UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Program:	B.Sc., LL.B. (Hons.) IPR/FHEL/MFL	**Semester**	: I
Subject (Course):	PHYSICS	**Max. Marks**	: 100
Course Code :	CLNL 1033	**Duration**	: 3 Hrs
No. of page/s:	03		

SECTION A

[10 x 1 =10]

1. When a few drops of oil spread on a water surface, it displays beautiful colours in daylight because of
   a. Dispersion of light
   b. Polarization of light
   c. Interference of light
   d. Reflection of light
   (co1)

2. The resolving power of a telescope is highest amongst the following for
   a. Blue light
   b. Red light
   c. Violet light
   d. Green light
   (co1)

3. The phenomenon of Polarization in light proves
   a. Corpuscular nature of light
   b. Longitudinal wave nature of light
   c. Transverse wave nature of light
   d. Quantum nature of light
   (co1)

4. Two photons recede from each other. Their relative velocity would be
   a. 0
   b. c/2
   c. 2c
   d. c
   (co3)

5. An n – type semiconductor is
   a. Negatively charged
   b. Positively charged
   c. Electrically neutral
   d. None of the above
   (co4)

6. The need for population inversion in a laser is
   a. To bring most atoms in the ground state
   b. To bring most atoms to an excited state
   c. To bring most atoms to a stable state
   d. None of the above
   (co2)

7. Monochromatic light of wavelength 'λ', is incident on a grating with transparent strips of width 'a' separated by opaque strips of width 'b'. The angular separation between the different orders of the spectrum would depend on
   a. 'a'
   b. 'b'
   c. 'λ'
   d. 'a', 'b' and 'λ'
   (co1)

8. A Nicol's prism may be used to
   a. Only produce polarized light
   b. Only analyze polarized light
   c. Both produce and analyze polarized light
   d. Undo polarization of light

9. A cube when moved along one of its faces at very high speed will look like a
   a. Rectangle
   b. Cube
   c. Sphere
   d. Rectangular parallelepiped

(co3)

10. In a Young's double slit arrangement, if the light source is changed from red to violet one
    a. Fringe width decreases
    b. Fringe width increases
    c. Fringe width becomes non-uniform
    d. Fringe width remains the same

(co1)

SECTION B

[5 x 4 = 20]

11. In what way is Laser light different from that obtained from the other conventional light sources, like the filament bulbs? (co2)

12. What is the effect on the fringe system obtained by a Young's double slit arrangement if,
    a) Intensity of light from one of the slits is decreased,
    b) Separation between the two slits is reduced?

(co1)

13. Explain the concept of 'Time dilation' in the Special Theory of Relativity.

(co3)

14. What is elliptically polarized light? [Hint: illustrating with diagram would help!]

(co1)

15. What is 'depletion region' in a P-N junction diode? (co4)

OR

15. What is the effect of introduction of a thin transparent slab before the slits in a Young's double slit arrangement? (co1)

SECTION C

16. A researcher observes that a certain atom A moving with velocity 2.0×10^8 m/s relative to him emits a particle B, which moves with a velocity 2.8×10^8 m/s with respect to the atom. Calculate the velocity of the emitted particle B with respect to the researcher. [7]

(co3)

17. A pulsed laser emits radiation of wavelength 8000 Å. If it emits 10^{17} photons per pulse, calculate the energy of the laser pulse. [7]

(co2)

OR

17. Calculate the minimum number of lines in a grating, which would just resolve lines of wavelengths, 6000 Å and 6010 Å. [Hint: For simplification of calculations use λ=6000Å]

[7]

18. A ray of light is incident on the surface of a transparent plate of refractive index √3 at the polarizing angle. Calculate the angle of refraction of the ray.   [6]

(co1)

SECTION D

19. What is polarized light? How would you detect plane, circularly and elliptically polarized light?   [3+12]

(co1)

20. Discuss Fraunhoffer diffraction at a single slit. Derive the expression for light intensity at a screen due to Fraunhoffer diffraction at a single slit. Discuss the intensity pattern in brief.   [3+12+5]

(co1)

