
5 a) Derive the conditions for bright and dark colours? Through the interference in thin films by reflection? (7M)
b) Calculate the thickness of soap film (μ=1.463) that will result in constructive interference in the reflected light, if the film is illuminated normally with light whose wavelength in free space is 6000 $\overset{0}{A}$. (3M)
6 a) Distinguish between interference and diffraction? (5M)
b) How we got different colours on thin films? (5M)
7 a) Discuss Fraunhofer single slit diffraction. (7M)
b) Draw intensity distribution curves and give condition for bright and dark fringes in single slit diffraction pattern. (3M)
8 a) Define Reverberation and Reverberation time? (4M)
b) What is the basic requirement of acoustically good hall? (6M)
9 a) Write Sabine's formula for reverberation time? Mention factors controlling the reverberation time? (6M)
b) A hall of volume 1000 m^3 is found to have a reverberation time of 2 seconds. If the area of the sound absorbing surface is 350 m^2, calculate average absorption coefficient? (4M)
10 a) Define and derive the absorption coefficient? (6M)
b) A class room of volume 360 m^3 has a reverberation time 1.6 seconds. Calculate the total sound absorption coefficient of the class room? (4M)

UNIT-IV - (LASERS)

I. Two marks questions

1 What are the characteristics lasers? (2M)
2 Define Meta stable state? (2M)
3 What is life time of atom? Give the life time of Hydrogen atom in excited state? (2M)
4 How laser radiation is utilized in medical field? (2M)
5 What are the various techniques of pumping? (2M)

II. Essay questions

1 a) Describe the important characteristic of laser beam? (6M)
b) Explain the difference between spontaneous and stimulated emission of radiation? (4M)
2 a) Derive the relation between the various Einstein's coefficients of absorption and emission of radiation. (6M)
b) the wavelength of emission is $6000\ \overset{0}{A}$ and the coefficient of spontaneous emission is 10^6/s. Determine the coefficient for stimulated emission? (Dr. SLR) (4M)
3 a) Differentiate between Laser beam and ordinary light beam (5M)
b) Explain the various pumping mechanisms? (5M)
4 a) Write brief note on basic components of laser with the help of neat diagram? (6M)
b) Define Meta stable state and write its significance? (4M)
5 a) Explain the construction and working principle of He-Ne laser with suitable energy level diagram. (8M)
b) Write few advantages of He-Ne laser. (2M)
6 a) State population inversion and give its importance in the production of laser? (6M)
b) Calculate the population of the two states in He:Ne laser that produces light of wavelength $6328\ \overset{0}{A}$ at $27^0 C$? (Dr. SLR) (4M)
7 a) Explain the construction and working of Nd:YAG laser with suitable energy level diagram? (8M)
b) What are the advantages of Nd:YAG laser? (2M)
8 a) Distinguish between He:Ne laser and Nd:YAG laser? (6M)
b) Explain the mono chromaticity and coherence of characteristics of laser? (4M)
9 a) Write short note on applications of lasers in scientific field? (5M)
b) What is lasing action? (5M)
10 a) State and explain the absorption process? (5M)
b) Write short note on applications of lasers in medical field? (5M)

UNIT-V – (PHYSICS OF NANOMATERIALS)

I. Two marks questions

1 Define top down and bottom up process? (2M)
2 What is the principle in the Ball milling synthesis process of nanomaterial? (2M)
3 Write allotropes of Carbon? (2M)
4 What are the various structures of carbon nanotubes? (2M)
5 What are the advantages of sol-gel process? (2M)

II. Essay questions

1. a) What is nanomaterial? Write the classification of nanomaterials (4M)
   b) Explain the basic principle of nanomaterials. (6M)
2. a) What is Quantum Confinement? (4M)
   b) Write the applications of nanomaterial? (6M)
3. a) Explain why surface to volume ratio very large for nano materials? (6M)
   b) Find the surface area to volume ratio of Sphere using surface area and volume calculation for the given radius is 5 meter? (4M)
4. a) What are the techniques available for synthesizing nanomaterials? (3M)
   b) Explain ball milling technique for synthesis of nanomaterial? (7M)
5. a) Explain Sol-Gel technique for synthesis of nanomaterial? (7M)
   b) Write advantages of sol-gel process? (3M)
6. a) What are the differences between nanotechnology and NanoScience? (5M)
   b) Write short note on physical properties of carbon nanotubes? (5M)
7. a) What are carbon nanotubes? Mention its structures? (5M)
   b) Write brief note on applications of Carbon nanotubes? (5M)
8. a) What is nanotechnology? And give applications of carbn nanotubes (CNT'S) in biomedical field? (6M)
   b) What are allotropes? Write allotropes of Carbon? (4M)
9. a) Define Condensation, Crystal growth and Nucleation? (6M)
   b) Write brief note on working and characteristics of carbon nanotubes based field effect transistor (FET)? (4M)
10. a) Mention the important applications of carbon nanotubes in information technology? (5M)
    b) Explain the sensor and catalyst applications of carbon nanotubes? (5M)

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QUESTION BANK (OBJECTIVE)

