## VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

College with Potential for Excellence
Residential \& Autonomous - A Gurukula Institute of Life-Training Re-accredited ( ${ }^{\text {rd }} \mathrm{Cycle}$ ) with 'A' Grade (CGPA 3.59 out of 4.00 ) by NAAC
[Affiliated to Madurai Kamaraj University]
B.Sc. Maths \& Chemistry Degree (Semester) Examinations, April 2021 Part - III: Allied Subject: Second Semester: Paper - I

ALLIED PHYSICS - II
Under CBCS - Credit 4
Time: $\mathbf{3}$ Hours
Max. Marks: 75

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. The phenomenon of superposition of two coherent waves in the region of superposition
a) Interference
b) Reflection
c) Diffraction
d) Polarization
2. The phenomenon of bending of light waves around corners and their spreading into the geometrical shadow of an object is called
a) Interference
b) Polarization
c) Diffraction
d) Reflection
3. The vector atom model is an extension of $\qquad$
a) Bohr atom model
b) Rutherford atom model
c) Bohr- Sommerfeld atom model
d) Thomson atom model
4. The limited number of electrons in M shell is
a) 2
b) 8
c) 18
d) 32
5. The formula for mass defect is
a) $\mathrm{M}-\mathrm{M}$
b) $\mathrm{M}-\mathrm{N}$
c) $\mathrm{M}-\mathrm{A}$
d) $\mathrm{N}-\mathrm{N}$
6. The energy equivalent of a mass unit is
a) 950.00 MeV
b) 931.49 MeV
c) 933.12 MeV
d) 940.34 MeV
7. According to the theory of relativity, which of the following always remains constant?
a) Length of an object
b) time
c) space
d) velocity of light
8. For length contraction
a) $\ell=\ell_{\text {o }}$
b) $\ell>\ell_{o}$
c) $\ell<\ell_{o}$
d) $\ell \mathrm{X} \ell{ }_{o}$
9. Which of the following gate having only one input and one output?
a) AND
b) OR
c) NOT
d) NOR
10. Zener diodes are used as
a) rectifier
b) switch
c) voltage regulator
d) oscillator

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. What is diffraction grating?
12. State Pauli exclusion principle.
13. Define mass defect.
14. Define Binding energy.
15. Write down the postulates of theory of relativity.
16. Draw the logic symbol for AND and OR gate.
17. What is LED?

## SECTION - C

## Answer ALL Questions

$(5 \times 5=25)$
18. a) Descirbe the theory of working of plane transmission grating.

## [OR]

b) A parallel beam of monochromatic light is allowed to be incident normally on a plane grating having 1250 lines per cm and a second spectral line is observed to be deviated thorugh $30^{\circ}$. Calculate the wavelength of the spectral line.
19. a) Explain the different quntum numbers associated with the vector atom model.

## [OR]

b) The experimental value of Bohr magnetron is $9.21 \times 10^{-24}$ SI units and planck's constant $\mathrm{h}=6.6 \times 10^{-34}$ joule second. Calculate the value of $\mathrm{e} / \mathrm{m}$ of an electron.
20. a) Distinguish between nuclear fission and nuclear fusion

## [OR]

b) An ionization chamber is connected to an electrometer of capacitance 0.5 pF and the voltage sensitivity of 4 divisions per volt. A beam of $\alpha$ particles causes a deflection of 0.8 divisions. Calculate the number of ion pairs required and the energy of the $\alpha$ particles.

Given that 1 ion pair requires energy of 35 eV and $\mathrm{e}=1.6 \times 10^{-19}$ coulomb.
21. a) Derive Einstein mass energy relation
[OR]
b) Calculate the rest energy of an electron in joules and in electron volts.
22. a) State and prove DeMorgan's thoerem.

## [OR]

b) Prove that $(A+B)(A+C)=A+B C$

## $\underline{\text { SECTION - D }}$

## Answer any THREE Ouestions

$(3 \times 10=30)$
23. Explain about the construction and use of a half shade polarimeter to measure the specific rotatory power of a sugar cane solution.
24. Describe Stern and Gerlach experiment and indicate the importance of the results obtained.
25. Describe the liquid drop model of the nucleus.How can the semiemprical mass formula be derived from it?
26. Using Lorentz transformation equations explain length contraction and time dilation.
27. Describe how a zener diode can be used as a voltage regulator.

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[Affiliated to Madurai Kamaraj University]
B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - III: Core Subject: Second Semester: Paper - I
THERMODYNAMICS AND STATISTICAL MECHANICS
Under CBCS - Credit 4
Time: 3 Hours
Max. Marks:

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. Unit of thermal conductivity is
a) J/kg.K
b) J/mol.K
c) J.ohm $/ \mathrm{sec} \cdot \mathrm{K}^{2}$
d) $\mathrm{W} / \mathrm{m} . \mathrm{K}$
2. Thermal diffusivity of a substance is
a) proportional of thermal conductivity (K)
b) inversely proportional to K
c) proportional to $\mathrm{K}^{2}$
d) inversely proportional to $\mathrm{K}^{2}$
3. According to Van der Waal's gas equation, critical coefficient $\mathrm{RT}_{\mathrm{c}} / \mathrm{P}_{\mathrm{c}} \mathrm{V}_{\mathrm{c}}$ is equal to
a) 8
b) 3
c) $3 / 8$
d) $8 / 3$
4. The value of critical volume $\mathrm{V}_{\mathrm{c}}$ according to Van der Waal's equation is
a) $V_{c}=b$
b) $V_{c}=3 b$
c) $V_{c}=2 b$
d) $V_{c}=4 b$
5. In Carnot cycle, the first step is
a) isothermal expansion
b) isothermal compression
c) adiabatic expansion
d) adiabatic compression
6. In an isochoric process, which of the following is constant
a) volume
b) pressure
c) temperature
d) entropy
7. The value of probability of an event cannot be

## SECTION - C

a) zero
b) 1
c) $1 / 2$
d) negative
8. The particles obeying Maxwell-Boltzmann statistics are
a) identical
b) identical and indistinguishable
c) distinguishable
d) identical and distinguishable
9. Fermions have spin value
a) $1 / 2$
b) 1
c) 0
d) 2
10. Which of the following statistics obeys pauli's exclusion principle
a) M.B. statistics
b) F.D. statistics
c) B.E. statistics
d) classical statistics

## $\underline{\text { SECTION - B }}$

## Answer any FIVE Ouestions

$(5 \times 2=10)$
11. State Widemann Franz Law
12. What is solar constant?
13. Write down the Van der Waals equation of state for a gas.
14. State Zeroth law of thermodynamics.
15. Define the efficiencyof carnot engine.
16. What is phase space?
17. Define Fermi energy.

## Answer ALL Questions

18. a) Describe Lee's method to find the coefficient of thermal conductivity of metals.

## [OR]

b) The opposite faces of a metal plate of 0.2 cm thickness are at a difference of temperature of $100^{\circ} \mathrm{C}$ and the area of the plate is $200 \mathrm{sq} . \mathrm{cm}$. Find the quantity of heat will flow through the plate in one minute if $\mathrm{K}=0.2$ CGS units.
19. a) Derive and discuss the Van der Waal's equation of sate of a gas.

## [OR]

b) Calculate the values of Van der Waal constants a and b in Van der Waal's equation for He , when critical pressure is $0.23 \times 10^{6} \mathrm{~N} / \mathrm{m}^{2}$ and critical volume is $58 \times 10^{-8} \mathrm{~m}^{3} / \mathrm{mol}, \mathrm{Pc}=37.2 \mathrm{~atm}, \mathrm{R}$ per mole $=82.07 \mathrm{~cm}^{3}$ atoms $\mathrm{K}^{-1}$.
20. a) State and prove Carnot's theorem.

## [OR]

b) Find the efficiency of a Carnot's engine working between $127^{\circ} \mathrm{C}$ and
$27^{\circ} \mathrm{C}$. It absorbs 80 cals of heat. How much heat is rejected.
21. a) Discuss additive law of probability.

## [OR]

b) An urn contains 4 black and 3 white balls. What is the probability that on two successive draws, the balls drawn are both black?
22. a) Derive Fermi-dirac distribution law

## [OR]

b) Calculate the value of Fermi energy at absolute temperature.