21. State the postulates of Special Theory of Relativity. Show that when an object moves with velocity 'v' (v → c) relative to a fixed frame, its measured length appears contracted (shorter) in the direction of motion. Discuss if the contraction is real?   [4+8+3]

(co3)

OR

21. Describe briefly the Einstein's co-efficients (as related to radiation), and derive the relation between them.   [5+10]

(co2)

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SECTION A

[10 x 1 =10]

1. Interference of waves have been observed with
   e.   Light waves
   f.   Water waves
   g.   Sound waves
   h.   All of above

   (co1)

2. Which property of light is confirmed by diffraction
   e.   Wave nature
   f.   Both of above
   g.   Corpuscular nature
   h.   None of above

   (co1)

3. The transverse nature of light is shown by the phenomenon of
   e.   Interference
   f.   Polarization
   g.   Diffraction
   h.   All of above

   (co1)

4. Two photons approach each other. Their relative velocity would be
   e.   0
   f.   c/2
   g.   2c
   h.   c

   (co3)

5. An p – type semiconductor is
   e.   Negatively charged
   f.   Positively charged
   g.   Electrically neutral
   h.   None of the above

   (co4)

6. The need for population inversion in a laser is
   e.   To bring most atoms in the ground state
   f.   To bring most atoms to an excited state
   g.   To bring most atoms to a stable state
   h.   None of the above

   (co2)

7. The capacity of an optical instrument to show separate images of very closely placed two objects is called
   e.   Interference power
   f.   Resolving power
   g.   Diffracting power
   h.   Optical power

   (co1)

8. A Nicol's prism is based on the action of

e. Refraction of light
f. Double refraction of light
g. Reflection of light
h. Undo polarization of light

(co1)

9. A square when moved along one of its faces at very high speed will look like a
   e. Rectangle
   f. Cube
   g. Sphere
   h. Rectangular parallelepiped

(co3)

10. In a Young's double slit arrangement, if the light source is changed from blue to green one
    e. Fringe width decreases
    f. Fringe width increases
    g. Fringe width becomes non-uniform
    h. Fringe width remains the same

(co1)

SECTION B

[5 x 4 = 20]

11. What are the differences between a spontaneous emission and a stimulated emission?

(co2)

12. What is the effect on the fringe system obtained by a Young's double slit arrangement if,
    a) Intensity of light from one of the slits is increased,
    b) Separation between the two slits is increased.

(co1)

13. Explain the concept of 'velocity addition' in the Special Theory of Relativity.

(co3)

14. What is elliptically polarized light? [Hint: illustrating with diagram would help!]

(co1)

15. What is a 'barrier' in a P-N junction diode?

(co4)

OR

15. What is the effect of introduction of a thin transparent slab after one of the slits in a Young's double slit arrangement?

(co1)

SECTION C

16. What would be the length of a one metre long stick moving parallel to its length, when its mass is 1.6 times its rest mass?   [7]

(co3)

17. A pulsed laser emits radiation of wavelength 8000 Å. If it emits 10^{17} photons per pulse, calculate the energy of the laser pulse.   [7]

(co2)

OR

17. Calculate the minimum number of lines in a grating, which would just resolve lines of wavelengths, 5000 Å and 5010 Å. [Hint: For simplification of calculations use λ=5000Å]

[7]

(co1)

18. When a ray of light is incident on the surface of a transparent plate at an angle of 53 degrees, the reflected light is found to be fully polarized. Find the angle of refraction and the refractive index of the plate. [6]

(co1)

SECTION D

19. What is polarized light? Give a scheme to detect the different components, i.e., unpolarized, plane, circularly and elliptically polarized ones, of a given light? [3+12]

(co1)

20. Discuss Fraunhoffer diffraction at multiple slits. Discuss the intensity pattern, the different maxima and minima in it. Give a practical application of this type of diffraction. [5+12+3]

(co1)

21. State the postulates of Special Theory of Relativity. Show that watches in moving frames appear to go slow for observers in stationary frame. Discuss if this time dilation is real?

[4+8+3]

(co3)

OR

21. Explain the concept of population inversion in a laser. Describe in detail the action of a He-Ne laser. State briefly its advantageous over some other lasers. [3+9+3]

(co2)