University of Mumbai Examination

Program: _First Year (All Branches) Engineering - SEM-II

Curriculum Scheme: Rev 2019

Engineering Physics-II

Question Bank

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	In holography, which of the following optical phenomena are involved?
Option A:	interference, diffraction
Option B:	polarization, diffraction
Option C:	interference, refraction
Option D:	reflection, diffraction
2.	By observing the diffraction pattern, the two spectral lines are said to be just resolved when
Option A:	The central maxima of one coincides with central maxima of the other
Option B:	The central maxima of one do not coincide with first maxima of the other
Option C:	The central maxima of one coincides with the first minimum of the other
Option D:	The central maxima of one do not coincide with the first minimum of other
3.	A step-index fibre has a numerical aperture of 0.26, a core refractive index of 1.5 and a core diameter of 100 μ m. Calculate the acceptance angle.
Option A:	1.47 degree
Option B:	15.07 degree
Option C:	2.18 degree
Option D:	24.15 degree
4.	Find the divergence of the field $\overline{F} = 30\hat{i} + 2xy\hat{j} + 5xz^2\hat{k}$ in Cartesian co-ordinates
Option A:	2x(1+5Z)
Option B:	2x(1+5k)
Option C:	12
Option D:	10
5.	Which ratio decides the efficiency of nano substances?
Option A:	Weight/volume
Option B:	Surface area/volume
Option C:	Volume/weight
Option D:	Pressure/volume
6.	_____ transformation are replaced by the Lorentz transformation which confirms the postulate of relativity
Option A:	Galilean
Option B:	Maxwell
Option C:	Planck's
Option D:	Newtons
7.	Maximum number of orders available with a grating is
Option A:	Independent of grating element.
Option B:	Directly proportional to grating element.

Option C:	Inversely proportional to grating element
Option D:	Directly proportional to wavelength.
8.	In holography
Option A:	only phase information is recorded
Option B:	only amplitude information is recorded
Option C:	both phase and amplitude get recorded
Option D:	neither phase nor amplitude gets recorded
9.	Find the value of "a" for which the vector 3i+2j+9k and i+aj+3k are perpendicular
Option A:	-40
Option B:	-13
Option C:	-15
Option D:	-10
10.	Calculate acceptance angle for an optical fibre whose core R.I.is 1.48 & cladding R.I.is 1.39
Option A:	10^0
Option B:	40.5^0
Option C:	30.5^0
Option D:	20^0
11.	An object whose length is 60m moves at a speed of 0.6 c. What is the length of the object according to a stationary observer?
Option A:	48m
Option B:	60m
Option C:	21m
Option D:	40m
12.	Scanning Electron Microscope (SEM) produces
Option A:	3-dimensional image
Option B:	2-dimensional image
Option C:	4-dimensional image
Option D:	6-dimensional image
13.	What is the principle of fibre optical communication?
Option A:	Frequency modulation
Option B:	Population inversion
Option C:	Total Internal Reflection
Option D:	Doppler effect
14.	The radiation emission process (emission of a photon at frequency) can occur in _____ ways.
Option A:	Two
Option B:	Three
Option C:	Four
Option D:	One
15.	Which property of nanoparticles provides a driving force for diffusion?
Option A:	Optical Properties
Option B:	High surface area to volume ratio

Option C:	Sintering
Option D:	There is no such property
16.	If ‘a’ is the width of the slits and b the distance between the slits, then a + b is called as
Option A:	Opacities
Option B:	Grating constant
Option C:	Transparency
Option D:	Lattice constant
17.	Which of the following is not an example of bottom-up approach for the preparation of nanomaterials?
Option A:	Sol-Gel
Option B:	Molecular self-assembly
Option C:	Mechanical grinding
Option D:	Chemical Vapour Deposition
18.	A beam of monochromatic light is incident on a plane transmission grating having 5000 lines/cm and the second order spectral line is found to be diffracted at 30°. The wavelength of the light is
Option A:	4000 Å
Option B:	5000 Å
Option C:	6000 Å
Option D:	7000 Å
19.	The length of a rod in a moving frame will be _____ to the observer in a rest frame.
Option A:	unchanged
Option B:	dilated
Option C:	contracted
Option D:	doubled
20.	Where type of pumping is used in ND: YAG Laser?
Option A:	Electrical pumping
Option B:	Direct conversion
Option C:	Collision of electron
Option D:	Optical pumping
21	A frame of reference has four coordinates, x, y, z, and t is referred to as the_____
Option A:	Inertial frame of reference
Option B:	Non-inertial frame of reference
Option C:	Space-time reference
Option D:	Four-dimensional plane
22.	The total electric flux through any closed surface surrounding charges is equal to the amount of charge enclosed". The above statement is associated with
Option A:	Coulomb's square law
Option B:	Gauss's law
Option C:	Maxwell's first law
Option D:	Maxwell's second law
23.	Maxwell's equation derived from Faraday’s law is

