

**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- Ultrasonics waves travel with the speed of \_\_\_\_  
a) Light                      b) sound                      c) IR rays                      d) UV rays
- The unit of absorption coefficient is \_\_\_\_  
a) Newton                      b) Coulomb                      c) Hertz                      d) Sabine
- It is defined as the ratio of volume stress to the volume strain.  
a) Young's Modulus                      b) Rigidity Modulus  
c) Bulk Modulus                      d) Poission's ratio
- The Rigidity Modulus (G) is  
a) Lateral strain/longitudinal strain                      b) bulk stress/volume strain  
c) Tangential stress/shearing strain  
d) longitudinal stress/longitudinal strain
- In reversible adiabatic process  
a) Change in entropy                      b) No change in entropy  
c) entropy is constant                      d) None of these.
- The efficiency of carnot engine working between steam point and ice point is  
a) 1                      b) 0                      c) 26.81 %                      d) 16.81 %

7. 1  $\mu\text{F}$  is equal to  
 a)  $10^{-8} \text{ F}$       b)  $10^{-6} \text{ F}$       c)  $10^{-9} \text{ F}$       d)  $10^{12} \text{ F}$

8. The resistance of the lamp (R) is given by  
 a)  $V / W$       b)  $V/I$       c)  $W / I$       d)  $V \times R$

9. The Snell's law is  
 a)  $n = \frac{\sin r}{\sin i}$       b)  $n = \frac{\sin i}{\sin r}$       c)  $n = \frac{\cos r}{\cos i}$       d)  $n = \frac{\cos i}{\cos r}$

10. The shape factor is determined by the ratio is  
 a)  $R_1 / R_2$       b)  $R_1 \times R_2$       c)  $R_2 / R_1$       d)  $R_2 / R_1$

### **SECTION – B**

#### **Answer any FIVE Questions**

**(5 × 2 = 10)**

11. Define simple harmonic motion.
12. What are ultrasonic waves?
13. Define Poisson's ratio.
14. Define surface tension. Write its unit also.
15. State and explain zeroth law of thermodynamics.
16. Give the merits of circuit breaker.
17. List out the methods used to minimise spherical aberration.

### **SECTION – C**

#### **Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Discuss the composition of two simple harmonic motions in a straight line.

**[OR]**

- b) The volume of a room is  $600 \text{ m}^3$ . The wall area of the room is  $220 \text{ m}^2$ , the floor area is  $120 \text{ m}^2$  and the ceiling area is  $120 \text{ m}^2$ . The average sound absorption coefficient (i) for the wall is 0.03; (ii) for the floor is 0.06; (iii) for the ceiling is 0.80. Calculate the average sound absorption coefficient and the reverberation time.

19. a) Define bending moment. Derive the expression for the bending moment.

**[OR]**

- b) Water flows through a horizontal tube of length 0.2 metres and internal radius  $8.1 \times 10^{-4} \text{ metre}$  under a constant head of the liquid 0.2 metres high. In 12 minutes  $8.64 \times 10^{-4} \text{ m}^3$  of liquid issues from the tube. Calculate the coefficient of viscosity of water. (The density of water =  $1000 \text{ Kg m}^{-3}$  and  $g = 9.81 \text{ ms}^{-2}$ ).

20. a) Define and explain 'Entropy'.

**[OR]**

- b) Calculate the change in entropy when 5 Kg of water at  $100^\circ\text{C}$  is converted into steam at the same temperature.

21. a) What is a fuse? Explain its types.

**[OR]**

- b) A circular coil has a radius of 0.1 m and a number of turns of 50. Calculate the magnetic induction at a point (i) on the axis of the coil and distance 0.2 m from the centre; (ii) at the centre of the coil, when a current of 0.1 A flows in it.

22. a) Explain the construction and working of direct vision spectroscope.

**[OR]**

b) The dispersive powers for crown and flint glass are 0.015 and 0.030 respectively. Calculate the focal lengths of the lenses (made of crown and flint glass) which form an achromatic doublet of focal length 60 cm when placed in contact.

### **SECTION – D**

#### **Answer any THREE Questions**

**(3 × 10 = 30)**

23. What is piezo electric effect? Explain how this effect is used to produce ultrasonic waves.
24. i) Derive an expression for the period of oscillation of a torsion pendulum.  
ii) A metal disc of 0.1 m radius and mass 1 Kg is suspended in a horizontal plane by a vertical wire attached to its centre. If the diameter of the wire is  $10^{-3}$  m, its length 1m and the period of torsional vibrations is 4 seconds, find the rigidity modulus of the wire.
25. Obtain the expressions for change in entropy in  
i) a reversible process  
ii) an irreversible process
26. State Biot- Savart law. Calculate the magnetic induction at a point on the axis of a circular coil.
27. What is meant by chromatic aberration? Find the achromatism of two thin lenses  
i) placed in contact                      ii) separated by a finite distance.




**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
**College with Potential for Excellence**

 Residential & Autonomous – A Gurukula Institute of Life-Training  
 Re-accredited (3<sup>rd</sup> Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC  
 [Affiliated to Madurai Kamaraj University]

**B.Sc. Physics Degree (Semester) Examinations, November 2021**

Part – III: Core Course: First Semester: Paper – I

**MECHANICS**

Under CBCS and LOCF – Credit 4

 Time: **3 Hours**

 Max. Marks: **75**
**SECTION – A**
**Answer ALL Questions**
**(10 × 1 = 10)**

- A body covering equal displacement in equal interval of time possesses:
  - Variable velocity
  - Uniform acceleration
  - Uniform velocity
  - None of above
- Inertia of an object is quantitative measure of its:
  - Volume
  - Density
  - Mass
  - Temperature
- Motion of projectile is \_\_\_\_\_dimensional.
  - One
  - Two
  - Three
  - Four
- An object moving in a circle at constant speed:
  - must have only one force acting on it
  - is not accelerating
  - is held to its path by centrifugal force
  - has an acceleration of constant magnitude
- The center of mass of a system of particles remains at the same place if:
  - it is initially at rest and the external forces sum to zero
  - it is initially at rest and the internal forces sum to zero
  - the sum of the external forces is less than the maximum force of static friction
  - no friction acts internally

6. When the net external force acting on a system is zero, the total linear momentum of the system will be \_\_\_\_\_

- a) zero                      b) constant                      c) increasing                      d) decreasing

7. The rate at which work is done is called

- a) power                      b) displacement                      c) force                      d) energy

8. The amount of work required to stop a moving object is equal to:

- a) the velocity of the object                      b) the kinetic energy of the object  
c) the mass of the object times its acceleration  
d) the mass of the object times its velocity