## $\underline{\text { SECTION - D }}$

## Answer any THREE Questions

$\mathbf{( 3 \times 1 0 = 3 0 )}$
23. Discuss in detail about Forbe's method for finding the coefficient of thermal conductivity of a metal bar.
24. Describe about the porous plug experiment and mention their conclusions have been drawn from it. What is inversion temperature?
25. Describe Carnot's cycle and obtain an expression for the efficeny of an ideal heat engine working between $\mathrm{T}_{1}$ and $\mathrm{T}_{2}$
26. Derive Maxwell Boltzmann energy distribution law.
27. Compare the Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac

Statistics.

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B.Sc. Physics Degree (Semester) Examinations, April 2021 Part - III: Core Subject: Second Semester: Paper - II

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. The phase difference for constructive interference
a) $0,2 \pi, 4 \pi$,
b) $\pi, 3 \pi, 5 \pi, \ldots$.
c) $0, \pi / 2, \pi, 3 \pi / 2$,
d) zero
2. The ratio between phase difference and path difference is
a) $\frac{2 \pi}{\lambda}$
b) $\frac{\lambda}{2 \pi}$
c) $\frac{\pi}{\lambda}$
d) $\frac{3 \pi}{\lambda}$
3. The bending or spreading of waves that encounter an object in their path is called
a) Interference
b) Diffraction
c) Polarization
d) refraction
4. Dispersion ' $D$ ' of a grating is
a) $\frac{\Delta \theta}{\Delta \lambda}$
b) $\frac{\Delta \lambda}{\Delta \theta}$
c) $\frac{m \lambda}{d}$
d) $\frac{m}{\cos \theta}$
5. Transverse nature of light is best shown by
a) interference
b) diffraction
c) polarization
d) refraction
6. In doubly refracting crystals, the varying parameter of the extraordinary ray is $\qquad$
a) velocity
b) refractive index
c) both a and b
d) none
7. The average acceleration in one time period in a simple harmonic motion is
a) $\mathrm{A} \omega^{2}$
b) $\mathrm{A} \omega^{2} / 2$
c) $\mathrm{A} \omega$
d) zero
8. A particle moves in a circular path, with a uniform speed. Its motion is
a) periodic
b) simple harmonic
c) oscillatory
d) angular simple harmonic
9. Mechanical waves can be longitudinal or transverse in $\qquad$
a) solid
b) liquid
c) gas
d) all the above
10. In traveling sound waves, the displacement variations are $\qquad$ . out of phase with pressure
a) $45^{\circ}$
b) $90^{\circ}$
c) $120^{\circ}$
d) $135^{\circ}$

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. Define the term constructive interference.
12. Define the term coherence.
13. State Bragg's law.
14. Define polarization.
15. What is a Simple Harmonic Oscillator?
16. What is damped harmonic motion?
17. Differentiate compressions and rarefactions in sound waves.

## SECTION - C

## Answer ALL Questions:

$(5 \times 5=25)$
18. a) Write a note on total internal reflection.

## [OR]

b) Green light of wavelength $5100 \mathrm{~A}^{0}$ from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 200 cm away
is 2 cm . Find the slit separation.
19. a) Write a note on Holography.

## [OR]

b) In a plane transmission grating the angle of diffraction for the second order principal maximum for the wavelength $5 \times 10^{-5} \mathrm{~cm}$ is $30^{0}$.
Calculate the number of lines in 1 cm of the grating surface.
20. a) Describe the process of polarization by reflection.
[OR]
b) Calculate the thickness of double refracting plate capable of producing a path difference of $\lambda / 4$ between extraordinary and ordinary waves.
Given: $\lambda=5890 \mathrm{~A}^{0}, \mu_{0}=1.53, \mu_{e}=1.54$.
21. a) Describe the working of Simple Pendulum.
[OR]
b) The period of a disk of radius 10.2 cm executing small oscillations about a pivot at its rim is measured to be 0.784 sec . Find the value of g , the acceleration due to gravity at that location.
22. a) Describe the theory of interference in sound waves.

## [OR]

b) Spherical sound waves are emitted uniformly in all directions from a point source, the radiated power P being 25 W att. What are the intensity and the sound level of the sound wave a distance $\mathrm{r}=2.5 \mathrm{~m}$ from the source?

## SECTION - D

## Answer any THREE Questions: $\quad(\mathbf{3} \times \mathbf{1 0}=\mathbf{3 0})$

23. Explain the working principle of Michelson's interferometer. Also how to measure the changes in the length by means of interference fringes.
24. Explain the theory of double slit interference and diffraction combined.
25. Illustrate the phenomena of double refraction.
26. Compare Simple Harmonic Motion and Uniform Circular Motion.
27. Explain sound wave as
i) pressure wave
ii) displacement wave


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B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - III: Core Subject: Fourth Semester: Paper - I
ANALOG ELECTRONICS
Under CBCS - Credit 4
Time: 3 Hours

## SECTION - A

## Answer ALL Ouestions

$(10 \times 1=10)$

1. A crystal diode has
a) one $p n$ junction
b) two $p n$ junctions
c) three $p n$ junctions
d) four $p n$ junctions
2. A Zener diode is used as
a) an amplifier
b) a voltage regulator
c) a rectifier
d) a multivibrator
3. The base of a transistor is $\qquad$ doped
a) heavily
b) moderately
c) lightly
d) infinitely
4. In a transistor
a) $I_{c}=I_{E}+I_{B}$
b) $\mathrm{I}_{\mathrm{B}}=\mathrm{I}_{\mathrm{C}}+\mathrm{I}_{\mathrm{E}}$
c) $\mathrm{I}_{\mathrm{E}}=\mathrm{I}_{\mathrm{C}}-\mathrm{I}_{\mathrm{B}}$
d) $\mathrm{I}_{\mathrm{E}}=\mathrm{I}_{\mathrm{C}}+\mathrm{I}_{\mathrm{B}}$
5. Transistor biasing represents $\qquad$ conditions
a) a.c
b) d.c
c) both a.c \& d.c
d) thermal
6. The final stage of a multistage amplifier uses
a) RC coupling
b) transformer
c) direct coupling
d) impedance coupling
7. An oscillator converts
a) a.c. power into d.c. power
b) d.c. power into a.c. power
c) mechanical power into a.c. power
d) d.c. to oscillation
8. The $Q$ of a crystal is of the order of
a) 100
b) 1000
c) 50
d) more than 10,000
9. Modulation is done in
a) transmitter
b) radio receiver
c) between transmitter and radio receiver
d) transreceiver
10. The major advantage of FM over AM is
a) reception is less noisy
b) higher carrier frequency
c) smaller bandwidth
d) small frequency deviation

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. Define the term rectifier efficiency
12. What is operating point?
13. What do you meant by transistor biasing
14. Give the two advantages of phase shift oscillator.
15. Define modulation
16. What is ripple factor?
17. Draw the symbol of n-channel and p-channel JFET

## SECTION - C

## Answer ALL Questions

$(5 \times 5=25)$
18. a) Derive an expression for the efficiency of a half wave rectifier

## [OR]

b) A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed constant at $20 \Omega$. The transformer r.m.s. secondary voltage from centre tap to each end of secondary is 50 V and load resistance is $980 \Omega$. Find
i) the mean load current
ii) the r.m.s. value of load current
19. a) Write a brief note on transistor load line analysis

## [OR]

b) A JFET has a drain current of 5 mA . If $\mathrm{I}_{\mathrm{DSS}}=10 \mathrm{~mA}$ and
$\mathrm{V}_{\mathrm{GS}(\mathrm{off})}=-6 \mathrm{~V}$, find the value of
i) $V_{G S}$
ii) $V_{P}$
20. a) Describe the base resistor method in detail
[OR]
b) In a transistor amplifier when the signal changes by 0.02 V , the base current changes by $10 \mu \mathrm{~A}$ and collector current by 1 mA . If collector load $\mathrm{R}_{\mathrm{C}}=5 \mathrm{k} \Omega$ and $\mathrm{R}_{\mathrm{L}}=10 \mathrm{k} \Omega$ find: i) current gain
ii) input impedance
iii) a.c. load
iv) voltage gain
v) power gain
21. a) With a neat diagram, explain the Colpitt's oscillator

## [OR]

b) A 1 pF capacitor is available. Choose the inductor values in a Hartley oscillator so that $\mathrm{f}=1 \mathrm{MHz}$ and $\mathrm{m}_{\mathrm{v}}=0.2$
22. a) Explain the general principles of radio broadcasting, transmission and reception

## [OR]

b) The r.m.s. value of carrier voltage is 100 V . After amplitude modulation by a sinusoidal of voltage, the r.m.s. value becomes 110 V .

