Raiganj University

Ph. D Admission Test : 2020-21

Subject: Physics

Time: 2 Hour Full Marks: 70

**Paper-I**

Part-A

**(Multiple choice question from Research methodology) 1X25=25**

1. Applied research is directed towards

a. Problem solving

b. Action oriented research

c. Real time problem

d. All

**Answer:**

2. The following are good research study except

a. Should be replicable

b. Should be systematic and objective

c. Should be completed in three months

d. Should be ethical and unbiased

**Answer:**

3. The primary object of …….. is to provide insight and an understanding of the problem confronting the researcher

a. Exploratory research

b. Conclusive research

c. Casual research

d. Descriptive research

**Answer:**

4. Research is

a. Searching again and again

b. Finding solution to any problem

c. Working in a scientific way to search for truth of any problem

d. None of the above

**Answer:**

 5. Which of the following is the first step in starting the research process?

a. Searching sources of information to locate problem.

b. Survey of related literature

c. Identification of problem

d. Searching for solutions to the problem

**Answer:**

6. A common test in research demands much priority on

a. Reliability

b. Useability

c. Objectivity

d. All of the above

**Answer:**

 7. The essential qualities of a researcher are

a. Spirit of free enquiry

b. Reliance on observation and evidence

c. Systematization or theorizing of knowledge

d. All the above

**Answer:**

 8. In the process of conducting research ‘Formulation of Hypothesis” is followed by

a. Statement of Objectives

b. Analysis of Data

c. Selection of Research Tools

d. Collection of Data

**Answer:**

9. Research involve all the following concept

a. Promotion

b. validation

c. control

d. Testing

**Answer:**

10. The research study carried out with the help of data points is termed as

a. Conceptual

b. Observational

c. empirical

d. None

**Answer:**

11. According to author research method is everything

a. Unconstructed

b. Unbiased

c. Sequential

d. Directed

**Answer:**

 12. A research paper is a brief report of research work based on

a. Primary Data only

b. Secondary Data only

c. Both Primary and Secondary Data

d. None of the above

**Answer:**

13. The research is always -

a. verifying the old knowledge

b. exploring new knowledge

c. filling the gap between knowledge

d. all of these

**Answer:**

14. The research that applies the laws at the time of field study to draw more and more clear ideas about the problem is:

a. Applied research

b. Action research

c. Experimental research

d. None of these

**Answer:**

15. Shodhganga is

a. reservoir of Indian thesis

b. reservoir of research paper of Indian

c. collection of UGC related information

d none

**Answer:**

16. Which of the following tools is good for presenting data

a. excel

b. power point presentation

c. word document

d. none

**Answer:**

17. Which of the following tools is good for report a thesis

a. excel

b. power point presentation

c. word document

d. none

**Answer:**

18. Which of the following tools is good for calculaton with the help of the formula

a. excel

b. power point presentation

c. word document

d. none

**Answer:**

19. Which of the following e-journal is database

a. Scopous

b. Journal of engineering and science

c. International journal of operation management

d. none

**Answer:**

20. Which help researchers all over the world to work together in collaboration

a. ICT( information and communication technology)

b. Plagiarism

c. word processing

d. all

**Answer:**

21. The process not needed in experimental research is:

a. Observation

b. Manipulation and replication

c. Controlling

d. Reference collection

**Answer:**

22. A research problem is not feasible only when:

a. it is researchable

b. it is new and adds something to knowledge

c. it consists of independent and dependent variables

d. it has utility and relevance

**Answer:**

23. Deconstruction is a popular method of research in

a. Basic Science

b. Applied Science

c. Social Science

d. Literature

**Answer:**

24. Identify the correct sequence of research steps :

a. Selection of topic, review of literature, data collection, interpretation of findings

b. Review of literature, selection of topic, data collection, and interpretation of findings

c. Selection of topic, data collection, review of literature, interpretation of findings

d. Selection of topic, review of literature, interpretation of findings, data collection

**Answer:**

25. Which one of the following is not a type of experimental method?

a. Single group experiment

b. Residual group experiment

c. Parallel group experiment

d. Rational group experiment

**Answer:**

Part-B

**(Answer any one from following questions) 1x10=10**

1. a) Discuss basic elements of teaching aptitude. 6

b) Difference between Teaching strategy and method. 4

1. a) What do you mean by basic research?

b) What do you mean by Inter-disciplinary and group research?

c) Discuss different method of research.

 (3+3+4=10)

  **Paper-II**

Part-A

**(Multiple choice question from Physics) 1X25=25**

Q.1 Consider the linear differential equation

 ; If *y* =2 at *x=*0, then the value of *y* at *x*=2 is given by

(A) e-2 (B) e-2 (C) e2 (D) 2e2

**Answer:**

Q.2 Which of the following magnetic vector potentials gives rise to a uniform magnetic field ?

(A) (B) (C) ) (D)

**Answer:**

Q.3 The transition the state n=4 to n=1 in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition form

(A) 32 (B) 54 (C)42 (D)21

**Answer:**

Q.4 There are four electrons in the 3*d* shell of an isolated atom. The total magnetic moment of the atom

in units of Bohr magneton is \_\_\_\_\_\_\_\_.

(A) 1 (B) 0 (C) 2 (D) 4

**Answer:**

Q.5 Which of the following transitions is NOT allowed in the case of an atom, according to the electric

dipole radiation selection rule?