9. The actual pressure at a point in a fluid is called

- a) atmospheric pressure                      b) absolute pressure  
c) gauge pressure                      d) vapour pressure

10. According to equation of continuity,  $A_1V_1 = A_2V_2 = \text{constant}$ . The constant is equal to:

- a) Flow rate    b) Volume of fluid    c) Mass of fluid    d) Density of fluid

### **SECTION – B**

**Answer any FIVE Questions**

**(5 × 2 = 10)**

11. What are inertial frames of references?

12. Differentiate between static friction and kinetic friction

13. Express Newton's second law of motion in terms of momentum.

14. How angular momentum and angular velocity is related?

15. State work-energy theorem.

16. Define the term density.

17. What is absolute pressure?

### **SECTION – C**

**Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Illustrate accelerated motion with example.

**[OR]**

b) A large horizontal cable pulls a 200 kg cart along a horizontal track. The tension in the cable is 500N. Starting from rest, a) how long will it take the cart to reach a speed of 8 m/s? b) How far will it be used?

19. a) Why the roadbeds are banked on curves? Find the angle of banking “ $\theta$ ” in a roadbed in the absence of friction.

**[OR]**

b) A body projected upwards from the level ground at an angle of  $50^\circ$  with the horizontal has an initial speed of 40 m/sec. How long will it be before it hits the ground?

20. a) Describe linear momentum of a body and express Newton's second law in terms of momentum.

**[OR]**

b) A 2 kg rock is moving at a speed of 6 m/sec. What constant force is needed to stop the rock in  $7 \times 10^{-4}$  sec?

21. a) Calculate the work done by a variable force.

**[OR]**

b) A body of mass  $m = 4.5$  kg is dropped from rest at a height  $h = 10.5$  m above the earth's surface. Neglecting air resistance, what will be its speed just before it strikes the ground?

22. Elucidate how to measure the atmospheric pressure using mercury barometer.

**[OR]**

b) The interior of a submarine located at a depth of 50m in seawater is maintained at sea-level atmospheric pressure. Find the force on a window  $20 \text{ cm}^2$ . The density of seawater is  $1.03 \times 10^3 \text{ kg/m}^3$ .

### **SECTION – D**

**Answer any THREE Questions**

**(3 × 10 = 30)**

23. Derive the equations of motion when the particle moves with constant acceleration.

24. Arrive at the equation to calculate the period of motion of a conical pendulum.

25. Deduce Newton's second law in the case of many particle systems.

26. Illustrate angular momentum. Derive the relation between torque and angular momentum for a single particle.

27. Explain how the pressure of a fluid varies with depth.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- Electric field is a \_\_\_\_\_ quantity  
a) Vector                      b) scalar                      c) phasor                      d) polar
- The torque  $\tau$  can be written in the vector form is  
a)  $\mathbf{p} \times \mathbf{F}$                       b)  $\mathbf{p} \times \mathbf{Q}$                       c)  $\mathbf{p} \times \mathbf{E}$                       d)  $\mathbf{p} \times \mathbf{R}$
- Insulator which is placed between two plates of capacitor is  
a) electric                      b) dielectric                      c) resistor                      d) inductor
- Which of the following element used as a dielectric medium in variable air capacitor?  
a) air                      b) mica                      c) aluminium                      d) metal sheet
- The power dissipated in a resistance R carrying a current i is  
a)  $P=V^2/R$                       b)  $P=V/R^2$                       c)  $P=V/R$                       d)  $P=V/R^3$
- Why Kelvin Bridge is known as double bridge?  
a) two power supplies                      b) two unknowns  
c) two ratio arms                      d) None of the above
- Name the rule based on which moving coil ballistic galvanometer works.  
a) Right hand clasp rule                      b) Maxwell cork Screw rule  
c) Flemings left hand rule                      d) Ampere swimming rule

8. A current carrying conductor has \_\_\_\_\_

- a) Magnetic field                      b) current capacity
- c) Voltage capacity                      d) resistance capacity

9. Root mean square value of an alternating current is

- a)  $2I_0/\pi$                       b)  $\sqrt{I^2}$                       c)  $I_0/\sqrt{2}$                       d)  $I^2R$

10. Transformer which convert low voltages into higher voltages are called \_\_\_\_\_

- a) Step up                                      b) step down
- c) both (a) & (b)                                      d) None of the above

### **SECTION – B**

**Answer any FIVE Questions**

**(5 × 2 = 10)**

- 11. State Coulomb's Law.
- 12. What is called equipotential surface?
- 13. Define 'Current density'.
- 14. What is called 'Charge Sensitiveness' of the ballistic galvanometer?
- 15. Define 'Form factor'
- 16. State Ampere's circuital law.
- 17. What is the principle of A.C Dynamo?

### **SECTION – C**

**Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Derive expression for the electric field at a point on the axial line.

**[OR]**

b) State and prove Gauss's Law for a charge inside the closed surface.

19. a) Derive the relation between Electric field and Electric potential.

**[OR]**

b) Derive expression for the loss of energy on sharing of charges between two capacitors.

20. a) Prove the equation of continuity  $\text{div } J + \frac{dp}{dt} = 0$

**[OR]**

b) Describe kelvin's Null method to determine the capacitance of a capacitor.

21. a) Obtain an expression for the magnetic induction at a point on the axis of a circular coil carrying current.

**[OR]**

b) Describe how the ballistic galvanometer is used to compare the capacitances of two capacitors.

22. a) Compare Series and parallel resonant circuits.

**[OR]**

b) Describe the star connection and delta connection in a 3 - phase system with neat diagrams.



## **SECTION – D**

**Answer any THREE Questions**

**$(3 \times 10 = 30)$**

23. Obtain expressions for the electric field due to a uniformly charged sphere when the point P lies

- i) outside the sphere      ii) on the surface      iii) inside the sphere.

24. A capacitor consists of two concentric spheres.

Calculate the capacitance when

- a) the inner sphere is charged and the outer sphere earthed  
b) the outer sphere is charged and the inner sphere earthed

25. Describe Carey Foster Bridge with neat diagram. Explain the theory of CF bridge with necessary diagrams.

26. Give the principle and construction of moving coil galvanometer, derive an expression between the quantity of charge flowing through it and the throw obtained.