Subject with Code : PHYSICS ((18HS0850)
Course & Branch: B.Tech – ME **Year & Sem:** I-B.Tech & I-Sem
Regulation: R18

UNIT-I - (ELECTROMAGNETISM AND MAGNETIC PROPERTIES OF MATERIALS)

I. MULTIPLE CHOICE QUESTIONS

1. Which of the following is true for electrostatics? [ ]
   A) $E=-\nabla V$ B) $\nabla^2.V=0$ C) Both A & B D) None of these
2. According to Coulomb's Law, force between two point charges [ ]
   A) $\propto(distance)^2$ B) $\propto(distance)$ C) Both A & B D) None of these
3. The value of ε_0 the absolute permittivity is _____ pF/m. [ ]
   A) 8.854 B) $8.854X10^{-12}$ C) $8.845X10^{-10}$ D) $8.854X10^{-10}$
4. Electric field intensity is related to force F and charge q [ ]
   A) $E=\frac{F}{q}$ B) $E=\frac{q}{F}$ C) E=Fq D) E=F.q
5. As per Gauss's Law, the total electric flux φ through a closed surface and the total charge q_{enc} by that surface related as [ ]
   A) $\varphi=\int B\,ds$ B) $q=\varphi$ C) Both A & B D) none
6. According to ampere's law [ ]
   A) Total electric flux is equal to electric charge
   B) Total magnetic flux is equal to electric charge
   C) Total magnetic flux is equal to current passing
   D) None of these
7. Electric and magnetic fields are [ ]
   A) Perpendicular to each other B) Parallel to each other
   C) Both A & B D) None of these
8. When there change in magnetic flux, emf is induced. This statement is [ ]
   A) Faraday's First B) Faraday's Second
   C) Faraday's Third D) Faraday's Fourth
9. The direction of emf induced is always such as to oppose the very reason producing the emf. This is according to [ ]
   A) Bio-Savart's B) Lenz's C) Ampere's D) Faraday's
10. Bio-Savart's Law is expressed mathematically as [ ]
    A) H B) $B\propto\int I\,dl\sin\theta/r^2$ C) $\int H\,dl=I_{enc}$ D) $\int H\,dl=\int(\nabla XH)ds$
11. Biot-Savart's Law can be applied to current-carrying conductor of [ ]
    A) Large length B) Very small length C) Medium length D) None

12. The magnitude of the emf induced is directly proportional to rate of change of flux. This is put forth by [ ]
A) Biot-Savart' Law B) Faraday's First Law
C) Ampere's Law D) Faraday's Second Law

13. According to Ampere's Circuital Law field intensity at a point at distance R from a very strong filament conductor-carrying current I is given as [ ]
A) $\int H\,dl = I_{enc}$ B) $\int J\,ds = I$ C) Both A & B D) None

14. Ampere's Circuital Law and which of the following law in electrostatics are analogous [ ]
A) Lenz's B) Gauss's C) Biot-Savart's D) Faraday's

15. Ampere's Circuital Law can be applied _____ the conductor [ ]
A) Inside B) Outside C) Both A & B D) None of these

16. According to Maxwell's first equation in differential form gives [ ]
A) $\nabla . E = div\, E = \frac{\rho}{\varepsilon_0}$ B) $\nabla . B = div\, B = 0$
C) $\nabla X\, E = Curl\, E = -\frac{\partial B}{\partial t}$ D) $\nabla X\, E = \mu_0\left(j + \varepsilon_0 \frac{\partial E}{\partial t}\right)$

17. The idea of displacement current was introduced by [ ]
A) Hertz B) Maxwell C) J C Bose D) Marconi

18. The displacement current is found [ ]
A) Between the plates of condenser when it is being charged
B) Between the plates of condenser when it is being discharged
C) Between the plates of condenser when AC is applied to the condenser
D) All of the above cases

19. The displacement current was named as current because [ ]
A) It is similar to the conduction current
B) It produces a magnetic field
C) It is a time varying electrical field
D) It is current due to uniformly moving charges

20. The SI unit of displacement current is [ ]
A) Henry B) Coulomb C) Ampere D) Faraday

21. Maxwell's equation $\int B\,ds = 0$ is a statement of [ ]
A) Faraday's law of induction B) Modified Amperes law
C) Gauss's law of electricity D) Gauss's law of magnetism

22. Copper is _____ magnetic material. [ ]
A) Dia B) Para C) Ferro D) Anti-ferro

23. The SI unit of magnetic moment is [ ]
A) Wb/m^2 B) Wb C) A/m^2 D) $A\,m^2$

24. Relation between B, H and M is [ ]
A) $B = \mu_0(H+M)$ B) $M = \mu_0(H+B)$
C) $H = \mu_0(B+M)$ D) $B = \mu(H+M)$

25. Magnetic susceptibility is [ ]
A) Torque per unit area B) Dipole moment per unit volume

C) Magnetization per unit magnetic field intensity D) None of these

26. One Bohr magneton μ_B is equal to [ ]

A) $\frac{4\pi m}{eh}$ B) 4πmhe C) $\frac{me}{4\pi h}$ D) $\frac{eh}{4\pi m}$

27. Relative permeability is related to magnetic susceptibility by [ ]

A) $\mu_r = 1 - \chi$ B) $\mu_r = 1 + \chi$ C) $\mu_r = \chi - 1$ D) $\mu_r = 1/\chi$

