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# ENTRANCE EXAMINATION – JULY 2016

## QUESTION PAPER

## PROGRAMME : Ph. D

### Physics

**Time : 2 hours** **Marks: 100**

**INSTRUCTION TO THE CANDIDATES**

1. Use only Pencil to indicate your answers. Use Ball-Point only for writing Name, Register Number and Signature.
2. Darken the square completely. Mark your answers like this [1] [2] [3] [4]
3. Part A is common to all.

| | |
|---|---|
| Name of the Student: .....<br><br>Programme Applied: ..... | Register Number<br><br>Exam Centre Seal |
| Signature of the Student | Signature of the Invigilator |

**NIUEE 2016**

## Part A

1. The development of a solid foundation of reliable knowledge typically is built from which type of research?
   a. basic research b. action research
   c. evaluation research d. orientational research

2. The idea that when selecting between two different theories with equal explanatory value, one should select the theory that is the most simple, concise, and succinct is known as _____.
   a. criterion of falsifiability b. critical theory
   c. guide of simplicity d. rule of parsimony

3. Research that is done to examine the findings of someone else using the "same variables but different people" is which of the following?
   a. exploration b. Hypothesis c. Replication d. empiricism

4. A researcher designs an experiment to test how variables interact to influence how well children learn spelling words. In this case, the main purpose of the study was:
   a. Explanation b. Description c. Influence d. Prediction

5. What is the key defining characteristic of experimental research?
   a. extraneous variables are never present
   b. a positive correlation usually exists
   c. a negative correlation usually exists
   d. manipulation of the independent variable

6. Which of the following includes examples of quantitative variables?
   a. age, temperature, income, height
   b. grade point average, anxiety level, reading performance
   c. gender, religion, ethnic group
   d. both a and b

7. One step that is not included in planning a research study is:
   a. Identifying a researchable problem b. A review of current research
   c. Statement of the research question d. Developing a research plan

8. Sources of researchable problems can include:
   a. Researchers' own experiences as educators
   b. Practical issues that require solutions
   c. Theory and past research
   d. All of the above

9. The feasibility of a research study should be considered in light of:
   a. Cost and time required to conduct the study
   b. Skills required of the researcher
   c. Potential ethical concerns
   d. All of the above

10. A formal statement of the research question or "purpose of research study" generally _____.
    a. Is made prior to the literature review b. Is made after the literature review
    c. Will help guide the research process d. b and c

11. Which term refers to publishing several articles from the data collected in one large study?
    a. Duplicate publication b. Partial publication
    c. Triplicate publication d. None of these

12. Which of the following is a right of each participant according to the AERA?
    a. Deception b. Utilitarianism
    c. Freedom to withdraw d. Participants have no rights

13. Which of the following is a type of criterion–related validity evidence?
    a. Concurrent evidence b. Predictive evidence
    c. Internal consistency d. Both a and b are correct answers

14. Which of the following is not a type of reliability?
    a. Test-retest b. Split-half c. Content d. Internal consistency

15. Which of the following types of reliability refers to the consistency of test scores over time?
    a. Equivalent forms reliability b. Split-half reliability
    c. Test-retest reliability d. Inter-scorer reliability

16. Which type of reliability refers to the consistency of a group of individuals' scores on two equivalent forms of a test designed to measure the same characteristic?
    a. Split-half b. Test-retest c. Split-forms d. Equivalent forms

17. _____ refers to how well the particular sample of behaviors used to measure a characteristic reflects the entire domain of behaviors that constitutes that characteristic.
    a. Construct validity evidence b. Criterion-related validity evidence
    c. Content validity evidence d. Face validity evidence

18. Which of these is not a method of data collection.
    a. Questionnaires b. Interviews c. Experiments d. Observations

19. Another name for a Likert Scale is a(n):
    a. Interview protocol b. Event sampling
    c. Summated rating scale d. Ranking

20. A question during an interview such as "Why do you feel that way?" is known as a:
    a. Probe b. Filter question c. Response d. Pilot

21. A census taker often collects data through which of the following?
    a. Standardized tests b. Interviews
    c. Secondary data d. Observations

22. In which of the following nonrandom sampling techniques does the researcher ask the research participants to identify other potential research participants?
    a. Snowball  b. Convenience  c. Purposive  d. Quota

23. Which of the following is the most efficient random sampling technique?
    a. Simple random sampling  b. Proportional stratified sampling
    c. Cluster random sampling  d. Systematic sampling

24. Which of the following would usually require the smallest sample size because of its efficiency?
    a. One stage cluster sampling  b. Simple random sampling
    c. Two stage cluster sampling  d. Quota sampling

25. _____ is a set of elements taken from a larger population according to certain rules.
    a. Sample  b. Population  c. Statistic  d. Element