27. An alternating emf is applied to a circuit containing an inductor, capacitor and resistor in series. Obtain expressions for the current, impedance and phase of current. Obtain the resonant Frequency.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- Two resistors having values 5 ohms and 10 ohms are connected in series to a 10 V source. Find the current flowing through the circuit  
a) 0.66 A                      b) 1.5 A                      c) 2 A                      d) 2.5 A
- A certain current source has the values  $I_s = 3\mu\text{A}$  and  $R_s = 1.0\text{ M}\Omega$ . The value of equivalent voltage source is  
a)  $3\mu\text{V}$ ,  $1.0\text{ M}\Omega$                       b) 3V,  $1.0\text{ M}\Omega$   
c) 1V,  $3.0\text{ M}\Omega$                       d) 3 mV,  $3.0\text{ M}\Omega$
- A phasor represents  
a) the magnitude of the quantity  
b) the magnitude and direction of a quantity  
c) the phase angle                      d) the length of a quantity
- What is the correct expression of  $\omega$ ?  
a)  $\omega=2\pi$                       b)  $\omega=2\pi f$                       c)  $\omega=\pi f$                       d)  $\omega=2f^2$
- What is the phase angle for a parallel circuit consisting of a 500 kHz, 5 Vac source with a 47pF capacitor, and a 4.7 k  $\Omega$  resistor in parallel?  
a)  $55.3^\circ$                       b)  $55.3^\circ$                       c)  $34.8^\circ$                       d)  $-34.8^\circ$

6. When the frequency of the source voltage decreases, the impedance of a parallel RC circuit

- a) increases
- b) does not increase
- c) decreases
- d) decreases to zero

7. The unit of inductive reactance  $X_L$  is

- a) ohm
- b) farad
- c) henry
- d) farad  $\text{sec}^{-1}$

8. If a load is purely inductive and the reactive power is 12 VAR, the apparent power is

- a) 12 V
- b) 0 V
- c) 6 V
- d) 24 V

9. In a certain series resonant circuit,  $V_c=150$  V,  $V_L=150$  V, and  $V_R=50$  V. the value of the source voltage is

- a) 150 V
- b) 300 V
- c) 50 V
- d) 350 V

10. For each decade increase in frequency above the critical frequency, the output of a low-pass filter decreases by

- a) 20 dB
- b) 3 dB
- c) 10 dB
- d) 0 dB

### SECTION – B

#### Answer any FIVE Questions

(5 × 2 = 10)

- 11. Define load current.
- 12. State maximum Power transfer theorem.
- 13. Define RMS value.
- 14. Tell about Oscilloscope and its basic types.
- 15. What is called Cut-off frequency?
- 16. Define Conductance, Susceptance and Admittance of RL circuits.
- 17. Define Bandpass filter.

### SECTION – C

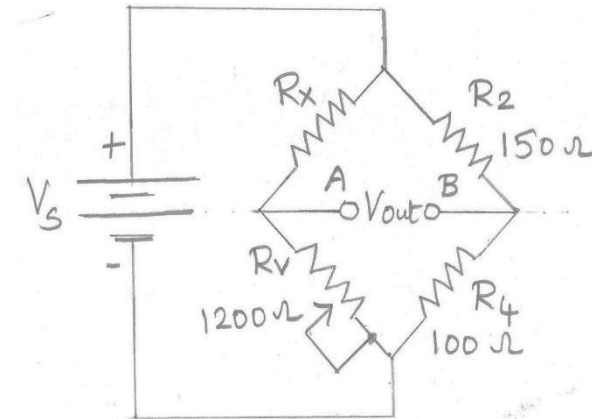
#### Answer ALL Questions

(5 × 5 = 25)

18. a) Explain Norton's Theorem.

[OR]

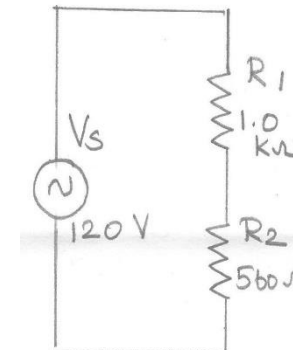
b) Determine the value of  $R_x$  in the balanced bridge shown in figure.



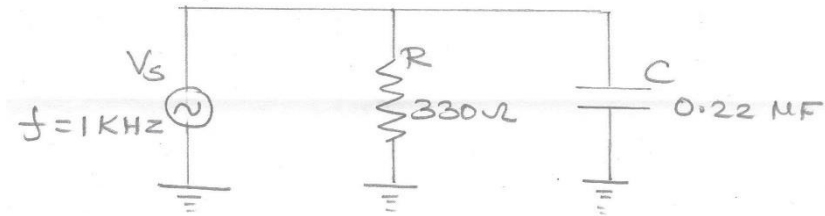
19. a) Explain Sine Wave formula.

[OR]

b) Determine the RMS voltage across each resistor and the rms current in figure. The source voltage is given as a rms value. Also, determine the total power.



20. a) Determine the total admittance (Y) and then convert it to total impedance (Z) in figure. Draw the admittance phasor diagram.

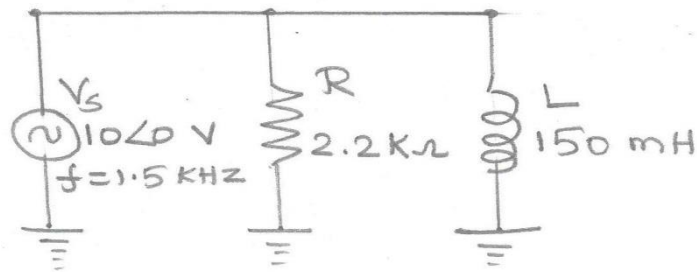


[OR]

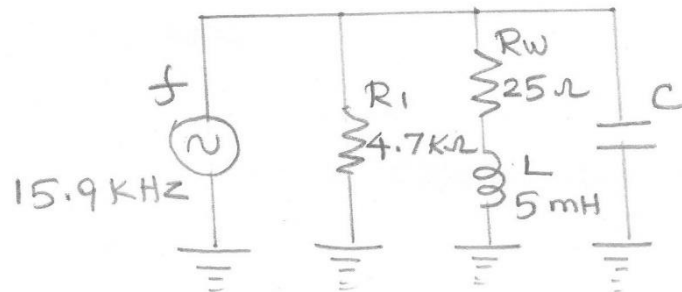
- b) Show the phase relationships of current and voltages.  
21. a) Determine Impedance of series RL circuits.

[OR]

- b) Determine the total current and the phase angle in the circuit of figure. Draw a phasor diagram showing the relationship of  $V_s$  and  $I_{tot}$ .



22. a) Convert the series parallel circuit in the below figure to an equivalent parallel form at the given frequency.