Option A:	$\vec{\nabla} . \vec{H}$= J
Option B:	$\vec{\nabla} . \vec{D}$= I
Option C:	$\vec{\nabla} \times \vec{E}$= −dB/dt
Option D:	$\vec{\nabla} \times \vec{B}$= −dH/dt
24.	A vector V is irrotational if
Option A:	$\vec{\nabla} . \vec{V} = 0$
Option B:	$\vec{\nabla} \times \vec{V} = 0$
Option C:	$\vec{\nabla} . \vec{V} = \vec{\nabla} \times \vec{V}$
Option D:	$(\vec{\nabla} \times \vec{V})$. V=0
25.	According to Einstein theory of relativity, _____ in vacuum is the same in every inertial frame.
Option A:	the speed of light
Option B:	the intensity of light
Option C:	the speed of particle
Option D:	the mass of particle
26.	Which of the following Einstein's coefficient represents stimulated emission
Option A:	A_{12}
Option B:	A_{21}
Option C:	B_{12}
Option D:	B_{21}
27.	What is the effective distance between the source of light and the screen in Fraunhofer Diffraction?
Option A:	Focal length of the convex lens
Option B:	Less than Focal Length of the convex lens
Option C:	Greater than the focal length of the convex lens and less than infinite
Option D:	Infinite

28.	Pumping is done in order to achieve
Option A:	Steady state
Option B:	Population inversion
Option C:	Equilibrium
Option D:	Photon emission
29.	The Maxwell's equation, $\vec{\nabla} . \vec{B} = 0$ signifies
Option A:	No electric field
Option B:	Non-existence of a mono pole
Option C:	Variation of magnetic field
Option D:	No magnetic field
30.	Nanomaterials are the materials with at least one dimension measuring less than
Option A:	1nm
Option B:	10nm
Option C:	100nm
Option D:	1000nm
31.	What is the meaning of grating element for a diffraction grating
Option A:	It is the width of a single slit

Option B:	It is the width of the opaque space
Option C:	It is the distance between two slits
Option D:	It is the width of diffraction grating
32.	Which of the following is an example of top-down approach for the preparation of nanomaterials?
Option A:	Gas phase agglomeration
Option B:	Molecular self-assembly
Option C:	Ball milling
Option D:	Sol-Gel
33.	The numerical aperture of a fiber if the angle of acceptance is 15 degrees, is
Option A:	0.17
Option B:	0.26
Option C:	0.50
Option D:	0.75
34.	According to Einstein's Special Theory of Relativity, laws of physics can be formulated based on
Option A:	Inertial Frame of Reference
Option B:	Non-Inertial Frame of Reference
Option C:	Both Inertial and Non-Inertial Frame of Reference
Option D:	Quantum State
35.	Maximum number of modes supported in step index fibre is _____.
Option A:	$\frac{V^2}{2}$
Option B:	$\frac{V^2}{3}$
Option C:	$\frac{V^2}{4}$
Option D:	$\frac{V}{2}$
36	Which type fibre can overcome multimode dispersion?
Option A:	step index fibre
Option B:	graded index fibre
Option C:	single mode step index fibre
Option D:	multi mode step index fibre
37.	Which of the following is Einstein's mass energy relation?
Option A:	$E_k = (m - m_0)c^2$
Option B:	$E = mc^2$
Option C:	$E^2 - p^2c^2 = m_0^2c^4$
Option D:	$E_k = mv^2/c^2$
38.	What is the region enclosed by the optical cavity called?
Option A:	Optical Region
Option B:	Optical System
Option C:	Optical box
Option D:	Optical Resonator
39.	Which of the following is not a property of emitted light in stimulated emission?
Option A:	incoherent
Option B:	unidirectional

Option C:	monochromatic
Option D:	high intensity
40.	In semiconductor diode laser, the lasing action takes place when the diode is _____
Option A:	unbiased
Option B:	reverse biased
Option C:	forward biased
Option D:	in equilibrium

