MLFO End Semester Exam 2021 (Div - F)

* Required

Section 2- Solve (1 marks each)

In which type of fibre, Refractive index of core is not uniform. It is maximum along the axis of core and decreases towards core cladding boundary. *

○ Multimode index fibre

○ Step index fibre

○ Graded index fibre

○ All the above.

According to the wave function and its first partial derivative should be _____ functions for all values of x

○ Zero

○ Infinity

○ Imaginary

○ Continuous

Which of the following loss occurs inside the fibre? *

○ Radiative loss

○ Scattering

○ Absorption

○ Attenuation

If φ is a scalar point function. Then ∇ φ is a _____ *

○ Vector quantity

○ Scalar quantity

○ All the above

○ Null vector

What is the angular momentum vector in an orbital motion? *

○ The vector is perpendicular to the orbital plane

○ The vector is along the radius vector

○ The vector is parallel to the linear momentum

○ The vector is in the orbital plane

The optical cavity consists of *

○ cylindrical mirror

○ a set of plain mirrors

● a pair of parallel mirrors

○ concave mirrors

If the Lagrangian is cyclic in qj , then: *

○ pj is not conserved.

○ pj is conserved.

○ qj appears in the Lagrangian.

○ qj (i.e., dqj/dt) does not appear in the Lagrangian.

○ the Lagrangian is circular.

A laser beam of wavelength 1000 nm has a coherence time 1 x 10^-5 s. What is the value of coherence length (l) ? *

○ 3x10^5 m

○ 1x10^3 m

● 3x10^3 m

○ 3x10^-5 m

In He-Ne laser, the possible transition among 3s and 2s groups to the level of 3p and 2p are which of the following? *

○ λ = 3.39 μm

○ λ = 0.633 μm

○ λ = 1.15 μm

◉ All the above

A single mode fibre has low intermodal dispersion than multimode. *

◉ True

○ False

If the lagrangian does not depend on time explicitly *

○ The Hamiltonian is constant

○ The Hamiltonian cannot be constant

○ The kinetic energy is constant

○ The Potential energy is constant

By what percentage does the kinetic energy increase, if the linear momentum is increased by 50% *

○ 25%

○ 50%

○ 100%

○ 125%

How does the refractive index vary in Graded Index fibre? *

○ Tangentially

○ Radially

○ Longitudinally

○ Transversely

The work done of vectors force F and distance d, separated by angle θ can be calculated using, *

○ Cross product

○ Dot product

○ Addition of two vectors

○ Cannot be calculated

When a particle is bounded to a limited space, then the probability of finding the particle at a finite distance can be *

○ Infinite

○ 1/2

◉ Cannot say

○ None of these

Consider two satellites A and B revolving around the earth in circular orbits with radii RA and RB. Their periods TA and TB are 8h and 1h, respectively. The ratio RA/RB is equal to *

○ 8^3/2

○ 8

◉ 4

○ 8^1/2

The energy of the particle in one dimensional closed box of width a *

○ Increases with width

○ Decreases with width

○ Is independent of width

○ Zero

Three particles moving in space so that the distance between any two of them always remain fixed have degree of freedom equal to *

○ 1

○ 3

○ 6

◉ 9

Find the Maxwell equation derived from Faraday's law. *

○ Div(H) = J

○ Div(D) = I

○ Curl(E) = -dB/dt

○ Curl(B) = -dH/dt

Find the ratio of population of two states in a HeNe laser that produces a wavelength λ = 6328 Å at 27°C = 300 K. *

○ 1.8 x 10^-33

◉ 1.1 x 10^-33

○ 0.1 x 10^-33

○ 2.1 x 10^-33

Which among the following functions represent physically acceptable wave functions? *

○ A sec(x)

◉ 3 Sin(px)

○ A exp(x^-2)

○ x

The dot product of two vectors is a scalar. The cross product of two vectors is a vector. State True/False. *

◉ True

○ False

The motion of planets in the solar system is an example of conservation of *

○ Energy

○ Linear momentum

◉ Angular momentum

○ Mass

The cross product of the vectors 3i + 4j − 5k and −i + j − 2k is *

○ 3i − 11j + 7k

◉ -3i + 11j + 7k

○ -3i − 11j − 7k

○ -3i + 11j − 7k

A non-holonomic constrain may be expressed in the form of *

○ Equality

◉ Inequality

○ Vector

○ None of these

In a material at 400 K two energy levels have a wavelength separation of 2.5 μm. Determine the ratio of upper to lower energy level occupation densities (N2/N1) when the material is in thermal equilibrium. *

○ 1.4 x 10^-21

◉ 5.5 x 10^-7

○ 1.4 x 10^-7

○ 5.5 x 10^-21

Constraints that can be expressed as equations of coordinates and time, i.e., by an expression of the form f (r1, r2, r3, . . ., t) = 0, are said to be: *

○ Holonomic

○ Nonholonomic

○ Scleronomous

○ Hieronymus

○ Cruciform

When two vectors are perpendicular, their *

○ Dot product is zero

○ Cross product is zero

○ Both are zero

○ Both are not necessarily zero

The wavelength of de-Broglie wave associated with a particle at rest is *

○ h/mv

○ h/v

○ Zero

○ Infinite

Which of the following is not true? *

○ A . (B . C) = scalar value

○ A . (B x C) = scalar value

◉ A x (B . C) = scalar value

○ A x (B x C) = vector value

For the central force problems, which of the following statements are true? *

○ The angular momentum of the particle about the center of the force is always conserved.

○ The orbit of the particle is one of the trajectories: circle, ellipse, hyperbola, and parabola.

○ When the energy E < 0, the trajectory is always closed.