[OR]

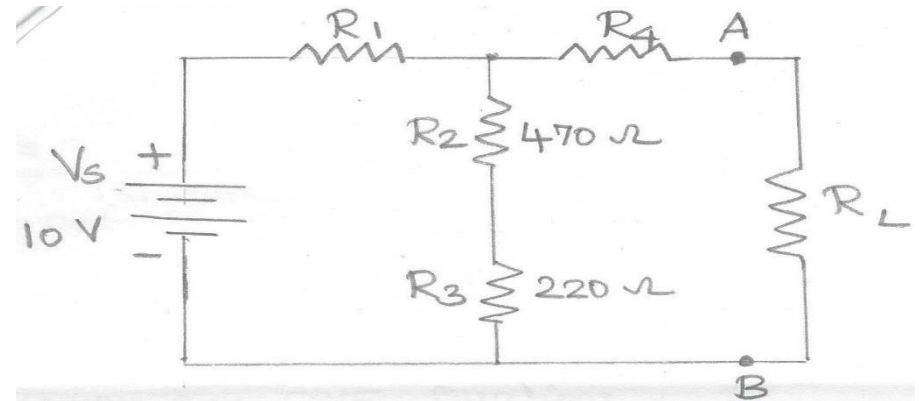
- b) Analyze series RLC circuit.

## SECTION – D

Answer any THREE Questions

$(3 \times 10 = 30)$

23. Find the Thevenin equivalent circuit between A and B of the circuit in the below fig.

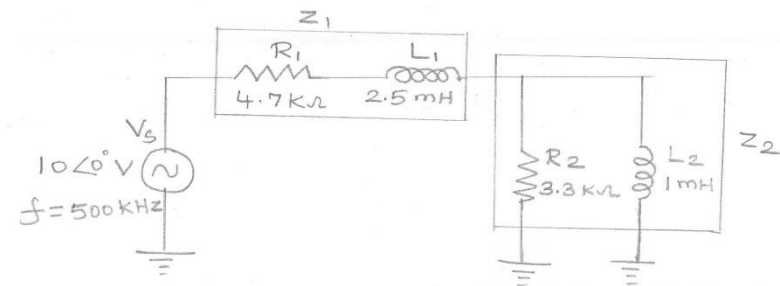


24. Write the characteristics of basic non sinusoidal wave forms.

25. Discuss about Power in RC circuits.

26. In the circuit, determine the following value

- a)  $Z_{tot}$       b)  $I_{tot}$       c)  $\vartheta$



27. Analyse the operation of band pass and band stop filters.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- If  $n_1 = 5$  and  $n_2 = 6, 7, 8, \dots$  we get \_\_\_\_\_ series.  
a) Balmer                      b) Lyman                      c) Brackett                      d) Pfund
- \_\_\_\_\_ theory was able to explain only the series spectra of the simplest hydrogen atom.  
a) Bohr's                      b) Sommerfeld's                      c) Rutherford's                      d) Larmor's
- $g$  is called \_\_\_\_\_.  
a)  $g$  factor                      b) acceleration due to gravity  
c) Lande's splitting factor                      d) gyro magnetic ratio
- The only sensible effect of a magnetic field upon the motions of atomic electrons is called  
a) coupling                      b) Larmor's precession  
c) dipole moment                      d) spin orbit coupling
- Microwave rotational spectrum is absent in \_\_\_\_\_ molecules  
a) Linear                      b) Symmetric top  
c) Asymmetric top                      d) Spherical top
- Which among the following is used as source in Microwave spectroscopy?  
a) Klystron                      b) Magnetron                      c) Cyclotron                      d) Betatron

7. The correct order of different types of energies is

- a)  $E_{el} \gg E_{vib} \gg E_{rot}$                       b)  $E_{el} \gg E_{rot} \gg E_{vib}$   
c)  $E_{rot} \gg E_{vib} \gg E_{el}$                       d)  $E_{vib} \gg E_{rot} \gg E_{el}$

8. For a diatomic molecule undergoing harmonic vibration, the spectral absorption occurs at

- a)  $\widetilde{\omega}_{osc}/4$               b)  $\widetilde{\omega}_{osc}$               c)  $\widetilde{\omega}_{osc}/3$               d)  $\widetilde{\omega}_{osc}/2$

9. When a beam of light is passed through a transparent substance, certain discrete frequencies above and below that of the incident beam scattered is referred as \_\_\_\_\_ scattering.

- a) Rayleigh              b) Raman              c) Morse              d) Fourier

10. Pure rotations of spherical top molecules are completely \_\_\_\_\_ in the Raman.

- a) inactive              b) active              c) unobservable              d) absent

### **SECTION – B**

**Answer any FIVE Questions**

**(5 × 2 = 10)**

11. State correspondence principle.
12. Mention the two ways of exciting an atom.
13. What is gyro-magnetic ratio?
14. What is Stark effect?
15. Why OCO (CO<sub>2</sub>) is microwave inactive?
16. What are 'hot bands'?
17. Why lasers are preferred as ideal sources in Raman Spectrometers?

### **SECTION – C**

**Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Describe the Bohr atom model and derive the radius of the n<sup>th</sup> permissible orbit for hydrogen.

**[OR]**

b) Calculate: i) ionisation potential              ii) first excitation potential of the hydrogen atom. Given  $h = 6.62 \times 10^{-34} \text{ Js}$ ,  $e = 1.6 \times 10^{-19} \text{ C}$  and  $m = 9.1 \times 10^{-31} \text{ kg}$ .

19. a) State and explain Larmor's theorem.

**[OR]**

b) A beam of electrons enters a uniform magnetic field of 1.2 T calculate the energy difference between electrons whose spins are parallel and antiparallel of the field.

20. a) Classify the molecules on the basis of their principal moments of inertia.

**[OR]**

b) The rotational spectrum for HCl shows series of lines separated by  $20.6 \text{ cm}^{-1}$ . Find the moment of inertia and the intermolecular distance.

21. a) Explain the principle and working of ATR spectrometer.

**[OR]**

b) Calculate the vibrational energy levels of an HCl molecule, assuming the force constant to be  $516 \text{ Nm}^{-1}$ .

22. a) Define Rayleigh scattering and Raman scattering. Explain Raman effect on the basis of Quantum theory.

**[OR]**

b) The exciting line in an experiment is  $5460\text{\AA}$  and the Stokes line is at  $5520\text{\AA}$ . Find the wavelength of anti-Stokes line.