**Part B**

26. Bohr postulated in this model quantization of _____
    a. Energy  b. Linear momentum
    c. Angular momentum  d. Spin

27. No two electrons will have all the four quantum numbers equal. This statement is known as _____
    a. Pauli exclusion principle  b. Uncertainty principle
    c. Hund's rule  d. Aufbau's principle

28. The hydrogen atom is in d-state. For this state the value of m are _____
    a. 2, 1, 0  b. -1, 0, 1  c. -2, -1, 0, +1, +2  d. -3, -1, 0, 1, 3

29. Davisson and Germer experiments relates to _____
    a. Interference  b. Polarisation  c. Electron diffraction  d. Phosphorene

30. The wavelength λ associated with a particle of mass m moving with velocity v is given by _____
    a. $\lambda = h/mv$  b. $\lambda = mv/h$  c. $\lambda = hv/m$  d. $\lambda = m/hv$

31. Matter waves _____-
    a. Are longitudinal  b. Are electromagnetic
    c. Always travel with speed of light  d. Show diffraction

32. According to Schrodinger a particle is equivalent to a _____
    a. Single wave  b. Wave packet  c. Light wave  d. Cannot behave as wave

33. Of the following moving with the same velocity, the one which has largest wavelength, is _____
    a. An electron  b. A photon  c. A neutron  d. An α- particle

34. The uncertainty relation cannot hold for the following pairs _____
    a. Position and momentum  b. Energy and time
    c. Linear momentum and angle  d. Angular momentum and angle

35. The zero point energy of harmonic oscillator is _____
    a. ħω  b. 1/2ħω  c. 2ħω  d. 1/4ħω

36. Value of $[L_x, r^2]$ is _____
    a. iħy  b. Iħpy  c. –iħx  d. 0

37. The energy of photo-electron in photo electric effect _____
    a. Changes with intensity of light  b. Changes with frequency of light
    c. Changes with velocity of falling light  d. None of these

38. A wave packet corresponding with a moving particle has _____
    a. Same the speed of the particle  b. Has the same size as the particle
    c. Has the velocity of light  d. Consists of electromagnetic rays

39. The quantum state energy of an atom depends on _____-
    a. Principal quantum number  b. Orbital quantum number
    c. Mahnetic quantum number  d. Spin quantum number

40. Heisenberg uncertainty principle _____
    a. Establishes the Bohr's orbital concept
    b. Established the existence of electron inside the nucleus
    c. Is not observable for macroscopic objects
    d. Does not agree with the de-Broglie hypothesis

41. The expectation value of a Hermitian operator is always _____
    a. Same  b. Conjugate  c. Negative  d. Real

42. If a generalised co-ordinate has the dimensions of momentum, the generalised velocity will have the dimension of _____
    a. Velocity  b. Acceleration  c. Force  d. Torque

43. The product of any generalised momentum and the associated co-ordinate must have the dimensions 0f _____
    a. Velocity  b. Angular momentum
    c. Linear momentum  d. Force

44. The path followed by a particle in sliding from one point to another in the absence of friction in the shortest time is a _____
    a. Sphere  b. Sigmoid  c. Cycloid  d. Catenary of revolution

45. If a co-ordinate is cyclic, Hamiltonian would reduce the number of variables in new formulation by _____
    a. One  b. Two  c. Three  d. Four

46. For attractive inverse square forces, the shape of orbit will be _____
    a. Elliptic  b. Parabolic  c. Hyperbolic  d. All of these

47. For repulsive inverse square forces, the shape of orbit _____
    a. Elliptic b. Parabolic c. Hyperbolic d. All of these

48. A body is freely falling on the earth's surface, the body deflects by _____
    a. 3 cm towards west b. 3 cm towards east
    c. 3 cm towards north d. 3 cm towards south

49. Lorentz transformation assume _____
    a. Space and time are both relative b. Space is relative, but time is absolute
    c. Space is absolute, but time is relative d. Space and time are both absolute

50. In the normal co-ordinates of the system, each of the new co-ordinate involving _____ resonant frequencies.
    a. One b. Two c. Three d. Four

51. Possible longitudinal normal modes of the linear symmetric triatomic molecule is/are _____
    a. One b. Two c. Three d. Four

52. How many degree's of freedom a rigid body posses _____
    a. 3 b. 6 c. 9 d. Infinite

53. Scleronomous constraints are _____
    a. Independent of time b. Dependent of time
    c. Both (A) and (B) d. None of these

54. A non-holonomic constraint may be expressed in the form of _____
    a. Equality b. Inequality c. Vector d. None of these

55. The conservation of angular momentum is the central force-field motion leads us to _____
    a. Kepler's $1^{st}$ law b. Kepler's $2^{nd}$ law c. Kepler's $3^{rd}$ law d. None of these