28. A field of strength 100 A/m produces a magnetization 2000 A/m in a ferromagnetic material. The relative permeability of the material is [ ]

A) 19 B) 3 C) 21 D) 1.05

29. The area enclosed by hysteresis loop is a measure of [ ]

A) Retentivity B) Susceptibility

C) Permeability D) Energy loss per cycle

30. Material which lack permanent dipoles are called_____ [ ]

A) Diamagnetic B) Paramagnetic

C) Ferromagnetic D) Ferrimagnetic

31. The permeability of free space is [ ]

A) $4\pi \times 10^{-7}$ H/m B) $4\pi \times 10^{-8}$ H/m

C) $2\pi \times 10^{-7}$ H/m D) $2\pi \times 10^{-8}$ H/m

32. The magnetic dipole moments of neighbouring atoms are antiparallel and unequal for __ magnetic material [ ]

A) Dia B) Para C) Ferri D) Anti-ferro

33. The hysteresis loss is less for _____ magnetic materials. [ ]

A) Dia B) Para C) Soft D) Hard

34. Diamagnetic susceptibility is [ ]

A) Large, negative B) Small, negative C) Small, positive D) Large, positive

35. One Bohr magneton equal to [ ]

A) 9.27×10^{-16} A m^2 B) 9.27×10^{-19} A m^2

C) 9.27×10^{-28} A m^2 D) 9.27×10^{-24} A m^2

36. Magnetic dipole moment per unit volume of material is called [ ]

A) Permeability B) Polarisation

C) Magnetisation D) Magnetic induction

37. The materials don't having permanent magnetic dipoles are [ ]

A) Diamagnetic B) Paramagnetic

C) Ferromagnetic D) Ferrimagnetic

38. The SI unit of magnetic field intensity is [ ]

A) H/m B) Wb/m^2 C) A/m D) no unit

39. One nuclear magnetron equals to [ ]

A) 9.27×10^{-24} A m^2 B) 5.05×10^{-27} A m^2

C) 5.05×10^{29} A m^2 D) 9.27×10^{24} A m^2

40. Paramagnetic susceptibility varies as [ ]

A) T^2 B) 1/T C) T D) $1/T^2$

UNIT-II – (ELECTROMAGNETIC WAVES)

1. Maxwell's equations involve [ ]
   A) Charge density B) Current density C) Magnetic Intensity D) All of these
2. Maxwell's are based on _____ Law(s) [ ]
   A) Faraday's B) Gauss's C) Ampere's D) All of these
3. Steady magnetic fields are governed by [ ]
   A) Ampere's circuital Law B) Faradays law C) Biot-Savart law D) None
4. Power density is [ ]
   A) Power delivered B) Power/area C) Both A & B D) None of these
5. The types of integral related to electromagnetic theory? [ ]
   A) Line integral B) Surface integral C) Volume integral D) All of the above
6. The velocity of electromagnetic wave is parallel to [ ]
   A) B X E B) E X B C) E D) B
7. The time varying electric and magnetic fields in space [ ]
   A) Produce EM wave which is propagated with a velocity less than velocity of light
   B) Do not produce EM wave
   C) Produce EM wave which is propagated with the velocity of light
   D) None of these
8. The electromagnetic waves do not transport [ ]
   A) Charge B) Energy C) Momentum D) Information
9. Electromagnetic waves are transverse in nature are evident by [ ]
   A) Polarization B) Interference C) Reflection D) Diffraction
10. The first experimental evidence of the existence of electromagnetic waves was provided by [ ]
    A) Maxwell B) Hertz C) J C Bose D) Marconi
11. Select wrong statement from the following
    Electromagnetic waves [ ]
    A) Are transverse B) Travel with same speed in all media
    C) Travel with the speed of light in space D) Are produced by accelerating charge
12. Which of the following are electromagnetic waves [ ]
    A) X-Rays B) γ- Rays C) β- rays D) Heat rays
13. Maxwell's equations describe the fundamental laws of [ ]
    A) Electricity only B) Magnetism only C) Mechanics only D) Both A and B
14. The face and orientation of the electric field vector linked with electromagnetic wave differ from those of the corresponding magnetic field vector, respectively by [ ]
    A) Zero and zero B) $\frac{\pi}{2}$ *and* $\frac{\pi}{2}$ C) Zero and $\frac{\pi}{2}$ D) $\frac{\pi}{2}$ *and zero*
15. An electromagnetic wave passing through vacuum is described by the equation ;
    $E = E_0 \, Sin(kx - wt)$ *and* $B = B_0 \, Sin(kx - wt)$ Then [ ]
    A) $E_0 = B_0$ B) $E_0 w = B_0 k$ C) $E_0 B_0 = wk$ D) $E_0 k = B_0 w$
16. The unit of permeability of free space μ_0 is [ ]
    A) $\frac{Henry}{metre}$ B) $\frac{Web}{amp - metre}$ C) $\frac{Newton}{amp^2}$ D) All these