### **SECTION – D**

**Answer any THREE Questions**

**(3 × 10 = 30)**

23. Explain Davis and Goucher experiment to determine excitation and ionization potentials.

24. State and explain Pauli-exclusion principle.

25. Explain the factors which affect the intensities of spectral lines.

26. Explain the transition between the rotational-vibrational energy level of a diatomic molecule together with the spectrum.

27. Explain Raman Spectrometer. Discuss the problems encountered and the remedial measure of Raman spectroscopy.





**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- Materials having different properties along different directions are called  
a) isotropic      b) anisotropic      c) amorphous      d) homogeneous
- The relation between atomic radius  $r$  and lattice constant  $a$  in the case of BCC structure is  
a)  $a = 2r$       b)  $a = 4r/\sqrt{3}$       c)  $a = 2\sqrt{2}r$       d)  $a = (\sqrt{3}/4)r$
- Real crystals are of finite  
a) size      b) weight      c) density      d) all the above
- Point defects influence  
a) electrical properties      b) mechanical properties  
c) optical properties      d) all the above
- The unit for permittivity of free space  $\epsilon_0$  is  
a)  $\text{Hm}^{-1}$       b)  $\text{Fm}^{-1}$       c)  $\text{Cm}^{-1}$       d) dimensionless
- Dielectrics are  
a) solids      b) metals      c) semiconductors      d) insulators
- When a diamagnetic material is placed inside an external magnetic field  
a) induced magnetic dipoles act along the applied field direction

- b) induced magnetic dipoles are opposite to the applied field direction
- c) induced magnetic dipoles act perpendicular to the applied field direction
- d) there will be no induced magnetic dipoles

8. Upon application of external magnetic field, the orbital magnetic dipole moment changes. The induced dipole moment  $\mu_{\text{ind}}$  is given by

- a)  $e^2 r^2 B / 4m$
- b)  $e^2 B / 4m r^2$
- c)  $e^2 B / 4\pi r^2$
- d)  $e^2 r / 4\pi B$

9. The magnetic flux lines are rejected out of the superconductor. This property is known as

- a) Isotope effect
- b) Meissner effect
- c) Coulomb effect
- d) Cooper pair effect

10. The BCS theory is based on advanced

- a) quantum concept
- b) classical concept
- c) micro concept
- d) macro concept

### **SECTION – B**

**Answer any FIVE Questions**

**(5 × 2 = 10)**

11. Define space lattice.
12. What is Edge dislocations?
13. How does ionic polarization occur?
14. Define Magnetization.
15. What is Bohr magneton?
16. Write a note on Isotope effect.
17. What are cooper pairs?

### **SECTION – C**

**Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Explain on Face centred cubic (FCC) structure.

**[OR]**

b) Find the maximum radius of the interstitial sphere that can fit into the void at  $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$  between the atoms in the body centred cubic structure.

19. a) Illustrate surface imperfections with neat diagram.

**[OR]**

b) X- rays of wavelength  $1.5418 \text{ \AA}$  are diffracted by (111) planes in a crystal at an angle  $30^\circ$  in the first order. Calculate the interatomic spacing.

20. a) Explain Clausius-Mosotti relation in dielectrics subjected to static fields.

**[OR]**

b) The dielectric constant of He gas at NDT is 1.0000684. Calculate the electronic polarizability of He atoms if the gas contains  $2.7 \times 10^{25}$  atoms per  $\text{m}^3$ .

21. a) Explain the quantum numbers with diagram.

**[OR]**

b) A paramagnetic material has a magnetic field intensity of  $10^4 \text{ A/m}$ . If the susceptibility of the material at room temperature is  $3.7 \times 10^{-3}$  calculate the magnetization and flux density in the material.

22. a) What is Meissner effect? Show that superconductors exhibit perfect diamagnetism.

**[OR]**

b) A superconducting tin has a critical temperature of  $3.7 \text{ K}$  at zero magnetic field and a critical field of  $0.0306 \text{ Tesla}$  at  $0\text{K}$ . Find the critical field at  $2 \text{ K}$ .

### **SECTION – D**

#### **Answer any THREE Questions**

**(3 × 10 = 30)**

23. Identify and explain the following crystal structures

i) Close packed structures (FCC and HCP),

ii) Hexagonal close packed (HCP) structure.

24. Derive Bragg's law. Determine the lattice parameters utilizing Bragg's

X-ray spectrometer method.

25. Apply electronic polarizability in atoms and obtain an expression for it.

26. Develop in detail the Langevin classical theory of diamagnetism.

27. Make use of Josephson effect to discuss it in cases of D.C and A.C.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- In a 7segment display, LEDs *b* and *c* lit up. The decimal number displayed is  
a) 9                      b) 7                      c) 3                      d) 1
- Which number system has base 16?  
a) decimal              b) binary                      c) octal                      d) Hexadecimal
- An astable multivibrator has \_\_\_\_\_  
a) one stable state                      b) two stable states  
c) no stable state                      d) none of the above
- Total number of inputs in a half adder is  
a) 2                      b) 3                      c) 4                      d) 1
- A register is defined as  
a) The group of latches for storing one bit of information  
b) The group of latches for storing n-bit of information  
c) The group of flip-flops suitable for storing one bit of information  
d) The group of flip-flops suitable for storing binary information
- Synchronous counter is a type of  
a) SSI counters      b) LSI counters      c) MSI counters      d) VLSI counters

7. If modulation index is greater than one

- a) The baseband signal is not preserved in the envelope of the AM signal
- b) The recovered signal is distorted
- c) It is called over modulation
- d) All of the above

8. Modulation index for FM is defined as

- a)  $\delta/f_m$
- b)  $\delta/f_r$
- c)  $f_m/\delta$
- d)  $\delta/2 f_r$

9. Which of these are 16bit microprocessors?

- a) 80286
- b) MC68000
- c) Z8000
- d) all

10. The address bus of any microprocessor is always

- a) unidirectional
- b) bidirectional
- c) multidirectional
- d) none of the above

### **SECTION – B**

#### **Answer any FIVE Questions**

**(5 × 2 = 10)**

- 11. What are universal gates? Why are they called as universal gates?
- 12. How will you differentiate decoder from demultiplexer?
- 13. Recall the synchronous and asynchronous operation.
- 14. Define shift register.
- 15. Recall the effect of noise on a carrier signal.
- 16. Relate the deviation ratio with the frequency modulation.
- 17. List the four primary operations of micro-processing unit.

### **SECTION – C**

#### **Answer ALL Questions**

**(5 × 5 = 25)**

- 18. a) Interpret the output result of EX-OR gate and outline their importance.