Calculate the modulation index

## $\underline{\text { SECTION - D }}$

## Answer any THREE Questions

$(3 \times 10=30)$
23. Describe the action of the following filter circuits:
i) capacitor filter
ii) choke input filter
iii) capacitor input filter
24. Briefly explain the construction and working of a JFET
25. Discuss in detail about the RC coupled transistor amplifier with a neat circuit diagram
26. Describe the OP-AMP applications
27. Explain the amplitude modulation and its limitations

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B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - III: Core Subject: Fourth Semester: Paper - II
NUMERICAL METHODS
Under CBCS - Credit 4
Time: 3 Hours

## SECTION - A

## Answer ALL Questions

1. Newton Raphson method is also called
a) Method of tangents
b) Method of Chords
c) Bisection method
d) All the above
2. Regula - Falsi method is also known as a $\qquad$
a) Method of tangents
b) Method of chords
c) Method of false position
d) Method of slopes
3. Gauss-Elimination method of solving Simultaneous Linear Algebraic Equation is
a) direct method
b) indirect method
c) iterative method
d) interactive method
4. To ensure that the following system of equations,

$$
\begin{aligned}
2 x_{1}+7 x_{2}-11 x_{3}= & 6 \\
x_{1}+2 x_{2}+x_{3}= & -5 \\
7 x_{1}+5 x_{2}+2 x_{3}= & 17
\end{aligned}
$$

converges using Gauss-Seidel Method, one can rewrite the above equations as follows:
a) $\left[\begin{array}{ccc}2 & 7 & -11 \\ 1 & 2 & 1 \\ 7 & 5 & 2\end{array}\right]\left[\begin{array}{l}x_{1} \\ x_{2} \\ x_{3}\end{array}\right]=\left[\begin{array}{c}6 \\ -5 \\ 17\end{array}\right]$
b) $\left[\begin{array}{ccc}7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11\end{array}\right]\left[\begin{array}{l}x_{1} \\ x_{2} \\ x_{3}\end{array}\right]=\left[\begin{array}{c}17 \\ -5 \\ 6\end{array}\right]$
c) $\left[\begin{array}{ccc}7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11\end{array}\right]\left[\begin{array}{l}x_{1} \\ x_{2} \\ x_{3}\end{array}\right]=\left[\begin{array}{c}6 \\ -5 \\ 17\end{array}\right]$
d) The equations cannot be rewritten in a form to ensure convergence
5. Gauss forward interpolation formula is applicable if $u$ is $\qquad$

## SECTION - C

a) zero
b) one
c) between 0 and 1
d) greater than 1
6. Newton's forward interpolation formula is used to interpolate the value of $y$ is $\qquad$
a) nearer to the beginning
b) nearer to the end
c) nearer to the middle
d) nearer to one third
7. In Interpolation techniques the value of $u$ is given by
a) $u=\left(x-x_{0}\right) / h$
b) $u=\left(x_{0}-h\right) / x$
c) $u=h x / x_{0}$
d) $u=x_{x} / h$
8. In Simpson's ( $1 / 3)^{\text {rd }}$ Rule the number of intervals $\qquad$
d) multiple of 6
a) odd
b) even
c) multiple of 3
9. The differential equation $2 \frac{d y}{d x}+x^{2} y=2 x+3, y(0)=5$ is
a) linear
b) nonlinear
c) linear with fixed constants d) undeterminable to be linear or nonlinear
10. In which of the following method, we approximate the curve of solution by the tangent in each interval.
a) Picard's method
b) Runge-Kutta method
c) Newton's method
d) Euler's method

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. Give an example for transcendental equation.
12. Write down the iterative formula of Newton-Raphson method.
13. What do you mean by Simultaneous Linear Algebraic Equations?
14. How do you find the solution of simultaneous linear algebraic equations by Gauss-Elimination method?
15. Give the main features of Gregory-Newton's forward interpolation formula.
16. Write down the Newton-Cote's quadrature formula.
17. Write down the equations of Second order Runge-Kutta algorithm

## Answer ALL Questions

$(5 \times 5=25)$
18. a) Find the positive root of $x-\cos x=0$ by bisection method.

## [OR]

b) Find the positive root of $f(x)=2 x^{3}-3 x-6=0$ by Newton-Raphson method correct to five decimal places.
19. a) Solve the system of equations by Gauss-Elimination method

$$
\begin{aligned}
& x+2 y+z=3 \\
& 2 x+3 y+3 z=10 \\
& 3 x-y+2 z=13
\end{aligned}
$$

[OR]
b) Solve by Gauss-Seidel method, the following system

$$
\begin{aligned}
& 28 x+4 y-z=32 \\
& x+3 y+10 z=24 \\
& 2 x+17 y+4 z=35
\end{aligned}
$$

20. From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for polices maturing at age 46 and 63

| Age x : | 45 | 50 | 55 | 60 | 65 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Premium y : | 114.84 | 96.16 | 83.32 | 74.48 | 68.48 |

[OR]
b) Apply Gauss's forward formula to find $\mathrm{f}(\mathrm{x})$ at $\mathrm{x}=3.5$ from the table below

| $\mathbf{x}:$ | 2 | 3 | 4 | 5 |
| :--- | :---: | :---: | :---: | :---: |
| $\mathbf{f ( x ) :}$ | 2.626 | 3.454 | 4.784 | 6.986 |

21. a) The table given below reveals the velocity ' $v$ ' of a body during the time ' $t$ ' specified. Find its acceleration at $t=1.1$.

| $\mathbf{t :}$ | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{v}:$ | 43.1 | 47.7 | 52.1 | 56.4 | 60.8 |
| $[\mathbf{O R}]$ |  |  |  |  |  |

b) Evaluate $\int_{-3}^{3} x^{4} d x$ using i) Trapezoidal rule ii) Simpson's rule
22. a) Using Taylor series method, find correct to four decimal places, the value of $y(0.1)$, given $d y / d x=x^{2}+y^{2}$ and $y(0)=1$.
[OR]
b) Using Euler's method, Solve numerically the equation $y^{\prime}=x+y$, $\mathrm{y}(0)=1$ for $\mathrm{x}=0.0$ (0.2) (1.0). Check your answer with exact solution.

## SECTION - D

## Answer any THREE Questions:

23. Solve $e^{x}-3 x=0$ by the method of iteration.
24. Solve by Gauss-Elimination method

$$
\begin{aligned}
& 3 x+4 y+5 z=18 \\
& 2 x-y+8 z=13 \\
& 5 x-2 y+7 z=20
\end{aligned}
$$

25. Find the values of y at $\mathrm{x}=21$ and $\mathrm{x}=28$ from the following data

| $\mathbf{x}:$ | 20 | 23 | 26 | 29 |
| :--- | :---: | :---: | :---: | :---: |
| $\mathbf{v}:$ | 0.3420 | 0.3907 | 0.4384 | 0.4848 |

26. Evaluate the integral $I=\int_{4}^{5.2} \log _{e}^{x} d x$ using Trapezoidal and Simpson's rules.
27. Solve $d y / d x=x+y$ given $y(1)=0$ and get $y(1.1), y(1.2)$ by Taylor series method.