17. In the propagation of electromagnetic wave, the angle between the direction of propagation and plane of polarization is [ ]
A) 0^0 B) 90^0 C) 45^0 D) 180^0

18. Velocity of electromagnetic waves in vacuum is related to the fundamental constants μ_0 *and* ε_0 as [ ]
A) $c = \sqrt{\mu_0\varepsilon_0}$ B) $c = \frac{1}{\sqrt{\mu_0\varepsilon_0}}$ C) $c = \frac{1}{\mu_0\varepsilon_0}$ D) $c = \frac{w}{\mu_0\varepsilon_0}$

19. Which of the following are non- mechanical waves? [ ]
A) Radio waves B) X-Rays C) Light waves D) All of these

20. All electromagnetic waves are [ ]
A) Non-mechanical B) Passed through vacuum C) Transverse wave nature D) All of these

21. The general wave equation is represented by [ ]
A) $\nabla^2 y = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$ B) $\nabla^2 = \frac{\partial^2 y}{\partial t^2}$ C) $\nabla^2 y = \frac{1}{\sqrt{\mu_0\varepsilon_0}}$ D) None

22. Electromagnetic wave equation for B [ ]
A) $\nabla^2 y = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$ B) $\nabla^2 B = \mu\varepsilon\frac{\partial^2 B}{\partial t^2}$ C) $\nabla^2 = \frac{\partial^2 y}{\partial t^2}$ D) $\nabla^2 = \frac{\partial^2 x}{\partial t^2}$

23. Electromagnetic wave equation for E [ ]
A) $\nabla^2 y = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$ B) $\nabla^2 E = \mu\varepsilon\frac{\partial^2 E}{\partial t^2}$ C) $\nabla^2 = \frac{\partial^2 y}{\partial t^2}$ D) $\nabla^2 = \frac{\partial^2 x}{\partial t^2}$

24. The amount of field energy passing through the unit area of the surface perpendicular to the direction of energy is called ---------- [ ]
A) Electric vector B) Magnetic vector C) Pointing vector D) Unit vector

25. The basic equations of electricity and magnetism are studied and summarized by using ---- equations/laws [ ]
A) Newton's laws B) Guss's laws C) Maxwell's D) Fermi equations

26. Curl of electrostatic field is [ ]
A) ∞ B) 1 C) 0 D) None of these

27. The sum of reflection coefficient R and transmission coefficient, i.e., R + T =--- [ ]
A) ∞ B) 1 C) 0 D) None of these

28. Electromagnetic wave obey the ------ principle [ ]
A) Superposition principle M) Josephson's principle C) Both A & B D) None of these

29. The electric field (E) and magnetic field (B) are perpendicular to each other. Therefore their dot product E.B = ------- [ ]
A) ∞ B) 1 C) 0 D) None of these

30. The speed of propagation of electromagnetic wave in vacuum is ---- speed of light? [ ]
A) Less than B) Greater than C) Equals to D) None of these

31. At the upper surface of the Earth's atmosphere, the time averaged magnitude of the Pointing vector $\langle S\rangle = 1.35\,X\,10^3\,W/m^2$, is referred to as the -------- [ ]
A) Planck's constant B) Solar constant C) Polar constant D) Boltzmann's constant

32. If the radiation is completely absorption the radiation pressure is [ ]

A) $P=\frac{I}{c}$ B) $P=\frac{3I}{c}$ C) $P=\frac{4I}{c}$ D) $P=\frac{2I}{c}$

33. If the radiation is completely Reflected the radiation pressure is [ ]

B) $P=\frac{I}{c}$ B) $P=\frac{3I}{c}$ C) $P=\frac{4I}{c}$ D) $P=\frac{2I}{c}$

34. Electromagnetic waves carries [ ]

A) Energy B) Momentum and Exert radiation pressure C) Both A & B D) None

35. If a plane electromagnetic wave is completely absorbed by surface the momentum transferred is [ ]

B) $\Delta p=\frac{\Delta U}{c}$ B) $\Delta p=\frac{3\Delta U}{c}$ C) $\Delta p=\frac{4\Delta U}{c}$ D) $\Delta p=\frac{2\Delta U}{c}$

36. If a plane electromagnetic wave is completely reflected by surface the momentum transferred is [ ]

C) $\Delta p=\frac{\Delta U}{c}$ B) $\Delta p=\frac{3\Delta U}{c}$ C) $\Delta p=\frac{4\Delta U}{c}$ D) $\Delta p=\frac{2\Delta U}{c}$

37. By increasing the wavelength of electromagnetic wave frequency is ----- [ ]

A) Increases B) Decreases C) Remains same D) None

38. Which of the following is not a electromagnetic radiation [ ]

A) UV & X-Rays B) $\alpha,\beta,\gamma rays$ C) Infrared rays D) Sound waves

39. Velocity of electromagnetic waves in vacuum is [A]

A) 3×10^8 m/s B) 13×10^8 m/s C) 6×10^8 m/s D) 9×10^8 m/s

40. To catch the picture in dark which of the following electromagnetic radiation is utilized [ ]

A) X-Rays B) $\alpha,\beta,\gamma rays$ C) Infrared rays D) Radio waves

UNIT –III – (WAVES, OPTICS & ACOUSTICS)