**[OR]**

- b) Simplify  $Y = (A+B) (A' (B'+C'))' + A' (B+C)$ .

- 19. a) Demonstrate the operation of half adder and full adder.

**[OR]**

- b) 555 timer in a stable mode,  $R_B = 750 \text{ ohm}$ , determine the values for  $R_A$  and C to provide 1MHz clock that has a duty cycle of 25 percent.

- 20. a) Compare synchronous counter with the asynchronous counter.

**[OR]**

- b) Experiment with the clocked RS flip flop, examine the output condition of “NO CHANGE”.

- 21. a) Demonstrate the pre-emphasis and de-emphasis process.

**[OR]**

- b) Find the carrier and modulating frequencies, the modulating index and the maximum deviation of FM wave represented by the voltage equation  $V = 12 \sin (6 \times 10^8 t + 5 \sin 1250 t)$ . What power will this FM wave dissipate in 10 ohm resistor?

- 22. a) Summarize the instruction set of 8085 microprocessors.

**[OR]**

- b) Write the programme for addition of two 8- bit numbers of 49 H and 56 H and also infer the output result.

### **SECTION – D**

#### **Answer any THREE Questions**

**(3 × 10 = 30)**

23. Construct 16-1 multiplexer using the theory of multiplexer.
24. Make use of 2's complement representation, how to perform the arithmetic addition and subtraction?
25. What are the different types of registers available? Construct the register of serial in – serial out and explain the techniques to shift the data.
26. Develop the theory of amplitude modulation in detail.
27. Construct the functional block diagram of 8085 microprocessor.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

1. \_\_\_\_\_ refers to putting together essential features without including background details

- |                     |                  |
|---------------------|------------------|
| a) Data abstraction | b) Data members  |
| c) Data hiding      | d) Encapsulation |

2. What is the output of this program?

```
#include<iostream.h>
```

```
#include<math.h>
```

```
int main ()
```

```
{
```

```
int i;
```

```
cout << "Please enter an integer value: ";
```

```
cin >> i + 4;
```

```
return 0;
```

```
}
```

- |      |      |          |                      |
|------|------|----------|----------------------|
| a) 0 | b) 4 | c) error | d) none of the above |
|------|------|----------|----------------------|

3. \_\_\_\_\_ are widely used in C++ for memory management and to achieve polymorphism.

- |             |          |             |          |
|-------------|----------|-------------|----------|
| a) Pointers | b) Array | c) Function | d) Class |
|-------------|----------|-------------|----------|

4. Which of the following statement is correct?

- a) Overloaded functions can have at most one default argument
- b) An overloaded function cannot have default argument.
- c) All arguments of an overloaded function can be default.
- d) A function if overloaded more than once cannot have default argument.

5. A \_\_\_\_\_ member function can only be called by another function that is member of it's class.

- a) friend                      b) static                      c) public                      d) private

6. A \_\_\_\_\_ can only be called by another function that is member of its class.

- a) constant member function                      b) private member function
- c) static member function                      d) friend function

7. A \_\_\_\_\_ is used to declare and initialize an object from another object.

- a) default constructor                      b) default argument constructor
- c) implicit constructor                      d) copy constructor

8. Operator overloading is done with the help of a special function called \_\_\_\_\_, which describes the special task of an operator.

- a) overloading function                      b) special task function
- c) detail function                      d) operator function

9. Which is the correct syntax of inheritance?

- a) class derived\_classname : base\_classname{ /\*define class body\*/ };
- b) class base\_classname : derived\_classname{ /\*define class body\*/ };
- c) class derived\_classname : access base\_classname{ /\*define class body\*/ };
- d) class base\_classname :access derived\_classname{ /\*define class body\*/ };

10. A class can contain objects of other classes is known as \_\_\_\_\_

- a) virtual base class                      b) containership
- c) single inheritance                      d) polymorphism

**2**

## **SECTION – B**

### **Answer any FIVE Questions**

**(5 × 2 = 10)**

- 11. Define the term class.
- 12. What is data encapsulation?
- 13. What is an inline function?
- 14. Define function overloading.
- 15. Write the use of member function.
- 16. Write any two types of a constructor.
- 17. What is meant by multiple inheritance?

## **SECTION – C**

### **Answer ALL Questions**

**(5 × 5 = 25)**

18. a) Write about the benefits of OOP.

**[OR]**

b) Describe the structure of C++ program with example.

19. a) Narrate the basic data types in C++.

**[OR]**

b) Write a short note on Friend function with example.

20. a) How to create a class? Explain with example.

**[OR]**

b) Discuss about the static member function with example.

21. a) Explain copy constructor with example.

**[OR]**

b) Describe overloading unary operator with example.

**3**



22. a) Narrate the multilevel inheritance with example.

[OR]

b) Write about the hierarchical inheritance with example.

### **SECTION – D**

**Answer any THREE Questions**

**(3 × 10 = 30)**

23. Write a program to find the biggest among any three numbers.

24. Write a program to find the sum and average of given numbers using for loop.

25. Write a program to find the factorial of a given number using while loop.

26. Analyze in brief about Binary Operator Overloading with example.

27. Illustrate in detail about single Inheritance with example.




**VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST**
**College with Potential for Excellence**

 Residential & Autonomous – A Gurukula Institute of Life-Training  
 Re-accredited (3<sup>rd</sup> Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC  
 [Affiliated to Madurai Kamaraj University]

**B.A. / B.Sc. Degree (Semester) Examinations, November 2021**

Part – IV: Non-Major Elective Course: First Semester: Paper – I

**SPACE SCIENCE**

Under CBCS and LOCF – Credit 2

 Time: **2 Hours**

 Max. Marks: **75**
**SECTION – A**
**Answer ALL Questions**
**(10 × 1 = 10)**

1. The term ISRO stands for
  - a) Indian Space Research Organization
  - b) Indian Science Research Organization
  - c) Indian Sound Research Organization
  - d) Indian Space Recent Organization
2. The biggest planet in our solar system is
 

a) Saturn	b) Jupiter	c) Venus	d) Pluto
-----------	------------	----------	----------
3. Which one is the third position of our Solar system
 

a) Sun	b) Jupiter	c) Earth	d) Mars
--------	------------	----------	---------
4. The unwanted sound is named as
 

a) noise	b) music	c) light	d) echo
----------	----------	----------	---------
5. The term AM stands for
 

a) Amplitude Modulation	b) Air Modulation
c) Angular Modulation	d) Axis Modulation
6. A body moving in an orbit around a planet is called
 

a) missile	b) rocket	c) satellite	d) comet
------------	-----------	--------------	----------

7. Name the principle which behind the optical fiber cable  
 a) refraction    b) reflection    c) total internal reflection    d) diffraction
8. Which one planet has rock rings  
 a) Earth            b) Mercury            c) Mars            d) Saturn
9. The process of exchanging information is  
 a) communication    b) transport            c) cables            d) radio
10. PSLV stands for  
 a) Polar Satellite Launch Video            b) Polar Satellite Launch Vehicle  
 c) Polar Satellite Live Video            d) Polar Sound Launch Vehicle

### **SECTION – B**

#### **Answer any FIVE Questions**

**(5 × 2 = 10)**

11. Write down the name of the nine planets?
12. State Newton's third law of motion
13. What is rocket?
14. What is solar system?
15. What is astrophysics?
16. What is helio centric theory?
17. What is modulation?