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B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - III: Core Subject: Sixth Semester: Paper - I
NUCLEAR PHYSICS
Under CBCS - Credit 4
Time: 3 Hours

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. The empirical formula for the nuclear radius $(R)$ is
a) $\mathrm{r}_{0} \mathrm{~A}^{2 / 3}$
b) $r_{0} A^{1 / 3}$
c) $r_{0} A^{5 / 3}$
d) $r_{0} A^{9 / 3}$
2. The Betatron is a device to accelerate
a) protons
b) electrons
c) neutrons
d) mesons
3. The Geiger-Nuttal law is
a) $\log \lambda=\mathrm{A}+\mathrm{B} \log \mathrm{C}$
b) $\log \lambda=A+B \log R$
c) $\log \lambda=A+B \log N$
d) $\log \lambda=A+B \log M$
4. Radioactivity was discovered by
a) Henri Becqerel
b) Rutherford
c) Maxwell
d) Bohr
5. The half-life of neutron is
a) 13 hours
b) 13 minutes
c) 13 seconds
d) 13 days
6. Isotope of carbon used for archaeological dating is
a) $\mathrm{C}^{13}$
b) $\mathrm{C}^{12}$
c) $\mathrm{C}^{14}$
d) $\mathrm{C}^{11}$
7. Which of the following part in a nuclear reactor minimizes the neutron leakage?
a) shield
b) control rods
c) reflector
d) moderator
8. What type of reaction takes place in sun?
a) spontaneous fission
b) nuclear fission
c) nuclear fusion
d) double beta decay
9. What type of elementary particles are electrons?
a) Quarks
b) Photons
c) Leptons
d) Gluons
10. What particle is made up of two 'down' quarks and one 'up' quark?
a) atom
b) proton
c) neutron
d) electron

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. Distinguish between isotones and isomers.
12. What is packing fraction of a nucleus?
13. Define Half life period.
14. State the Geiger's law.
15. Define threshold energy.
16. What is chain reaction in nuclear reactor?
17. State Hubble's law.

## SECTION - C

## Answer ALL Questions

$(5 \times 5=25)$
18. a) Explain Yukawa's meson theory of nuclear forces.
[OR]
b) A cyclotron in which the flux density is 1.4 T is employed to accelerate proton. How rapidly should the electric field between the dees be reversed? Mass of the proton $=1.67 \times 10^{-27} \mathrm{~kg}$ and charge $=1.6 \times 10^{-19} \mathrm{C}$
19. a) Describe experiment to determine the wavelength of gamma rays.

## [OR]

b) 1 gram of radium is reduced by 2.1 mg in 5 years by $\alpha-$ decay.

Calculate the half life period of radium.
20. a) Write the basic properties of the neutron.
[OR]
b) The Q value of the $\mathrm{Na}^{23}(\mathrm{n}, \alpha) \mathrm{F}^{20}$ reaction is -5.4 MeV . Determine the threshold energy of the neutron for this reaction.
[Given : mass of incident $=1.008665 \mathrm{u}$ and mass of target $=22.9898 \mathrm{u}$ ]
21. a) Discuss the Bohr Wheeler theory of nuclear fission.

## [OR]

b) A reactor is developing energy at the rate of 300 kW . How many atoms of $\mathrm{U}^{235}$ undergo fission per second? How many kilogram of $\mathrm{U}^{235}$ would be used in 1000 hours of operation that on an average energy of 200 MeV is released per fission.
22. a) Summaries the four basic fundamental interactions between the elementary particles
[OR]
b) Using the baryon number and the strangeness number conservation laws, find which of the following reactions is allowed:
i) $\pi-p \rightarrow \Lambda^{0}+K^{0}$
ii) $\pi-p \rightarrow \Lambda^{0}+\pi^{0}$

## SECTION - D

## Answer any THREE Questions $\quad(\mathbf{3} \times \mathbf{1 0}=\mathbf{3 0})$

23. Explain liquid drop model of the nucleus brining out the analogies
between a small drop of a liquid and a nucleus.
24. Compare the properties of alpha, beta and gamma particles.
25. Explain the applications of radio isotopes.
26. Describe the construction and working of a nuclear reactor to generate electric power.
27. Explain about the theory of Quark model and its compositions in detail.

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## B.Sc. Phys

B.Sc. Physics Degree (Semester) Examinations, April 2021

## Part - III: Elective Subject: Sixth Semester: Paper - I

QUANTUM MECHANICS AND RELATIVITY
Under CBCS - Credit 5
Time: 3 Hours
Max. Marks: 75

## SECTION - A

## Answer ALL Questions:

$(10 \times 1=10)$

1. For an electron, the minimum energy needed to escape from a particular metal surface is called $\qquad$ of the metal.
a) work function
b) ionization energy
c) quantum energy
d) potential energy
2. Momentum of a massless particle is related to its energy by $\mathrm{E}=$ $\qquad$
a) $\mathrm{p} / \mathrm{c}$
b) pc
c) $c / p$
d) $\mathrm{pc}^{2}$
3. The quantity whose variations make up matter waves is called $\qquad$
a) pressure
b) electric field
c) magnetic field
d) wave function
4. de Broglie's wave velocity or phase velocity $\mathrm{V}_{\mathrm{p}}=$ $\qquad$
a) $c^{2} / v$
b) c/v
c) $\mathrm{V} / \mathrm{c}$
d) c V
5. Uncertainty in energy and time is given by
a) $\Delta \mathrm{E} \Delta \mathrm{t}=\hbar / 2$
b) $\Delta \mathrm{E} \Delta \mathrm{t}=\hbar$
c) $\Delta \mathrm{E} \Delta \mathrm{t} \geq \hbar / 2$
d) $\Delta E \Delta t=0$
6. Total energy operator is defined as
a) $i \hbar \partial / \partial t$
b) $\hbar \partial / \partial \mathrm{t}$
c) i $\partial / \partial \mathrm{t}$
d) $(\hbar / i) \partial / \partial t$
7. Steady state Schrodinger's equation using Hamiltonian operator is
a) $\mathrm{H} \psi_{\mathrm{n}}=\mathrm{E}_{\mathrm{n}} \psi_{\mathrm{n}}$ b) $\mathrm{H} \psi_{\mathrm{n}}=\mathrm{U}_{\mathrm{n}} \psi_{\mathrm{n}}$
c) $\mathrm{H} \psi_{\mathrm{n}}=\mathrm{T}_{\mathrm{n}} \psi_{\mathrm{n}}$
d) $H \psi_{\mathrm{n}}=\mathrm{V}_{\mathrm{n}} \psi_{\mathrm{n}}$
8. Energy levels are equally spaced in the case of $\qquad$

## SECTION - C

a) hydrogen atom
b) particle in a box
c) harmonic oscillator
d) all the above
9. Length contraction happens only
a) perpendicular to direction of motion b) along the direction of motion
c) parallel to direction of motion
d) parallel to the $Z$ axis
10. An object moving with the speed of light, the mass of an object is
a) zero
b) infinity
c) finite
d) not measurable

## SECTION - B

## Answer any FIVE Questions

11. What is photoelectric effect?
12. What do you understand by the term "photoelectric cell"? Mention the three types of photoelectric cells.
13. Distinguish dispersive and nondispersive medium based on the concept of phase velocity and group velocity.
14. Write down the Schrodinger's time dependent and time independent equation in three dimensions.
15. What is wavefunction? Discuss the properties of wavefunctions.
16. Express the equation of continuity of probability density.
17. What is meant by frame of reference? Define inertial and non-inertial frames.

## Answer ALL Questions

$(5 \times 5=25)$
18. a) With necessary theory, explain the Millikan's experimental verification of Einstein's photoelectric equation.

## [OR]

b) The photoelectric threshold for a metal is $3000 \AA$. Find the kinetic energy of the electron ejected from it by radiation of wavelength $1200 \AA$.
19. a) Give an account of Heisenberg's uncertainty principle. Outline an idealized experiment to bring out its significance.

## [OR]

b) Find the de Broglie wavelength associated with (i) A 46 gm golf ball with velocity $36 \mathrm{~m} / \mathrm{s}$. (ii) an electron with a velocity of $10^{7} \mathrm{~m} / \mathrm{s}$. Which one of these two show wave character and why?
20. a) Setup the Schrodinger's equation for a one-dimensional potential barrier and obtain the expression for transmission co-efficient.
[OR]
b) Calculate the expectation values of position and momentum of a particle trapped in a one-dimensional box.
21. a) Explain the importance of various postulates of Quantum Mechanics.
[OR]
b) Explain the significance of probability current density in Quantum Mechanics.
22. a) Derive the Lorentz transformation equations.

## [OR]

b) How fast would rocket have to go relative to an observer for its length
to be contracted to $99 \%$ of its length at rest?