1. The work done by the string of a simple pendulum during one complete oscillation is equal to
   A) Total energy of the pendulum B) K.E. of the pendulum [ ]
   C) P.E. of the pendulum D) Zero
2. A particle moves in X-Y plane according to the equation of motion of the particle is [ ]
   A) On a straight line B) On an ellipse C) Periodic D)Simple harmonic
3. A mass on a spring undergoes SHM. The maximum displacement from the equilibrium is called? [ ]
   A) Period B) Frequency C) Amplitude D) Wavelength
4. In a periodic process, the number of cycles per unit of time is called? [ ]
   A) Period B) Frequency C) Amplitude D) Wavelength
5. In a periodic process, the time required to complete one cycle is called? [ ]
   A) Period B) Frequency C) Amplitude D) Wavelength E. Speed
6. Another term is used for vibration called [ ]
   A) Association B) Motion C) Oscillation D) Floatation
7. Which of the following is not necessary for SHM? [ ]
   A)Elasticity B)Inertia C)Restoring force D) Gravity
8. In which of the following oscillations the amplitude varies with time [ ]
   A)Damped oscillator B) Forced oscillator C) Undamped oscillator D)None of these

9. The unit of spring constant in SI system of units is [ ]
   A) Nm^2 B) Nm^{-1} C) Nm^{-2} D) Nm
10. The periodic motion which is not oscillatory, is [ ]
   A) Simple pendulum B) Compound pendulum
   C) Acoustic harmonic oscillator D) Motion of earth around sun
11. In which of the following oscillations the frequency is reduced with time under the influence of force [ ]
   A) Damped oscillator B) Forced oscillator C) Undamped oscillator D) None
12. A mass of 1.0 kg is attached to a spring of stiffness constant 16 N/m find the natural frequency
   A) 0.54Hz B) 0.64Hz C) 0.74Hz D) 0.84Hz [ ]
13. The formula for natural frequency of simple harmonic oscillation made by spring [ ]
   A) $n = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ B) $n = \frac{1}{\pi}\sqrt{\frac{k}{m}}$ C) $n = \frac{m}{2}\sqrt{\frac{k}{2}}$ d) $n = \frac{1}{2\pi}\sqrt{\frac{m}{k}}$
14. Wave nature of light is supported by [ ]
   A) Photoelectric effect B) Interference C) Black body radiation D) All
15. Two sources are said to be coherent if their emitted waves have [ ]
   A) Same wavelength B) Same amplitude C) Constant phase difference D) All
16. In the presence of a plane parallel film, the path difference is equal to [ ]
   $A)\ 2\mu \sin i$ B) $2\mu t \cos r$ C) $2\mu \sin r$ D) $2\mu t \cos i$
17. In Newton's rings experiment, what is the condition for dark fringes in case of reflected light.
   A) D α $\sqrt{2n+1}$ B) D α n C) D α $\sqrt{n}$ D) D α $\sqrt{2n-1}$ [ ]
18. If a light wave is refracted from air to denser medium then the phase and path difference is[ ]
   A) π and λ B) π and λ/2 C) π/2 and λ D) π/2 and λ/2
19. When the light wave is reflected from the glass-air interface, the change of the reflected wave will be [ ]
   A) 0 B) π/2 C) π/4 D) π
20. The convex lens in Newton's ring apparatus is replaced by an ordinary glass plate, then
   A) Non-interference occurs B) Circular rings are still obtained [ ]
   C) Interference takes place but the shape of fringes is irregular
   D) Straight line fringes are observed
21. When the light wave is reflected from the air-glass interface, the change of phase of the reflected wave will be [ ]
   A) 0 B) π/2 C) π/4 D) π
22. In Newton's rings experiment, what is the condition for bright fringes in case of reflected light
   A) D α $\sqrt{2n+1}$ B) D α n C) D α $\sqrt{n}$ D) D α $\sqrt{2n-1}$ [ ]
23. In a diffraction grating, the condition for principal maxima is [ ]
   A) $e \sin\theta = n\lambda$ B) $(e+d)\sin\theta = n\lambda$
   C) $d \sin\theta = n\lambda$ D) $\sin\theta = n\lambda$
24. In a single slit experiment if the slit width is reduced [ ]
   A) The fringes become narrower B) The fringes become brighter
   C) The fringes become wider D) The colour of the fringes change
25. In which experiment the screen and sources are at finite distance [ ]
   A) Fraunhofer diffraction B) Fresnel's diffraction
   C) Young's diffraction D) Newton's diffraction
26. Maximum number of orders possible with a grating is [ ]

A) Independent of grating element B) Inversely proportional to grating element
C) Directly proportional to grating element D) Directly proportional to wavelength

27. In a grating, the combined width of a ruling and a slit is called _____ [ ]
A) Diffraction B) Corresponding points C) Grating element D) None

28. Which one of the following has maximum absorption coefficient [ ]
A) Marble B) Carpet C) Human body D) Glass

29. To have good sound effect inside a hall [ ]
A) The reverberation time has to be as large as possible
B) The reverberation time has to be zero
C) The hall should not have any sound absorbing material
D) The reverberation time has to be optimum.