### **SECTION – C**

#### **Answer ALL Questions**

**(3 × 9 = 27)**

18. a) Explain the phenomenon of Communication system

**[OR]**

- b) Give a breif note on Multistage rocket

19. a) Differentiate between frequency modulation and Amplitude modulation

**[OR]**

- b) Explain the terms:

- i) Transmitter    ii) Channel    iii) Noise    iv) Receiver

20. a) List out the various benefits of optical fiber communication system

**[OR]**

- b) Discuss about the red planet in the solar system.

### **SECTION – D**

#### **Answer any TWO Questions**

**(2 × 14 = 28)**

21. Describe in detail about the Geo stationary satellite.
22. Describe in detail about the Saturn and its rocky rings.
23. Explain the concept of fiber optic technology.
24. Explain about the mysterious uranus & neptune in planetary system.





# VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

College with Potential for Excellence

Residential & Autonomous – A Gurukula Institute of Life-Training  
Re-accredited (3<sup>rd</sup> Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC  
[Affiliated to Madurai Kamaraj University]

**B.Sc. Physics** Degree (Semester) Examinations, November 2021

Part – IV: Skill Based Course: Third Semester: Paper – I

## **SOLAR ENERGY**

Under CBCS and LOCF – Credit 2

Time: **2 Hours**

Max. Marks: **75**

### **SECTION – A**

#### **Answer ALL Questions**

**(10 × 1 = 10)**

- The instrument is used to measure the duration in hours of bright sunshine during the course of the day is
  - Pyranometer
  - Sunshine recorder
  - Eppley Pyranometer
  - Yellot Solarimeter
- The upper layer of the convective zone is called \_\_\_\_\_
  - Chromospheres
  - Photosphere
  - Convective layer
  - corona
- The first solar cooker was developed by \_\_\_\_\_
  - Mr.M.K.Gandhi
  - Mr.K.M.Bhosh
  - Mr.M.K.Ghosh
  - Mr.G.K.Bush
- Which of the following collectors use optical system in the form of reflectors or refractors?
  - Focusing collector
  - Liquid collector
  - air collector
  - none of the above.
- In India, a simple instrument is often used for quick measurement of the total solar radiation is
  - Agni
  - Suryamapi
  - Suryalight
  - Suryavista

6. Solar cells are connected and are often placed into a sealed glass or plastic unit called

- a) Array      b) Modules      c) phonons      d) absorber

7. Global radiation =

- a) Direct radiation – Diffuse Radiation  
b) Direct radiation + Diffuse Radiation  
c) Direct radiation / Diffuse Radiation  
d) Diffuse Radiation / Direct radiation

8. In a solar collector, why is the transparent cover providing for?

- a) Protect the collector from dust.  
b) Reduce the heat losses from collector beneath to atmosphere.  
c) Transmit solar radiation only      d) All of the above.

9. Basically there are \_\_\_\_\_ designs of solar cooker.

- a) three      b) five      c) seven      d) two

10. Which of the following scientist devised solar furnace composed of a paraboloidal concentrator and a lens?

- a) Lavoisier      b) M.K.Ghosh      c) Straubel      d) Trombe

### **SECTION – B**

#### **Answer any FIVE Questions**

**(5 × 2 = 10)**

11. Define Solar Constant.  
12. What is solar collector?  
13. List out the different solar energy measuring equipment's.  
14. What is focusing collector?  
15. Give a note on the application of solar energy in space.

16. What is solar cell?

17. Point out some advantages of Photovoltaic solar energy conversion.

### **SECTION – C**

#### **Answer ALL Questions**

**(3 × 9 = 27)**

18. a) Explain about sunshine recorder in detail.

**[OR]**

b) Explain about a typical liquid collector.

19. a) Write about the main advantages and disadvantages of concentrator systems over flat plate collector.

**[OR]**

b) Give a brief account on the application of solar energy in space.

20. a) Mention the different types of solar energy measuring equipment's and explain about the structure of the sun?

**[OR]**

b) What are the main components used in the flat plate collector and explain the effect of dust and shading.

### **SECTION – D**

#### **Answer any TWO Questions**

**(2 × 14 = 28)**

21. Discuss briefly about pyranometer the most common instrument used for the measurement of global radiation  
22. Illustrate the Box type solar cooker with neat diagram and also mention its merits and demerits.  
23. Describe about solar concentrator and receiver geometries in detail.  
24. Discuss briefly about the applications of solar furnace.



**SECTION – A****Answer ALL Questions****(10 × 1 = 10)**

- Optical fibre was invented in  
a) 1950                      b) 1960                      c) 1970                      d) 1975
- The working principle of an optical fibre is  
a) reflection    b) refraction  
c) total internal reflection    d) polarization
- The chief characteristics of stepped index monomode fibre is  
a) very small core diameter    b) low NA  
c) very high bandwidth    d) all of the above
- Multimode step index fiber has  
a) large core diameter and large NA    b) large core diameter and small NA  
c) small core diameter and large NA    d) small core diameter and small NA
- In the fabrication of optical fibre silica is used because  
a) it is cheap and easily available    b) it is obtained in abundance  
c) it is obtained in purest form    d) processing it is easier
- The optimal NA achieved using PHASIL system is  
a) 0.1                      b) 0.3                      c) 0.2                      d) 0.4
- Source of light in optical fibre is  
a) PIN diode                      b) Photo diode                      c) phototransistor                      d) LED

8. Which one of the following is true for a Laser source?
- spatial coherence
  - spatial and temporal coherence
  - temporal coherence
  - it has no coherence
9. Bandwidth of phototransistor is about
- 4 MHz
  - 400 MHz
  - 400 kHz
  - 40 kHz
10. Function of receiver in optical fibre is to
- reshape the degraded signal only
  - only amplify the degraded signal
  - both amplify and reshape the degraded signal
  - retrieve the signal

### **SECTION – B**

#### **Answer any FIVE Questions**

**(5 × 2 = 10)**

- State the two conditions for total internal reflection.
- How does one determine optical characteristic of a material?
- Enumerate three broad classes of optical fibres.
- What is transit time dispersion?
- Mention the different types of optical fibre fabrication process.
- What are the advantages of multi-element glasses?
- Enlist the two different classes of optical fibre transmitters.