(A) 2*s*-1*s* (B) 2*p*-1*s* (C) 2*p*-2*s* (D) 3*d*-2p

**Answer:**

Q.6 In the SU(3) quark model, the triplet of mesons (has

(A) Isospin = 0 , Strangeness = 0 (B) Isospin = 1 , Strangeness = 0

(C) Isospin = 1/2, Strangeness = +1 (D) Isospin = 1/2, Strangeness = -1

**Answer:**

Q.7 The magnitude of the magnetic dipole moment associated with a square shaped loop carrying a steady current *I* is *m*. If this loop is changed to a circular shape with the same current *I* passing through it, the magnetic dipole moment becomes *pm/π*. The value of *p* is

(A)2 (B) 3(C) 4(D) 1

**Answer:**

Q.8 The total power emitted by a spherical black body of radius *R* at a temperature *T* is *P*1. Let *P*2 be the

total power emitted by another spherical black body of radius *R/2* kept at temperature 2*T*. The ratio,

*P*1/*P*2 is \_\_\_\_\_\_\_. (Give your answer upto two decimal places)

(A)0.25 (B)0.35(C)0.45(D) 0.5

**Answer:**

Q.9 The entropy S of a system of N spins, which may align either in the upward or in the downward

direction, is given by . Here *kB* is the Boltzmann constant.

The probability of alignment in the upward direction is *p*. The value of *p*, at which the entropy is

maximum, is \_\_\_\_\_\_\_. (Give your answer upto one decimal place)

(A) 0.2 (B) 0.3(C) 0.5(D) 1.0

**Answer:**

Q.10An electron changes its Position from orbit n=4 to the orbit n=2 of an atom, the wavelength of emitted radiation interms of R(where R is Redbug constant)

(A) (B) (C) (D)

**Answer:**

Q.11 The distance of the closest approach of an alpha particle fire data nucleus with kinetic energy kis r0. The distance of the closest approach when thealpha- particle is fire data the same nucleus with kinetic energy 2k will

(A) (B) 4 (C) (D) 2

**Answer:**

Q.12 Which of the following is an analytic function of *z* everywhere in the complex plane?

(A) (B) (C) (D)

**Answer:**

Q.13 Which of the following operators is Hermitian?

(A) (B) (C) i (D)

**Answer:**

Q.14 The kinetic energy of a particle of rest mass *m0* is equal to its rest mass energy. Its momentum in units of *m0c*, where *c* is the speed of light in vacuum, is \_\_\_\_\_\_\_. (Give your answer upto two decimal places)

(A) 0.22 (B) 1.31 (C) 0.51(D) 1.73

**Answer:**

Q.15 The number density of electrons in the conduction band of a semiconductor at a given temperature

is 2 \*1019 m-3. Upon lightly doping this semiconductor with donor impurities, the number density of conduction electrons at the same temperature becomes 4\*1020m-3. The ratio of majority to minority charge carrier concentration is \_\_\_\_\_\_\_\_.

(A) 200 (B) 300 (C) 500(D) 400

**Answer:**

Q.16 If the binding energy of electron in a hydrogen atom is 13.6 eV, the energy required to remove the electron form the first state of Li2+ is.

(A)13.6 eV (B)30.6eV (C)122.4eV (D) 3.4eV

**Answer:**

Q.17 An infinite, conducting slab kept in a horizontal plane carries a uniform charge density σ. Another infinite slab of thickness *t*, made of a linear dielectric material of dielectric constant *k,* is kept above the conducting slab. The bound charge density on the upper surface of the dielectric slabis

(A) σ/2k (B)σ/k (C)σ(k-1)/k (D)σ(k-2)/2k

**Answer:**

Q.18 The number of spectroscopic terms resulting from the ***L***.***S*** coupling of a 3*p* electron and a 3*d*

electron is \_\_\_\_\_\_\_.

(A) 2 (B) 3 (C) 12 (D) 6

**Answer:**

Q.19 Ifand are the spin operators of the two electrons of a He atom, the value offor the

ground state is

(A) (B) (C) 0 (D)

**Answer:**

Q.20 Let Vi be the ith component of a vector field, which has zero divergence. If the expression foris equal to

(A) (B) (C) (D)-

**Answer**:

Q.21 The direction of for a scalar field at the point P (1, 1, 2) is

(A) (B) (C) (D)

**Answer:**

Q.22 For the Pauli matrices the expression is equal to

(A) (B) (C) (D)

**Answer:**

Q.23 The Lagrangian of a system is given by

 , Which of the following is conserved?

(A) (B) (C)(D) )

**Answer:**

Q.24 For the digital circuit given below, the output X is



(A) (B) (C) ) (D)

**Answer:**

Q.25 A two-level system has energies zero and *E* . The level with zero energy is non-degenerate, while

the level with energy *E* is triply degenerate. The mean energy of a classical particle in this system

at a temperature *T* is

(A) (B) (C) (D)

**Answer:**

**Part– B**

**(Answer any one from following questions) 1x10=10**

1. Consider the particle in three dimensions whose Hamiltonian is given by ). By calculating., H] obtain = 10

**Answer:**

**2.** a) Find the expectation value of the potential energy in the nth state of the harmonic Oscillator. 5

**Answer:**

b) Show that J+  and J-  are ladder operators. 5

**Answer:**