## SECTION - D

## Answer any THREE Questions <br> $(3 \times 10=30)$

23. Describe the Richardson and Compton experiment and explain the observations made from the experiment. State the laws of photoelectric emission.
24. Describe the Davisson and Germer experiment on the diffraction of electrons and explain the significance of the results.
25. Formulate the Schrodinger's equation for a linear harmonic oscillator and solve it to obtain its energy eigen values and eigen functions.
26. Setup the Schrodinger's equation and obtain the values of the energy for a particle trapped in a square well of three-dimensions.
27. Describe the Michelson-Morley experiment and explain the physical significance of negative results obtained.

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B.A. \& B.Sc. Degree (Semester) Examinations, April 2021

Part - IV: Non-Major Elective Subject: Second Semester: Paper - I
ELECTRICAL HOME APPLIANCES
Under CBCS - Credit 2
Time: 2 Hours
Max. Marks: 75

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. A wire coming from the ground from an electrode plate is
a) Transformer
b) Earthing
c) $l a m p$
d) heater
2. Name the electrolyte used in the lead acid cell
a) $\mathrm{NH}_{4} \mathrm{Cl}$
b) $\mathrm{H}_{2} \mathrm{SO}_{4}$
c) HCl
d) $\mathrm{D}_{2} \mathrm{O}$
3. The composition of fuse wire is
a) Lead + Tin
b) Zinc + Tin
c) Boron + lead
d) Lead + Zinc
4. Multimeter measure
a) Voltage
b) Current
c) Resistance
d) all
5. Ohm's law is $\qquad$
a) $V=I \times R$
b) $R=V / I$
c) $I=V / R$
d) $\mathrm{R}=\mathrm{VI}$
6. LED stands for $\qquad$
a) Light Emitting diode
b) Light Emission diode
c) Light Emitting detector
d) Light Effective diode
7. The Mica is an example for
a) Conductors
b) Insulators
c) Semiconductors
d) Resistance
8. One Horse Power is $\qquad$
a) 476 Watt
b) 746 watt
c) 647 watt
d) 647 watt
9. Which of the following used for control the electric fire
a) sand
b) water
c) woolen cloth
d) acid
10. Multimeter measure
a) voltage
b) current
c) resistance
d) all

## $\underline{\text { SECTION - B }}$

## Answer any FIVE Questions

$$
(5 \times 2=10)
$$

11. What is a fuse?
12. What is A.C?
13. What is D.C?
14. What is a transformer?
15. List out the types of transformer.
16. What is choke?
17. Darw the symbol for
i) a.c
ii) earth

## SECTION - C

## Answer ALL Questions

$(3 \times 9=27)$
18. a) What precautions should be observed while working or handling the electrical appliances and equipments in home?

## [OR]

b) Explain about the Single, two and three phase power supply.
b) Explain
19. a) Differentiate between A.C and D.C

## [OR]

b) Explain about LED and its functions.
20. a) Explain the construction and operating instructions of electric mixer.

## [OR]

b) Explain about the parts and function of iron box.

## $\underline{\text { SECTION - D }}$

## Answer any TWO Questions

$(2 \times 14=28)$
21. What is earthing? What is the necessity of earthing using in the electrical appliances and machines.
22. Briefly describe about the construction of transformer and also mention its advantages.
23. Discuss briefly about the various types of lamp.
24. Discuss about the electric and water heater.


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B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - IV: Skill Based Subject: Fourth Semester: Paper - I

Time: 2 Hours

## SECTION - A

## Answer ALL Questions

( $10 \times 1=10$ )

1. When the Moon's shadow crosses the Earth's surface, the eclipse occurred is
a) Solar eclipse
b) lunar eclipse
c) blue moon
d) super nova
2. Most familiar and characteristics features on the moon are its
a) Mountains
b) craters
c) maria
d) volcanoes
3. The dark region of sunspot is
a) chromosphere
b) umbra
c) photosphere
d) transition region.
4. The temperature of the corona is
a) 15 MK
b) 2 MK
c) 4 MK
d) 6 MK
5. A white dwarf is $\qquad$ star
a) new born
b) dead
c) living
d) burst
6. A star emits its maximum energy at $\qquad$ wavelength.
a) short
b) long
c) medium
d) ratio
7. Mass of our galaxy is about $\qquad$ billion times that of the sun
a) 200
b) 250
c) 100
d) 100
8. The spiral galaxies according to their size of the nuclei are classified into three groups
a) b,c,d
b) a,d,c
c) a,b,d
d) a,b,c
9. The ability of a telescope to separate the angular distance between neighbouting stars is called
a) dispersive power
b) dispersion
c) resolving power
d) resolution
10. The size of the image increases as the $\qquad$ increases
a) focal point
b) focal length
c) focal ration
d) focal value

## SECTION - B

## Answer any FIVE Questions

$$
(5 \times 2=10)
$$

11. What is maria?
12. What is sunspot?
13. Define Protostar.
14. What is a Star model?
15. What are irregular galaxies?
16. List out the four catergories of galaxies.
17. What is a radio telescope?

## SECTION - C

## Answer ALL Questions

$(3 \times 9=27)$
18. a) Explain solar and lunar eclipse with neat diagram.
[OR]
b) Explain sunspot cycle in detail.
19. a) Derive the expression for luminosity of a star.
[OR]
b) Explain strcture of milky way galaxy with suitable diagram.
20. a) Compare between the reflecting and refracting telescope.
[OR]
b) Explain the atmosphere of the earth.

## SECTION - D

## Answer any TWO Questions

$(2 \times 14=28)$
21. Explain Big Bang theory in detail.
22. Explain about the different stages of star.
23. Mention the classification of galaxies and explain its strcture with relavant diagram.
24. Explain refracting and reflecting telescopes in detail.

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B.Sc. Physics Degree (Semester) Examinations, April 2021 Part - IV: Skill Based Subject: Sixth Semester: Paper - I

NANOTECHNOLOGY
Under CBCS - Credit 2
Time: 2 Hours

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. Who first used the term Nanotechnology?
a) Richard Feymann
b) Norio Taniguichi
c) Eric Drexler
d) Sumio Lijima
2. Which of the following is an example of top-down approach for the preparation of nanomaterials?
a) Gas phase agglomeration
b) Molecular self-assembly
c) Mechanical grinding
d) Molecular beam epitaxy
3. "There is plenty of room at the bottom". This was stated by
a) Eric Drexler
b) Richard Feymann
) Harold Croto
d) Richard Smalley
4. Nanoscience can be studied with the help of $\qquad$
a) Quantum mechanics
b) Newtonian mechanics
c) Macro-dynamics
d) Geophysics
5. The size of nano particle is between $\qquad$ nm
a) 100 to 1000
b) 0.1 to 10
c) 1 to 100
d) 0.01 to 1
6. What is graphene?
a) a new 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
7. Sol-gel is $\qquad$ approach
a) Bottom-up
b) Top-Down
c) sputtering
d) chemical vapour deposition
8. Sputtering is a $\qquad$
a) Physical Vapour deposition method
b) Chemical vapour deposition method
c) Chemical precipitation method
d) Chemical bath deposition method
9. An important consequence of using the UV-Visible spectroscopy is that
$\qquad$ of bonding structure
a) nanomaterial can be determined
b) emission wavelength
c) excitation wavelength
d) Band gap
10. The power required for electro-deposition is
a) DC and very low voltage
b) DC and high voltage
c) AC and very low voltage
d) AC and high voltage

## $\underline{\text { SECTION - B }}$

## Answer any FIVE Questions <br> $(5 \times 2=10)$

11. What is nanotechnology?
12. What is nanomaterial?
13. List out the physica and chemical properties of nanomaterial.
14. What is nanocomposite?
15. List out the types of nanocomposite.
16. What are the different synthesis methods of nanomaterial?
17. What is electrodeposition?

## SECTION - C

## Answer ALL Questions

$(3 \times 9=27)$
18. a) Explain the role of bottom up and top down approaches in nanotechnology.

## [OR]

b) Explain spray pyrloysis techniques.
19. a) Explain the X-ray diffraction techniques in detail.
[OR]
b) Discuss briefly about the crystal strctures of a material.
20. a) Describe about UV-Visible spectroscopic techniques in optical chaarcterization.

## [OR]

b) Explain abou the applications of nanoparticles in biology and medicine.

## SECTION - D

## Answer any TWO Questions

$(2 \times 14=28)$
21. Explain about the sol gel process in detail.
22. Give a brief account on properties of nanomaterials.
23. Describe the surface morphological features using SEM techniques.
24. Discuss briefly about the applications of nanomaterials.