### **SECTION – C**

#### **Answer ALL Questions**

**(3 × 9 = 27)**

18. a) Explain the working principle of a stepped index fibre.

**[OR]**

- b) i) Compute the NA, acceptance angle, and the critical angle of the fibre having core refractive index 1.50 and clad refractive index 1.45.

- ii) Calculate the refractive indices of the core and cladding material of a fibre from the following data: NA = 0.22 and  $\Delta = 0.012$ .

19. a) Explain the external chemical vapour deposition process.

**[OR]**

- b) Explain the working principle of a semiconductor laser diode.

20. a) i) Calculate the efficiency of a PIN silicon photo-detector if the responsivity is 0.58 A/W at 800 nm.

- ii) A graded index fibre has a core diameter of 50  $\mu\text{m}$ . NA = 0.21 and index profile = 1.85. Compute the number of modes at operating wavelength of 1.3  $\mu\text{m}$ .

**[OR]**

- b) Explain various important applications of integrated optic fibre technology.

### **SECTION – D**

#### **Answer any TWO Questions**

**(2 × 14 = 28)**

- Derive the expression for the acceptance angle and numerical aperture of an optical fibre.
- Explain various internal CVD techniques along with their characteristics.
- Elucidate the working principle of PN junction photo detector and PIN photo diode.
- Explain with necessary circuit diagrams, the working principle of various fibre optic receivers.



# VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

**College with Potential for Excellence**

Residential & Autonomous – A Gurukula Institute of Life-Training  
Re-accredited (3rd Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC

Affiliated to Madurai Kamaraj University

**CERTIFICATE COURSE EXAMINATIONS, November 2021**

**HOUSE WIRING-I**

Time: **2 Hours**

Maximum Marks: **50**

## SECTION – A

**Answer ALL Questions**

**(10 × 1 = 10)**

1. What is A.C?
2. What is D.C?
3. What is the purpose of Multimeter?
4. Write down the abbreviation for LED.
5. What is the function of tester?
6. Write down the composition of fuse wire.
7. Name the electrolyte used in the lead cell.
8. Name the colours of wire used in three phase supply?
9. What is an inverter?
10. Write down the voltage range for A.C & D.C.

## SECTION – B

**Answer ALL Questions**

**(4 × 5 = 20)**

- 11.a) Give a brief account on parts of Iron box.

**[OR]**

- b) List out the tools used for electrical works in our daily life.

- 12.a) Explain about Earthing in detail.

**[OR]**

- b) Write down about different types of switches.

- 13.a) Explain how to connect wires from main board to switch board.

**[OR]**

- b) Explain about the parts and functions of a ceiling fan.

- 14.a) Illustrate the functions of MCB.

**[OR]**

- b) Draw the symbols for the following:

i) Earth

ii) Resistance

iii) Transformer

iv) Cell

v) Battery

## SECTION – C

**Answer any TWO Questions**

**(2 × 10 = 20)**

15. Discuss briefly about the precautions to be taken to prevent electric shock
16. Explain about the function of a transformer.
17. Explain about the function of a soldering rod.

*BBBBBB*





# VIVEKANANDA COLLEGE, TIRUVEDAKAM WEST

**College with Potential for Excellence**

Residential & Autonomous – A Gurukula Institute of Life-Training  
Re-accredited (3<sup>rd</sup> Cycle) with 'A' Grade (CGPA 3.59 out of 4.00) by NAAC  
[Affiliated to Madurai Kamaraj University]

**B.A. / B.Sc. Degree (Semester) Examinations, November 2021**

Part – IV: Non-Major Elective course: Fifth Semester: Paper – I

## **ARMED FORCES AND NATIONAL INTEGRATION**

Under CBCS and LOCF – Credit 2

Time: **2 Hours**

Max. Marks: **75**

### **SECTION – A**

#### **Answer ALL Questions**

**(10 × 1 = 10)**

- WOTA is located at  
a) Gwalior      b) Kamptee      c) Chennai      d) Delhi
- The Kunzru's committee formed in the year of  
a) 1947      b) 1948      c) 1950      d) 1946
- NCC was raised in the year  
a) 1935      b) 1947      c) 1948      d) 1938
- The national games of India is  
a) Hockey      b) cricket      c) football      d) kabaddi
- Kargil Vijay Diwas was celebrated on  
a) 26<sup>th</sup> July      b) 21<sup>st</sup> June      c) 8<sup>th</sup> October      d) 15<sup>th</sup> January
- Indian Military Academy (IMA) is located at\_\_\_\_\_.  
a) Dehradun      b) Pune      c) Mumbai      d) Chennai
- The NCC day of India is\_\_\_\_\_.  
a) Jan 15      b) Sep 05  
c) Jun 21      d) last Sunday of November
- The study of disease is called  
a) Pathology      b) ecology      c) virology      d) fungi

9. The International Yoga Day is

- a) Jun 05      b) June 21      c) Aug 15      d) Jan 26

10. Periyar Wild Life sanctuary is located in

- a) Kerala      b) Tamilnadu      c) Andrapradesh      d) Karnataka

### **SECTION – B**

**Answer any FIVE Questions**

**(5 × 2 = 10)**

11. State the motto of NCC.
12. Expand the terms: YEP and NIC.
13. Name any two wars of Independence.
14. What is Vijay Diwas?
15. Who is a democratic leader?
16. What is Ethics?
17. What is pollution?

### **SECTION – C**

**Answer ALL Questions**

**(3 × 9 = 27)**

18. a) What are the Cardinal points of NCC?

**[OR]**

b) Draw the different ranks of Army officers.

19. a) What are the fundamental duties of the Indian citizens.

**[OR]**

b) What are the qualities of a leader?

20. a) What are the aims of NCC?

**[OR]**

b) What are the preventive measures for dengue?

### **SECTION – D**

**Answer any TWO Questions**

**(2 × 14 = 28)**

21. Draw and explain the flow chart of NCC administration.
22. Write an essay about the national integration.
23. Explain the different types of fire and firefighting.
24. Explain the air pollution and water pollution.