Descriptive Questions

1.	Explain the construction and reconstruction of hologram.
2.	Explain top down and bottom up approaches to prepare nanomaterials.
3.	Light is incident normally on a grating 0.25 cm wide with 1250 lines. Find the angular separation of the two sodium lines in the first order spectrum. Can they be seen distinctively if the lines are 5895 Å & 5901 Å.
4.	Derive the expression of numerical aperture for a step index fiber. A light ray enters an optical fiber from air. The fiber has core refractive index 1.52 and cladding refractive index 1.41. Find the Critical angle and Numerical aperture.
5.	Find the divergence and curl of a vector $\vec{A}= x^2 y\,\hat{i} + (x-y)\,\hat{k}$.
6.	State the advantages of optical fiber cables on conventional electrical cables.
7.	What are different techniques to synthesize nanomaterials? Explain any one of them in detail.
8.	With neat energy level diagram describe the construction and working of a He-Ne Laser. What are its merits and demerits? What is the role of helium atoms?
9.	Discuss the phenomenon of Fraunhofer's diffraction at a single slit and obtain the condition for the first minimum. Calculate the maximum order of diffraction maxima seen from plane transmission grating with 2500 lines per inch if light of wavelength 6900 Å falls normally on it.
10.	What is a grating? Define grating element? Discuss the phenomenon of Fraunhofer's diffraction at a grating and obtain the expression for the intensity?
11.	Compute the maximum radius allowed for a fiber having core refractive index 1.5 and 1.48. the fiber is to support only one mode at a wavelength of 1500 nm.
12.	What is population inversion state? Explain its significance in the operation of LASER.
13.	Draw the schematic diagram of Scanning Electron Microscope and explain its construction, working, advantages, disadvantages and applications.
14.	Derive Maxwell's third equation in integral and differential form. Given that $\vec{D} = 20x\,\hat{i} + 10\,\hat{j}$ (C/m^2). Determine the flux crossing 1 m^2 area that is normal to the x-axis at x = 5m.
15.	Distinguish between step index and graded index optical fiber.
16.	Distinguish between single mode and multimode optical fiber.
17.	How is multipath dispersion overcome in Graded index fibre?
18.	What is importance of resonant cavity in the operation of laser?

19.	A diffraction grating used at normal incidence gives a line, $\lambda 1 = 6000$ A° in a certain order superimposed on another line$\lambda 2 = 4500$ A° of the next higher order. If the angle of diffraction is 30°, how many lines are there in a cm in the grating?
20.	Explain the working of atomic force microscope in detail.
21.	If $\phi(x,y,z) = 3x^2y - y^3z^2$, Find $\vec{\nabla}\phi$ at the point (-1, -2, 1).
22.	Given $\vec{A} = x^2yi + (x-y)k$, find $\vec{\nabla} . \vec{A}$
23.	A step index fiber has a core diameter of 29 $x10^{-6}$ m. the refractive indices of core and cladding are 1.52 And 1.5189 respectively. If the light of wavelength 1.3 μm is transmitted through the fiber, determine. Normalized frequency of the fiber.
24.	Derive Gauss law for static electric and magnetic field in differential and integral form.
25.	What is the highest order spectrum, which may be seen with monochromatic light of wavelength 6000 A° by means of a diffraction grating with 5000 lines/cm?
26.	Explain the concept of time dilation and deduce an expression for it. A particle moving with a speed of 0.7c. Calculate the ratio of the rest mass and mass while in motion.
27.	Explain the construction and working of a Transmission Electron microscope with a schematic diagram.
28.	State Maxwell's equations in differential form in a medium, in the presence of charges and currents.
29.	Describe any two methods to synthesize nanomaterials.
30.	Describe the physical significance of gradient, Divergence and Curl.
31.	If $\vec{A} = xy\,\boldsymbol{i} - 8xy^2\boldsymbol{z^2}\,\boldsymbol{j} + 2\boldsymbol{xyz}\boldsymbol{k}$. Find $\vec{\nabla} . \vec{A}$ at point (1,-2, 4).
32.	Derive the expression for the Numerical aperture for a step index fiber.
33.	Draw and explain energy level diagram of Nd: YAG Laser.
34.	Prove that $x^2+y^2+z^2-c^2t^2$ is invariant under Lorentz transformation.
35.	What is length contraction? Derive the expression for the same?
36.	State Maxwell's all four equations and give the significance of each.
37.	Calculate the number of modes of a step index optical fibre of diameter 40 $\boldsymbol{\mu m}$ if its core and cladding refractive indices are 1.5 and 1.46, respectively. Wavelength of light used is 1.5 $\boldsymbol{\mu}$m
38.	When a frame of reference is said to be a non-inertial frame of reference? Give an example.
39.	What is Galilean transformation? Derive Galilean transformation equations for position and time.
40.	Describe the fiber optics communication system with block diagram