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B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - IV: Skill Based Subject: Sixth Semester: Paper - II
PHYSICS FOR COMPETITIVE EXAMINATIONS
Under CBCS - Credit 2
Time: 2 Hours
Max. Marks:

## SECTION - A

## Answer ALL Questions

$(75 \times 1=75)$

1. The unit of power is
a) kilowatt
b) kilowatt-hour
c) dyne
d) Joule
2. The SI unit of universal gas constant $(\mathrm{R})$ is
a) $\mathrm{JK}^{-1} \mathrm{~mol}^{-1}$
b) $\mathrm{NK}^{-1} \mathrm{~mol}^{-1}$
c) $\mathrm{WattK} \mathrm{K}^{-1} \mathrm{~mol}^{-1}$
d) $\operatorname{ergK}^{-1} \mathrm{~mol}^{-1}$
3. The dimensional formula for Planck's constant (h) is
a) $\left[\mathrm{ML}^{2} \mathrm{~T}^{-3}\right]$
b) $\left[\mathrm{ML}^{2} \mathrm{~T}^{-2}\right]$
c) $\left[\mathrm{ML}^{2} \mathrm{~T}^{-1}\right]$
d) $\left[\mathrm{ML}^{-2} \mathrm{~T}^{-2}\right]$
4. If C and R denote capacity and resistance, the dimension of CR is
a) $\mathrm{M}^{0} \mathrm{~L}^{0} \mathrm{~T}^{1}$
b) $\mathrm{M}^{1} \mathrm{~L}^{0} \mathrm{~T}^{1}$
c) $\mathrm{M}^{0} \mathrm{~L}^{0} \mathrm{~T}^{0}$
d) not expressible in terms of M LT
5. Poise is the unit to measure
a) coefficient of viscosity
b) surface tension
c) torque
d) moment of inertia
6. Newton's first law of motion gives the concept of
a) energy
b) work
c) inertia
d) momentum
7. Two bodies of mass 1 kg and 4 kg are moving with equal kinetic energies. The ratio of their linear momentum is
a) $1: 2$
b) $2: 1$
c) $4: 1$
d) $1: 4$
8. When the amplitude of a particle executing S.H.M. increases, its time period
a) decreases
b) remains unchanged
c) increases
d) may increase or decrease depending upon phase
9. A loaded spring vibrates with a period T . The spring is now divided into nine equal parts and the same load is suspended from one of these parts. The new period is
a) $\mathrm{T} / 3$
b) $\mathrm{T} / 9$
c) 3 T
d) T
10. The equivalence of two systems in thermal equilibrium is represented by the property
a) temperature
b) heat
c) specific heat
d) energy
11. An ideal gas heat engine operates in a Carnot cycle between $227^{\circ} \mathrm{C}$ and $127^{\circ} \mathrm{C}$. It absorbs $6 \times 10^{4}$ cals at the higher temperature. The amount of heat converted into work is equal to
a) $4.8 \times 10^{4}$ cals b) $3.5 \times 10^{4} \mathrm{cals}$
c) $1.6 \times 10^{4}$ cals d)
$1.2 \times 10^{4} \mathrm{cals}$
12. The area under the curve on $\mathrm{P}-\mathrm{V}$ diagram represents
a) work done on or by the system
b) work done in a cyclic process
c) the thermodynamic process
d) the condition of the system
13. The triple point of a substance is the temperature at which
a) the liquid and the gas phases are in equilibrium
b) the solid and the gas phases are in equilibrium
c) the solid and the liquid phases are in equilibrium
d) all the three phases are in equilibrium
14. A perfect gas is compressed to $1 / 4$ th of its original volume. The initial pressure of the gas is 1 atm . If the compression is isothermal, the final pressure will be
a) 4 atm
b) $1 / 4 \mathrm{~atm}$
c) 16 atm
d) $1 / 16 \mathrm{~atm}$
15. The freezer in a refrigerator is located in the top section so that
a) the entire chamber of the refrigerator is cooled quickly
b) motor is not heated
c) heat gained from environment is less
d) heat gained from environment is more
16. The radiation emitted by a perfectly black body is proportional to
a) temperature on the ideal gas scale
b) fourth root of temperature on ideal gas scale
c) fourth power of temperature on ideal gas scale
d) source of temperature on ideal gas scale
17. Prof. S. N. Bose's contribution was to give
a) A derivation of Kirchhoff's law
b) A suggestion that bodies emit and absorb radiations at all temperatures
c) A definition of black body
d) A rigorous derivation of Planck law
18. Quantum nature of light is not supported by the phenomenon of
a) Compton effect
b) photoelectric effect
c) emission or absorption spectrum
d) interference of light waves
19. The energy and momentum of a photon are given by $\mathrm{E}=\mathrm{h} \nu$ and $\mathrm{P}=\mathrm{h} / \lambda$ respectively. Velocity of the photon will be
a) EP
b) $E / P$
c) $P / E$
d) $E / P^{2}$
20. The frequency of a light wave is $6.4 \times 10^{14} \mathrm{~Hz}$. Its energy in eV will be ( $\mathrm{h}=6.6 \times 10^{-34} \mathrm{~J}$-sec)
a) 5.28 eV
b) 3.96 eV
c) 2.64 eV
d) 1.32 eV
21. Two coherent sources of light produce interference (destructive) when the phase difference between them is
a) $2 \pi$
b) $3 \pi / 2$
c) $\pi$
d) $\pi / 2$
22. In Young's two slits interference experiment if the distance between the silts is made 3 fold, the fringe width becomes
a) $1 / 3$ fold
b) 2 fold
c) $1 / 9$ fold
d) 9 fold
23. Hardness of magnetic material is measured by the value of
a) magnetic induction
b) intensity of magnetisation
c) density of magnetic material
d) coercive force
24. Curie temperature is that temperature at which the ferromagnetic
material
a) has maximum susceptibility
b) has zero susceptibility
c) loses its ferromagnetism
d) develops reverse polarity