○ The motion of a particle can be three dimensional in some situations (assume classical physics).

What is the principle of fibre optical communication? *

○ Frequency modulation

○ Population inversion

◉ Total internal reflection

○ Doppler Effect

When more than one mode is propagating, how is it dispersed? *

○ Dispersion

○ Material dispersion

◉ Inter-modal dispersion

○ Waveguide dispersion

An operator representing observable dynamical variable has _____ value *

○ always zero

○ Infinite

○ Real

○ none of these

Which one of the following is true for the above system? *

○ The acceleration of the comet is maximum when it is closest to the sun

○ The linear momentum of the comet is a constant

○ The comet will return to the solar system after a specified period

○ The kinetic energy of the comet is a constant

_____ constraints are independent of time. *

○ Holonomic

○ Non-Holonomic

○ Scleronomous

○ Rheonomous

Find the de Broglie wavelength of a 15keV electron. *

○ 0.1 A0

○ 0.2 A0

○ 0.3 A0

○ 0.4 A0

The reduced mass: *

○ has lost weight.

○ we account for the inertia properties in a 2-body problem reduced to an equivalent 1-body problem.

○ is m1 + m2 for 2-body system with the two bodies having masses m1 and m2.

○ the smaller of the two masses in a 2-body system.

○ the larger of the two masses in a 2-body system.

The wavelength at which the spectral energy density of emitted radiation at temperature T from a black body attains maximum value is proportional to

○ 1/T

○ T

○ T^-4

○ T^-3/2

Why is laser light monochromatic? *

○ The excited electrons are in a metastable state.

○ The system is in a state of population inversion.

○ The emitted photon and incident photon are of the same phase.

○ Photons of the same energy as that of the incident photons are emitted when the electrons transit down from a higher energy level.

Generalized coordinates *

○ Depends on each other

○ Independent on each other

○ necessarily spherical coordinates

○ May be Cartesian coordinate

A step-index fibre has a numerical aperture of 0.26, a core refractive index of 1.5 and a core diameter of 100micrometer. Calculate the acceptance angle. *

○ 1.47°

○ 15.07°

○ 2.18°

○ 24.15°

Find the divergence of the field, P = x2yz i + xz k *

○ xyz + 2x

○ xyz + 2z

○ 2xyz + x

○ 2xyz + z

The Photoelectric effect occurs with *

○ Only bound electrons in an atom

○ Free electrons in metals

○ Both bound as well as free electrons

○ Secondary electrons

To produce laser action the following conditions should be satisfied: *

○ Population inversion

○ Stimulated emission

○ Cavity resonator

○ All the above

What is the band gap of blue light emitted from laser (λ = 380 nm). *

○ 3.8 eV

○ 3.2 eV

○ 5.3 eV

○ 1.8 eV

The Schrodinger equation for a particle *

○ Contain third order time derivative

○ Contain second order time derivative

○ Contain first order time derivative

○ None of these

If a ray of light in denser medium is directed at an angle greater than critical angle, the ray of light does not suffer refraction in rarer medium. But it is reflected back into the denser medium. This reflection is called _____. *

○ Dispersion

○ Diffraction

○ Total internal reflection

○ None of the above

Calculate the numerical aperture of an optical fibre whose core and cladding are made of materials of refractive index 1.6 and 1.5 respectively. *

○ 0.55

○ 55.77

○ 0.24

○ 0.64

In free space, the Maxwell equation can be written in which of the following ways, (a) $\nabla . D = 0$ (b) $\nabla . B = 0$ (c) $\nabla . D = \rho$ (d) $\nabla \times H = - dB/dt$ *

○ Option a, b, c are correct.

○ Only option c is correct.

○ Option a, b, d are correct.

○ All are correct.

An X-ray beam of wavelength 1 Angstrom (A0) is scattered through an angle of 900. How much will be the Compton shift?

○ 0.0212 A0

◉ 0.0243 A0

○ 0.0221 A0

○ 0.0486 A0

Hamilton's principle is an example of a: *

○ force

○ Hamiltonian.

○ Lagrange multiplier.

○ stationary point.

○ variational principle.

The ratio of Einstein's coefficients B21/A21 is *

◉ C^3/8 πhυ^3

○ C^2/8 πhυ^3

○ 8 πhυ^3 /C^3

○ 6 πhυ^3 /C^3

The minimum number of nodes of a state wave function of particle in infinite square well is/are *

○ 1

○ 2

○ 3

○ 4

The Eigen value of a particle in a box of length "L" is _____ *

○ L/2

○ 2/L

○ sqrt (L/2)

○ sqrt (2/L)

Rayleigh-Jeans law is correct only in the *

○ Low wavelength region of black body radiation spectrum

● High wavelength region

○ Entire wavelength region

○ none of these

What is the acceleration of the rolling sphere at the center of the plane with inclination, θ to the horizontal? *

○ Zero

○ Less than g sin θ

○ Greater than g sin θ

○ g sin θ

Find the gradient of the function given by, x2 + y2 + z2 at (1,1,1) *

○ i + j + k

○ 2i + 2j + 2k

○ 2xi + 2yj + 2zk

○ 4xi + 2yj + 4zk

_____is dependent only on the refractive indices of the core and cladding material. *

○ Acceptance angle

○ Critical Angle

○ Incident angle

○ Numerical Aperture

Which one of the following statements best describes stimulated emission in a laser? *

○ Photons interact with atoms in a metastable state and cause photons to be emitted.

○ Electrons collide with atoms in a metastable state and cause photons to be emitted.

○ Atoms in a metastable state de-excite and cause electrons to be emitted.

○ Photons interact with atoms in a metastable state and cause electrons to be emitted.

Back   Next

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