30. Sabine's formula is [ ]
A) $T = \frac{0.651V}{\sum aS}$ B) $T = \frac{0.165V}{\sum aS}$ C) $T = \frac{\sum aS}{0.651V}$ D) $T = \frac{\sum aS}{0.165V}$

31. The velocity of sound waves in air is [ ]
A) 120 m/s B) 420m/s C)330 m/s D) 480 m/s

32. Which one of the following has minimum absorption coefficient [ ]
A) Glass B) Felt C) Open window D) Wooden floor

33. The walls of a halls built for music concerns should [ ]
A) Amplify sound B) Reflect sound C) Transmit sound D) Absorb sound

34. The speed of propagation of ultrasonic waves _____with the increase of frequency [ ]
A) Increases B) Decreases
C) Exponentially increases D) Exponentially decreases

35. What is the range of infrasonic waves [ ]
A) 1 Hz – 20 Hz B) 20 Hz – 20 kHz C) 20 Hz – 20MHz D) All

36. Which of the following frequencies lies in the range of Ultrasonic waves [ ]
A) 10 KHz B) 8 KHz C) 6 KHz D) 1MHz

37. The branch deals with generation ,propagation and reception of sound in a room is -- [ ]
A) Acoustics B) Optics
C) Dynamics D) None

38. What is the range of audible sound [ ]
A) 1 Hz – 20 Hz B) 20 Hz – 20 kHz
C) 20 Hz – 20MHz D) All

39. The units of intensity of sound [ ]
A) Hz B) m C) m/s D) dB

40. The units of pitch of sound [ ]
A) Hz B) m C) m/s D) dB

UNIT-IV – (LASERS)

1. In He-Ne laser, the ratio of He and Ne in gas mixture is [ ]
A) 1:10 B) 10:1 C) 1:100 D) 100:1

2. He-Ne laser is a good example for a _____ level system. [ ]
A) Two B) Three C) Four D) Nine

3. In excited state, the atoms will remain for a time period of [ ]
   A) 10^{-4} sec B) 10^{-6} sec C) 10^{-8} sec D) 10^{-10} sec
4. The lasing action is possible only if there is [ ]
   A) A black body B) Population inversion
   C) A set of reflecting mirrors D) Oscillation of laser
5. The pumping process used in a He-Ne gas Laser is [ ]
   A) Optical pumping B) Electric discharge
   C) Chemical reaction D) Passing forward bias
6. He-Ne gas laser is [ ]
   A) Solid state laser B) Semiconductor laser C) Continuous laser D) Pulsed laser
7. The ratio of Einstein coefficients $\frac{A_{21}}{B_{21}} =$ [ ]
   A) $\frac{8\pi h\vartheta^3}{c^3}$ B) $\frac{8\pi h\vartheta^3}{c^2}$ C) $\frac{8\pi h\vartheta^3}{c}$ D) $\frac{2\pi h\vartheta^3}{c^3}$
8. Population inversion cannot be achieved by [ ]
   A) Optical pumping B) Chemical reaction
   C) Electric discharge D) Thermal process
9. Laser radiation is [ ]
   A) Monochromatic B) Highly directional C) Coherent and Stimulated D) All
10. The wavelength of the laser emitted by the He-Ne laser is [ ]
    A) 694.3 nm B) 632.8 nm C) 652.5 nm D) 671.6 nm
11. In a He-Ne laser, atoms involved in laser emission are [ ]
    A) Neon B) Helium C) Hydrogen D) Chlorine
12. The source of excitation in He-Ne gas laser is [ ]
    A) Xenon flash lamp B) Optical pumping C) Electric discharge D) Direct conversion
13. Emission of photon when an electron jumps from higher energy state to lower energy state due to interaction with another photon is called [ ]
    A) Spontaneous emission B) Stimulated emission
    C) Induced emission D) Amplified emission
14. Nd: YAG laser is [ ]
    A) Gas laser B) Liquid laser C) Solid laser D) Semiconducting laser
15. Measurement of variation of divergence of laser beam with distance is used to determine [ ]
    A) Coherence B) Monochromaticity C) Brightness D) Directionality
16. Coherence of light is measured from [ ]
    A) Variation in spot size with distance B) Visibility of interference fringes it produces
    C) Brightness of the beam D) Wavelength of the beam
17. Rate of stimulated emission is proportional to [ ]
    A) Population of lower energy state
    B) Population of excited state
    C) Incident radiation density
    D) Population of excited state and incident radiation density
18. What is the need to achieve population inversion? [ ]
    A) To excite most of the atoms
    B) To bring most of the atoms to ground state

C) To achieve stable condition
D) To reduce the time of production of laser

19. Which of the following can be used for generation of laser pulse? [ ]
A) Ruby laser B) Carbon dioxide laser
C) Helium neon laser D) Nd- YAG laser