25 . A circular coil of radius 4 cm having 50 turns carries a current of 2 A . It is placed in uniform magnetic field of $0.1 \mathrm{wb} / \mathrm{m}^{2}$. The work done to rotate the coil from equilibrium position by $180^{\circ}$ is
a) 0.1 J
b) 0.2 J
c) 0.4 J
d) 0.8 J
26. $\mathrm{F}_{\mathrm{g}}$ and $\mathrm{F}_{\mathrm{e}}$ represent the gravitational and electrostatic forces respectively between electrons situated at some distance. The ratio of $\mathrm{Fg}_{\mathrm{g}} / \mathrm{F}_{e}$ is of the order of
a) 1
b) 10
c) $10^{-43}$
d) $10^{-37}$
27. When the distance between two charged particles is halved, the force between them becomes
a) one-fourth
b) one-half
c) double
d) four times
28. A dipole of electric dipole moment $P$ is placed in a uniform electric field of strength $E$. If $\theta$ is the angle between positive directions of $P$ and $E$, then the potential energy of the electric dipole is largest when $\theta$ is
a) zero
b) $\pi / 2$
c) $\pi$
d) $\pi / 4$
29. Electric potential due to a point charge and a dipole respectively are directly proportional to
a) $\mathrm{r}^{-1}, \mathrm{r}^{-2}$
b) $\mathrm{r}^{1}, \mathrm{r}^{-1}$
c) $\mathrm{r}^{-2}, \mathrm{r}^{-3}$
d) $\mathrm{r}^{-2}, \mathrm{r}^{-2}$
30. The velocity of an electron which passes through a potential difference of 1000 volts is
a) $1.87 \times 10^{7} \mathrm{~m} / \mathrm{s}$
b) $18.7 \times 10^{7} \mathrm{~m} / \mathrm{s}$
c) $0.187 \times 10^{7} \mathrm{~m} / \mathrm{s}$
d) $187 \times 10^{7} \mathrm{~m} / \mathrm{s}$
31. A condenser is charged through a potential difference of 200 volts and possesses a charge of 0.1 Coulomb. When discharged it would release an energy of
a) 1 J
b) 2 J
c) 10 J
d) 20 J
32. Three condensers of capacitances 10,20 and $30 \mu \mathrm{~F}$ are first connected in series and then connected in parallel. The ratio of the resultant capacitances in the two cases is
a) $1: 11$
b) $11: 1$
c) $1: 6$
d) $6: 1$
33. The capacity of a parallel plate capacitor is $4 \mu \mathrm{~F}$. The distance between the plates is doubled. The new capacity is
a) $8 \mu \mathrm{~F}$
b) $4 \mu \mathrm{~F}$
c) $2 \mu \mathrm{~F}$
d) $1 \mu \mathrm{~F}$
34. $n$ similar resistors each of resistance $r$ when connected in parallel has the total resistance R . When these resistances are connected in series, the total resistance will be
a) $n^{2} R$
b) nR
c) $R / n$
d) $R / n^{2}$
35. In a Wheatstone bridge the resistances in the ratio arms are $100 \Omega$ and $150 \Omega$ respectively. If $\mathrm{R}=80 \Omega$, the resistance of the fourth arm will be
a) $120 \Omega$
b) $80 \Omega$
c) $150 \Omega$
d) $70 \Omega$
36. Two free parallel wires carrying currents in the opposite direction
a) attract each other
b) repel each other
c) do not affect each other
d) get rotated to be perpendicular to each other
37. The current in an inductor is reduced to half. The energy stored in it
a) is doubled
b) reduces to one-fourth of its initial value
c) remains unchanged
d) reduces to half of its initial value
38. The velocity of certain ions that pass undeflected through crossed E and $B$ fields for which $E=7.7 \mathrm{kV} / \mathrm{m}$ and $B=0.14 \mathrm{~T}$
a) $22 \mathrm{~km} / \mathrm{s}$
b) $33 \mathrm{~km} / \mathrm{s}$
c) $44 \mathrm{~km} / \mathrm{s}$
d) $55 \mathrm{~km} / \mathrm{s}$
39. A coil of 20 turns has an area of $800 \mathrm{~mm}^{2}$ and bears a current of 0.5 A . It is placed with its plane parallel to a magnetic field of intensity 0.3 T . The torque on the coil is
a) $2.4 \times 10^{-1} \mathrm{~N}-\mathrm{m}$
b) $2.4 \times 10^{-2} \mathrm{~N}-\mathrm{m}$
c) $2.4 \times 10^{-3} \mathrm{~N}-\mathrm{m}$
d) $2.4 \times 10^{-4} \mathrm{~N}-\mathrm{m}$
40. In a potentiometer, the length of its wire is doubled. The accuracy in determining the null point will
a) decrease
b) increase
c) remain unchanged
d) be equal to zero.
41. When different parts of a metal are kept at different temperatures and current is passed through it, the heat is either evolved or absorbed. The effect is called
a) Peltier effect
b) Seebeck effect
c) Thomson effect
d) Joule effect
42. A straight line conductor of length 0.4 m is moved with a speed of $7 \mathrm{~m} / \mathrm{s}$ perpendicular to a magnetic field of intensity $0.9 \mathrm{wb} / \mathrm{m}^{2}$. The induced e.m.f. across the conductor is
a) 5.04 V
b) 1.26 V
c) 2.52 V
d) 25.2 V
43. Which of the following phenomena is utilised in the construction of the mouth-piece of a telephone?
a) electromagnetic induction
b) heating effect of electric current
c) change of resistance with temperature
d) rectification
44. To step up the voltage, the number of turns in the secondary should be
a) less than the number of turns in the primary
b) greater than the number of turns in the primary
c) equal to the number of turns in the primary
d) infinite
45. Core of a transformer is made of soft iron and laminated to
a) reduce the heat loss
b) reduce the eddy current loss
c) reduce circuit permeability
d) make assembly cheap and convenient
46. Reactance offered by a coil having no resistance in an a.c. circuit is equal to
a) $\omega \mathrm{L}$
b) $1 / \omega \mathrm{L}$
c) $\omega^{2} L^{2}$
d) $\omega \mathrm{LR}$
47. An inductance of 0.4 Henry and a resistance of $100 \Omega$ are connected in series with an A. C. supply of 220 volts, 50 c.p.s. Phase lag of current from e.m.f. applies is
a) $\tan ^{-1}(\pi)$
b) $\tan ^{-1}(0.4 \pi)$
c) $\tan ^{-1}(4 \pi)$
d) $\tan ^{-1}(0.2 \pi)$
48. A student has a coil of 3 mH and wishes to construct a circuit whose resonant frequency is 1000 kHz . The value of capacitor he must use is
about ( $\mathrm{pico}=10^{-12}$ )
a) 8.5 pico farad
b) 0.8 pico farad
c) 85 pico farad
d) 850 pico farad
49. In an LCR-series circuit $\mathrm{R}=\sqrt{ } 3 \Omega, \mathrm{X}_{\mathrm{L}}=10 \Omega, \mathrm{X}_{\mathrm{C}}=11 \Omega$, the applied voltage is 10 Volt (R.M.S). The impedance of the circuit is
a) $8 \Omega$
b) $4 \Omega$
c) $2 \Omega$
d) $1 \Omega$
50. If $\mathrm{E}_{\mathrm{rms}}$, be the R.M.S value of e.m.f, then its peak-to-peak value is given by
a) $\mathrm{E}_{\mathrm{rms}} / \sqrt{ } 2$
b) $\sqrt{2} E_{r m s}$
c) $2 \sqrt{ } 2 E_{r m s}$
d) $E_{\mathrm{rms}} / 2$
51. The electron beam with velocities in the ratio $1: 2$ is subjected to identical magnetic fields at right angles to them. The ratio of the deflections produced will be
a) $1: 2$
b) $2: 1$
c) $1: 4$
d) $4: 1$
52. If elements with principal quantum number $n>4$ were not allowed in nature, the number of possible elements would be
a) 60
b) 32
c) 4
d) 64
53. A proton, deuteron, and an $\alpha$-particle are accelerated by the same potential difference. Their velocities will be in the ratio of
a) $1: 1: 1$
b) $\sqrt{ } 2: 1: 1$
c) $1: 1: \sqrt{ } 2$
d) $1: \sqrt{ } 2: 1$
54. "There are discrete energy levels in atoms and molecules" was first demonstrated experimentally by
a) Frank Hertz experiment
b) Rutherford alpha scattering experiment
c) Davisson and Germer's experiment d) G.P. Thomson's experiment
55. The order of wavelength of X-rays is
a) $10^{-10} \mathrm{~m}$
b) $10^{-8} \mathrm{~m}$
c) $10^{-12} \mathrm{~m}$
d) $10^{-14} \mathrm{~m}$
56. The velocity of the photoelectrons depends upon
a) frequency of the incident photon only
b) intensity of the incident photon only
c) intensity as well as frequency of the incident photon
d) kinetic energy of the incident photon
57. An X-ray has a wavelength of 0.01 A . Its momentum is
a) $3.313 \times 10^{-22} \mathrm{~kg}-\mathrm{m} / \mathrm{sec}$
b) $6.626 \times 10^{-22} \mathrm{~kg}-\mathrm{m} / \mathrm{sec}$
c) $3.456 \times 10^{-25} \mathrm{~kg}-\mathrm{m} / \mathrm{sec}$
d) $2.126 \times 10^{-22} \mathrm{~kg}-\mathrm{m} / \mathrm{sec}$
58. Bragg's equation will not have solution, if
a) $\lambda>2 \mathrm{~d}$
b) $\lambda<2 d$
c) $\lambda>d$
d) $\lambda=d$
59. The de Broglie wavelength $(\lambda)$ of a particle of mass $m$ and charge $e$, accelerated by a potential V is given by
a) $\sqrt{2 \mathrm{hmVe}}$
b) $h / \sqrt{2 m V e}$
c) $h \sqrt{2 m V e}$
d) $\frac{\sqrt{2 m V}}{e h}$
60. An $\alpha$-particle and a proton have the same kinetic energy. The ratio of their wavelengths is $\left(\mathrm{m}_{\alpha}=4 \mathrm{mp}\right)$
a) $1: 2$
b) $2: 1$
c) $1: 4$
d) $4: 1$
61. If $\Delta X$ and $\Delta P$ are uncertainties in the measurement of position and momentum respectively, then according to Heisenberg uncertainty principle
a) $\Delta X \Delta P \geq \hbar$
b) $\Delta X \Delta P \leq \hbar$
c) $\Delta X \Delta P>\hbar^{2}$
d) $\Delta X \Delta P<\hbar^{2}$
62. A spaceship 50 m long was to pass the earth travelling at $2.5 \times 10^{8} \mathrm{~m} / \mathrm{sec}$. Assuming a Lortenz-Fitzgerlad contraction, its apparent length will be
a) 3 m
b) 30 m
c) 300 m
d) 0.3 m
63. A nucleus of atomic mass A and atomic number Z emits a $\beta$ particle.

