Even Semester Honours Examination, 2021
Sem-4 : Internal Examination

Sub : PHSA Paper : CC-8-Th

Answer any ten questions. Each question carry 2 marks.

1. Express the given complex number, $z = 5 + 5i$ in polar form.

2. Prove that $e^{z_1}.e^{z_2}=e^{z_1+z_2}$

3. For $f(z)=\frac{5z^2-3z}{(z-1)^2}$, locate and name the singularities in the finite z plane.

4. Determine if the function $f(z) = z^2 = x^2 - y^2 + i2xy$ is analytic or not.

5. Evaluate the complex integral $\int tanz\,dz$ over a circle C defined as $|z| = 2$.

6. A physical system is described in two different schemes - by cartesian coordinates x_i (i=1,2,...,3N) and by generalized coordinates q_j (j=1,2,...,n). What is the connection between x_i and q_j ? What is the necessary and sufficient condition that the q's can be solved in terms of the x's ? 1+1

7. A physical system with N particles is subjected to l number of constrains. What is the role played by the constraints ?

8. Why does nonholonomic systems always require more coordinates for their description than their degrees of freedom ?

9. Justify : A virtual displacement conforms to the instantaneous constrains.

10. In case of a simple pendulum, the work done by the constraint force vanishes. In which situation, the work done should be nonzero ?

11. What are the information which the Lorentz transformation carries about space and time ? 1+1

12. Two events are simultaneous in an inertial frame. Explain whether they should appear so in a second inertial frame moving relative to the first. 0.5+1.5

13. Briefly explain how does the Lorentz invariant interval $ds^2 = c^2dt^2 - dx^2 - dy^2 - dz^2$ leads to the notion of hyperboloid geometry of space-time. 1+1

14. Justify : The invariant interval between two causally connected events are always timelike and their temporal ordering is absolute.

15. What is the similarity between the definition of velocity in three dimensional space and that in Minkowski space ?

Internal Assessment Examination'2021
Semester-IV Honours Paper : CC9 Time: 30 minutes

Full Marks : 20
Answer any *ten* of the following questions $10 \times 2 = 20$

1. What are the Barkhausen criteria for sustained oscillation?
2. What is the frequency of oscillation of a Wien Bridge oscillator?
3. Draw the simplified hybrid equivalent circuit diagram of Hartley oscillator.
4. What is astable multivibrator? Why it is called mutivibrator?
5. What is virtual ground in OPAMP?
6. Find the closed loop gain of an inverting amplifier using OPAMP.
7. Draw the energy band diagram of an unbiased p-n junction.
8. What do you mean by Zenner break down?
9. Draw a circuit diagram of a full wave rectifier.
10. When the emitter current of a transistor changes by 1 mA, its collector current changes by 0.995 mA. Calculate α and β.
11. Draw a circuit diagram for n-p-n transistor as CE amplifier.
12. What is Q point?
13. What do you mean by thermal runaway?
14. What do you understand by JFET?
15. What do you understand by MOSFET?
16. What is pinch off Voltage?
17. What does a Transistor amplifier do ?
18. What is frequency response of an amplifier ?
19. State the importance of choosing the Q point in a transistor amplifier .

Even Semester Honours Examination, 2021
Sem-4 : Internal Examination

Sub : PHSA Paper : CC-10-Th

Answer any ten questions. Each question carry 2 marks.

1. Write down the formula of spherical harmonics of the Schrodinger wave function in the hydrogen atom problem mentioning each term.

2. Using the formula from question 1, determine Y_0^0 .

3. Show that L^2 commutes with L_y.

4. The wave function of hydrogen atom is $\psi=\frac{1}{4}(2\psi_{100}+3\psi_{210})$, Find out the expectation value for L^2.

5. Write down the relativistic energy correction term with respect to the Bohr energy for hydrogen atom.

6. What is the physical interpretation of the eigenvalue equation $\hat{A}|f\rangle=a|f\rangle$ where $\hat{A}$ is an operator and $|f\rangle$ is a vector function ? What is the condition under which $\hat{A}$ can represent a physical variable ?

7. Why is it justified to multiply a state vector representing a quantum system by an arbitrary phase factor $exp(i\varphi)$?

8. Write down the eigenvalue equation of the position operator in momentum space and the eigenvalue equation of the momentum operator in position space.

9. Write down the Hamiltonian of a quantized simple harmonic oscillator and justify that the energy levels are discrete.

10. Why there should exist two different types of eigenstates of the Hamiltonian of linear harmonic oscillator ?

11. Let $|j,m\rangle$ be the simultaneous spectrum of J^2 and J_z (symbols have usual meanings). Explain the reason why 'm' should have a maximum value.

12. Write down the vector space of the simultaneous eigenkets of J^2 and J_z (symbols have usual meanings) when $j=4$.

13. Why should an eigenstate of S_z (z-component of spin operator) be represented by a two component column vector ?

14. A system $|12\rangle = c_1|1\rangle + c_2|2\rangle$ is operated by an operator $exp(-iS_z\varphi/\hbar)$. What are the probability densities with which the system will be found in states $|1\rangle$ and $|2\rangle$ after the operation ?

15. A spin system $|\beta\rangle = c_1|+\rangle + c_2|-\rangle$ is in the state $|S_x+\rangle$ at time $t=0$ (symbols have usual meaning). It is subjected to an external magnetic field. Justify the fate of the system at a later time.

Internal Assessment Examination'2021

Semester-IV Honours Paper :SEC B2 Time: 30 minutes

Full Marks : 20

Answer any *ten* of the following questions $10 \times 2 = 20$

1. What is megger?
2. What is vacuum circuit breaker?
3. Draw the single line diagram of an 11KV/0.443KV substation?
4. What are the types of symmetrical and unsymmetrical faults?
5. What are the protection devices against faults?
6. What is the difference between a generator and a motor?
7. What is the role of stator?
8. What is electromagnetic induction?
9. Explain the function of armature in motor.
10. Give examples of motor in real life.
11. What does a transformer do ?
12. What is the basic emf equation of a transformer?
13. What is no load current?
14. Why is ac motor referred to as induction motor?
15. What is slip speed ?
16. How is the rotating magnetic field generated in the stator of the ac motor ?