20. Which of the following can be used in vibrational analysis of structure? [ ]
A) Maser B) Quarts C) Electrical waves D) Laser

21. Directionality property of laser can be used in [ ]
A) Surveying B) Remote sensing C) Lidar D) All Correct

22. In Nd-YAG laser, YAG means [ ]
A) Yttrium Aluminium Garnet B) $Y3Al5O12$
C) Yellow Aluminium Garnet D) Both A and B

23. The active medium in Nd:YAG laser is [ ]
A) Nd B) YAG crystal C) Y D) AG

24. In which region , laser emission occurs in Nd:YAG laser [ ]
A) IR region at $1.06\mu m$ B) visible region C) UV region D) RF region

25. The role of He in He-Ne laser is [ ]
A) He is an active medium B) Population inversion takes place in He
C) Stimulated emission takes place in He D) He atoms help in exciting Ne atoms

26. The reason for narrow tube in He-Ne laser [ ]
A) Atomic collision with tube wall increases
B) Atomic collision with tube wall decreases
C) There is no effect of narrow tube on He-Ne Laser
D) Atomic collision with tube wall constant

27. Population inversion in laser means [ ]
A) Number of atoms in ground state are more than number of atoms in excited state
B) Number of atoms in ground state are less than number of atoms in excited state
C) Number of atoms in ground state is equal to number of atoms in excited state
D) None

28. Metastable state has life time approximately [ ]
A) 10^{-3} s B) 10^{-8} s C) 10^{-10} s D) 10^{-12} s

29. Which of the following statements concerning a laser system is incorrect? [ ]
A) Spontaneous emission occurs in the laser system.
B) The intensity of the laser beam can be varied by changing the reflective coefficient of the partially reflecting mirror.
C) The laser system does not require an external energy source.
D) The laser medium consists of a metastable state.

30. Which one of the following statements best describes stimulated emission in a laser? [ ]
A) Electrons collide with atoms in a metastable state and cause photons to be emitted.
B) Atoms in a metastable state de-excite and cause electrons to be emitted.
C) Photons interact with atoms in a metastable state and cause photons to be emitted.
D) Photons interact with atoms in a metastable state and cause electrons to be emitted.

31. Why is laser light monochromatic? [ ]
A) The excited electrons are in a metastable state.

B) The system is in a state of population inversion.
C) The emitted photon and incident photon are of the same phase.
D) Photons of the same energy as that of the incident photons are emitted when the electrons transit down from a higher energy level.

32. What determines the color of light? [ ]
A) Its intensity B) Its wavelength C) Its source D) None

33. Which scientist first came up with the idea of stimulated emission? [ ]
A) Alexander Graham Bell B) Isaac Newton C) Arthur Schalow D) Albert Einstein

34. The life time of ground state is [ ]
A) Limited B) Unlimited C) Zero D) None

35. Pickout the monochromatic light [ ]
A) Sun light B) Tube light C) Laser D) Sodium light

36. The population of the various energy levels of a system in thermal equilibrium [ ]
A) Boltzmann distributive Law B) Stimulated emission C) Planck's Law D) None

37. Units of Planck's constant is [ ]
A) sec B) Watts C) joule-sec D) m-sec

38. If an electron excites from lower state to higher state then the process is known as [ ]
A) Absorption B) Stimulated emission C) Spontaneous emission D) All of the above

39. Coherence means [ ]
A) Ordering of light field B) Monochromaticity C) Brightness D) Directionality

40. A He-Ne laser emits light of wavelength 632.8 nm and has a output power 2.3 mW then the number of photons emitted per second is [ ]
A) 73.3×10^{14} B) 29.56×10^{14} C) 1173.5×10^{14} D) 23.5×10^{14}

UNIT-V – (PHYSICS OF NANOMATERIALS)

1. The average spacing between neighboring atoms in a typical crystal is about [ ]
A) 50 Pico meters B) 300 Pico meters C) 2 nanometers D) 5 nanometers

2. Who was the first to propose the concept behind nanotechnology (atomic precision)? [ ]
A) Galileo Galilei (1600) B) Richard P. Feynman (1959)
C) K. Eric Drexler (1977) D) Richard Smalley (1985)

3. By reducing the size of a nanomaterial, the change in the interatomic spacing is [ ]
A) Increased B) Decreased
C) First increased and then decreased D) Kept constant

4. 1 nm = [ ]
A) 10^{-9} mm B) 10^{-9} cm C) 10^{-9} m D) 10^{-9} m^2

5. Nanomaterials are catalysts because of their enhanced ____ [ ]
A) Chemical activity B) thermal activity
C) Mechanical activity D) optical activity

6. In quantum confinement effect, the energy levels of ------- changes. [ ]
A) Electrons B) Atoms C) Molecules D) Nanoparticles

7. Who first visualised the concept of nanotechnology? [ ]
A) Eric Drexler B) Richard Feynman
C) Norio Taniguchi D) Newton