The atomic mass and atomic number of the resulting nucleus are
a) $\mathrm{A}, \mathrm{Z}$
b) $A+1, Z$
c) $\mathrm{A}, \mathrm{Z}+1$
d) $\mathrm{A}-4, \mathrm{Z}-2$
64. The phenomenon of nuclear fission to a certain extent can be easily explained by
a) liquid drop model
b) shell model
c) collective model
d) central force field model
65. Tungsten is extensively used for thermionic filament because
a) its work function is the smallest
b) it has a very high melting point
c) it has low density
d) it acts like a black body for filament radiation
66. Atomic power station at Tarapur has a generating capacity of 200 MW.

The energy generated in a day by this station is
a) 200 MW
b) 200 Joules
c) $4800 \times 10^{6}$ Joules
d) $1728 \times 10^{10}$ Joules
67. If $r$ denotes the mean distance of a planet from the sun and $T$ the time period of the planet, then
a) $r \propto T^{2 / 3}$
b) $r \propto T^{3 / 2}$
c) $r \propto T^{1 / 3}$
d) $r \propto T$
68. Fermi energy is
a) the minimum energy possessed by an electron at 0 K
b) the maximum energy possessed by an electron at 273 K
c) the maximum energy possessed by an electron at 0 K
d) the minimum energy possessed by an electron at 273 K
69. The term transistor stands for
a) transfer of resistance, i.e., the change of resistance
b) transfer of voltage
c) transfer of power
d) transfer of current
70. The planet having no atmosphere on it is
a) earth
b) venus
c) mars
d) mercury
71. The three axes of a crystal lattice are mutually perpendicular and two of the lattice parameters are equal. The crystal system is
a) tetragonal
b) trigonal
c) rhombohedral
d) cubic
72. The circuit used for parallel to serial conversion of data is called
a) multivibrator
b) multiplexer
c) demultiplexer
d) amplifier
73. Stars radiate light of their own because of
a) fission reactions
b) chemical reactions
c) mechanical contractions
d) fusion reactions
74. The binary code of $(21.25)_{10}$ is
a) 10100.001
b) 10101.001
c) 10101.010
d) 10100.100
75. A half adder can be constructed from
a) one XOR gate and one AND gate
b) one XOR gate and one OR gate with their inputs connected in parallel
c) two XOR gates only
d) one XOR and one OR gate with their outputs connected in parallel

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[Affiliated to Madurai Kamaraj University]
B.Sc. Physics Degree (Semester) Examinations, April 2021

Part - IV: Skill Based Subject: Sixth Semester: Paper - III
MEDICAL INSTRUMENTATION
Under CBCS - Credit 2
Time: 2 Hours

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. $\qquad$ is the measure of the reproducibility of the measurements
a) Precision
b) Simplicity
c) Stability
d) Hysteresis
2. $\qquad$ is called cardiac pacemaker.
a) Sino Atrial node
b) Atrio-Ventricular node
c) The bundle of HIS
d) Purkinje fibres
3. The device used to convert one form of signal to electrical signal is
a) ECG
b) EEG
c) Transformer
d) Transducer
4. Study of electrical activity of heart muscles is
a) EEG
b) ECG
c) PET
d) MRI
5. The outer layer of the brain is called $\qquad$
a) cerebrum
b) skull
c) cerebral cortex
d) cerebellum
6. On the surface of the brain, the voltage is about $\qquad$ mV
a) 5
b) 10
c) 15
d) 100
7. Servo Controlled Ventilators work in $\qquad$ mode
a) Assisted
b) Assisted-control
c) Controlled
d) Pressure control
8. $\qquad$ is used to measure the volume of exhaled air.
a) Spirometer
b) Humidifier
c) Nebulizer
d) Ventilator
9. $80 \%$ of our body atoms are of $\qquad$
a) Nitrogen
b) Oxygen
c) Hydrogen
d) Carbon
10. Waves used in MRI is
a) Microwaves b) Infrared
c) Radio waves
d) X-rays

## SECTION - B

## Answer any FIVE Questions

$(5 \times 2=10)$
11. Define linearity.
12. What is the amplitude of QRS complex in ECG wave?
13. What is called evoked potential?
14. What do you mean by REM sleep?
15. What is the frequency of Alpha waves?
16. Write down the combination used in anesthetic Nitrous oxide
17. Give any two advantages of Laser surgery.

## $\underline{\text { SECTION - C }}$

## Answer ALL Questions

$$
(3 \times 9=27)
$$

18. a) Draw the block diagram of Bio-Medical instrument system.
[OR]
b) Explain about Bipolar Limb leads.
19. a) Illustrate brain waves on the basis of frequency.

## [OR]

b) Explain various electro surgery techniques used in diathermy unit.
20. a) With neat diagrams explain about Rotameter and Turbine flowmeter.

## [OR]

b) Illustrate Positron Emission Tomography.

## SECTION - D

## Answer any TWO Questions

$(2 \times 14=28)$
21. Explain about Augmented unipolar Limb leads system used in ECG.
22. Draw the block diagram of ECG recording setup and explain.
23. Describe the working of anaesthesia machine with neat diagram.
24. Explain MRI system with neat block diagram.

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B.A. \& B.Sc. Degree (Semester) Examinations, April 2021

Part - IV: Non-Major Elective Subject: Second Semester: Paper - I
CIVIL DEFENCE AND ADVENTURE TRAINING
Under CBCS - Credit 2
Time: 2 Hours
Max. Marks:

## SECTION - A

## Answer ALL Questions

$(10 \times 1=10)$

1. The strength of the Guard of Honour for Prime minister is
a) 100
b) 150
c) 50
d) 125
2. The word of command thaine mur is meaning of
a) right turn
b) stand at ease
c) left turns
d) Stand easy
3. Sequence of fire control order is
a) GRIT
b) RITG
c) ITGR
d) FCO
4. In MR, yellow color represents
a) Reserved forest
b) Cultivated area
c) living area
d) dry river
5. Cadets one behind another is called
a) file
b) Rank
c) blank file
d) None of these
6. Caliber size of $0.22^{\prime \prime}$ rifle is
a) $0.22^{\prime}$ '
b) 7.62 mm
c) $0.33^{\prime \prime}$
d) 2 cm
7. In aadha dhaine mur the squad turns $\qquad$ degree right.
a) $45^{\circ}$
b) $100^{\circ}$
c) $120^{\circ}$
d) $90^{\circ}$
8. For NCC training, the obstacle course consist of
a) 10 obstacle
b) 12 obstacle
c) 15 obstacle
d) 5 obstacle
9. self- help measures adopted by civilian population are called
a) self defence
b) civil defence
c) Rescue service
d) salvage service
10. Two or more persons share some idea or information via some media is called
a) communication
b) transmission
c) receiver
d) Transreceiver

## SECTION - C

## Answer ALL Ouestions

$(3 \times 9=27)$
18. a) Write the five aims of Drill
[OR]
b) Explain the functions of Civil defence.
19. a) Explain how to set a map to ground.
[OR]
b) Describe the methods of judging distance.
20. a) What are the types of adventure training?
[OR]
b) Write the ten parts of the liquid prismatic compass.

## SECTION - B

## Answer any FIVE Questions

11. What is civil defence?
12. Write the parts of word of command.
13. What are the types of north?
14. What is communication?
15. Expand the term RTE and NGO.
16. Write the uses of service protector.
17. Define the term "line tor".

## SECTION - D

## Answer any TWO Questions

$(2 \times 14=28)$
21. Explain the safety measures for cycle expedition to NCC cadets.
22. Describe the different section formation drill.
23. Explain the different methods of communication.
24. Write down the parts of 7.62 mm SL rifle with neat diagram.