8. Quantum dot is an example of [ ]
   A) 1D nanomaterial B) 2D nanomaterial C) 3D nanomaterial D) all
9. For a cubic nanoparticle of side 'a' surface area to volume ratio is given by
   A) 3/a B) 4/a C) 5/a D) 6/a [ ]
10. When the dimension of the nanoparticles is of the order of de Broglie wavelength, or mean free path of electrons, energy levels of electrons change. This effect is called _____ [ ]
    A) Surface area to volume ratio B) Quantum confinement
    C) CNT D) None
11. For nanomaterials, the surface area to volume ratio is [ ]
    A) Large B) Very large C) Small D) Very small
12. The size range of nanomaterials is [ ]
    A) 1 to 100 cm B) 1 to 100 nm C) 1 to 100 mm D) 1 to 100 µm
13. Cloths made up of nanofibres are [ ]
    A) Water repellent B) Wrinkle free C) Stress resistant D) All of these
14. In the fabrication of nanoparticles, bulk material is crushed into nanoparticles on _____ method. [ ]
    A) CVD B) Ball milling C) Plasma arching D) Sol-gel method
15. For a sphere of nanoparticles of radius r, surface area to volume ratio is given by [ ]
    A) 2/r B) 3/r C) 4/r D) 5/r
16. The technique used for the fabrication of nanomaterials [ ]
    A) Ball milling B) Sol-gel C) CVD D) All of these
17. Gold nanospheres of 100 nm appear [ ]
    A) Blue in color B) Red in color
    C) Violet in color D) Orange in color
18. Fullerene is [ ]
    A) Carbon molecule with carbon atoms arranged in a spherical shape
    B) Thin film of polymer C) Another form of diamond D) Graphite sheets
19. Carbon nanotubes are [ ]
    A) Copper tubes B) Plastic tubes
    C) Sheet of graphite rolled into a tube D) Orange in color
20. Diameter of one carbon atom is [ ]
    A) 0.5 nm B) 0.05 nm C) 0.15 nm D) 5 nm
21. Nanotechnology is the engineering of functional systems at the [ ]
    A) Atomic scale B) Molecular scale C) Structure level D) Conic scale
22. Nanomaterials are [ ]
    A) Small volume materials B) The atoms or molecules
    C) Having grain size of 1 nm D) Having domain size about 100 nm
23. Properties of nanoparticles differ from bulk materials due to presence of [ ]
    A) Less number of atoms B) More number of atoms
    C) Impurities D) More number of atoms and impurities
24. An electrochromic device is [ ]
    A) Used in solar cells
    B) Display device which displays information by changing colour when a voltage is applied
    C) A crystalline mixture

D) None of the above

25. The prefix "nano" comes from a Greek word meaning ------- [ ]
A) Billion B) Dwarf C) Invisible D) Infinite

26. Which of the following wave lengths for electromagnetic radiation (light) is within the visible spectrum? [ ]
A) 1 nm B) 100 nm C) 500 nm D) 1 μm

27. A quantum dot is [ ]
A) An object that changes it properties upon addition or removal of a single electron
B) A mathematical operator used in string theory, and represented by the character
C) A hole in spacetime
D) An electromagnetic vacuum fluctuation

28. In the fabrication of nanoparticles, microcrystalline structures are broken down to nano crystalline structures in [ ]
A) Chemical vapour deposition B) Ball milling C) Plasma arching D) Sol-gel method

29. The advantages of sol-gel technique in the fabrication of nanomaterial is [ ]
A) It is a low temperature process B) The product can be obtained from any form
C) It is polished to optical quality D) All of the above

30. The size of red blood cell is [ ]
A) 700 nm B) 30 nm C) 100 nm D) 1 nm

31. The size of virus is [ ]
A) 700 nm B) 30 nm C) 100 nm D) 1 nm

32. Crystal growth is an example of --------- technique [ ]
A) Bottom up B) Top down C) Both A & B D) None of above

33. Due to quantum confinement, in nanoparticles electronic bands become ------- [ ]
A) Wider B) Disappear C) Narrower D) None of above

34. Preparation of nanomaterial by slicing or successive cutting of a bulk material to get nano sized particles [ ]
A) Bottom up B) Top down C) Both A & B D) None of above

35. Quantum well lasers and high quality optical mirrors are fabricated using ---- technique [ ]
A) Bottom up B) Top down C) Both A & B D) None

36. What is graphene? [ ]
A) Anew material made from carbon nanotubes
B) A one atom thick sheet of carbon
C) Thin film made from fullerenes
D) A software tool to measure and graphically represent nanoparticles

37. What is "self assembled mono layers"? [ ]
A) Atoms are molecules that spontaneously form uniform single lawyers
B) A type of clothing that gets thicker in response to colder temperatures
C) An optical device that puts itself together
D) A fuzzy logic circuit

38. Quantum coupling refers to [ ]
A) Interaction or energy exchange on the quantum level
B) The method used by nanoscale life forms for reproduction
C) Supra-paramagnetic oscillations within quantum well devices

D) None of the above

39. Which of the following products contain nanoscale manufactured parts or materials? [ ]
A) Sunscreens B) Tennis balls C) Device that read computer hard drives D) All

40. FET stands for [ ]
A) Field effect thermostat B) Field effect transistor
C) Field effect triode D) Function effect table

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