56. The total energy of a particle executing simple harmonic motion is directly proportional to
    a. Amplitude b. Square Root of amplitude
    c. Square of amplitude d. Reciprocal of amplitude

57. The amplitude of a vibrating body situated in a resisting medium
    a. decreases exponentially with time b. increases exponentially with time
    c. decreases rapidly with time d. remains constant with time

58. If circular waves are incident on a plane wall, then after reflection we get
    a. circular waves b. elliptical waves c. plane waves d. All the above

59. Which of the following is a sensory effect rather than a measureable physical quantity?
    a. frequency b. intensity c. quality d. wave form

60. Which of the following is the practical application of reflection of sound?
    a. ear trumpet  b. speaking tube  c. sound board  d. All of the above

61. Sound travels faster in ammonia than in air because
    a. ammonia is soluble in water  b. ammonia is alkaline in character
    c. ammonia is lighter than air  d. ammonia is heavier than air

62. The physical property which is most responsible for resonance is
    a. wave form  b. frequency  c. intensity  d. Quality

63. The amplitude at resonance of a vibrating body placed at vacuum is
    a. infinite  b. maximum  c. minimum  d. Zero

64. What happens to the frequency of a stretched wire when its length and diameter are increased?
    a. increases  b. decrease
    c. remains unchanged  d. may increase or decrease

65. The voice of women is shriller because
    a. The pitch of their organs is more  b. they have more energy
    c. The amplitude of vibration of their organs is more  d. they have control over their tongue.

66. Beats can be heard when the difference in frequencies is not more than
    a. 4  b. 6  c. 10  d. 15

67. A particle of mass 5 gm makes 35 oscillations in 11 sec, with an amplitude of 8 cm. What is its energy?
    a. 0.0064 joule  b. 0.64 joule  c. 0.08 joule  d. 0.8 joule

68. When source and observer are moving away from each other the apparent pitch will
    a. Increase  b. Decrease  c. remain same  d. become infinite

69. The apparent change in frequency due to a relative motion between the source and the observer is known as
    a. Laplace's principle  b. Sabine's principle
    c. Newton's principle  d. Doppler's principle

70. What is the least distance at which reflection should take place for the formation of a distinct echo?
    a. 17  b. 18  c. 19  d. 20

71. Bells are made of metal and not of wood, because ----------
    a. The thermal conductivity of metal is greater than that of wood
    b. The density of metal is greater than that of wood
    c. The sound is not conducted by metals but is radiated
    d. Wood dampens vibration while metals are elastic

72. Echoes arise from
    a. reflection  b. refraction  c. diffraction  d. dispersion of sound waves

73. What is the maximum number of syllables a person can speak in one second?
a. 2 b. 3 c. 4 d. 5

74. An example for forced oscillation is
a. The pendulum of a clock b. the wind screen wiper
c. a plucked sonometer wire d. sonometer wire excited by a tuning fork

75. A water wave is an example of
a. Diffracted wave b. electromagnetic wave
c. longitudinal wave d. transverse wave

76. Minimum distance between an object and its real image in a biconvex lens of focal length 'f' is equal to
a. 4f b. 2f c. 3f d. 6f

77. The ability of a convex lens to produce convergence in a parallel beam is known as its
a. focal length b. power c. magnification d. none of the above

78. A prism binocular is a substitute for
a. Microscope b. Telescope c. Spectroscope d. None of these

79. Resolving power of a telescope is given by
a. $\lambda/D$ b. $1.22\ D/\lambda$ c. $1.22\lambda/D$ d. $\lambda/1.22D$

80. Wave theoryof light was given by
a. Newton b. Huygene c. Maxwell d. Copernicus

81. If there were no atmosphere, then the duration of the day light on earth will
a. increase b. decrease c. remain unchanged d. depend upon the weather

82. On the total solar eclipse, the fraunhofer lines will
a. be observed bright b. be observed black
c. not be observed d. cannot be correctly predicted

83. The phenomenon responsible for formation of shadow is
a. Interference of light b. diffraction of light
c. polarization of light d. rectilinear propagation of light

84. In an interference pattern minima has zero intensity when the disturbances superimposed have
a. unequal amplitudes b. equal amplitudes
c. unequal phases d. none of the above

85. The Compton effect deals with
a. diffraction b. interference c. polarization d. Scattering

86. When the moon is near the horizon it appears bigger. This is due to
a. atmospheric diffraction b. Scattering of light
c. diffraction d. optical illusion

87. In case of diffraction due to a opaque circular disc , the center of the shadow is always
    a. bright b. dark c. coloured d. none of the above

88. Light is polarized to the maximum when a light is incident on a glass surface at an angle of
    a. $57^0$ b. $67^0$ c. $37^0$ d. $47^0$

89. Wavelength of laser light can be used as a standard of
    a. time b. temperature c. angle d. Length

90. Dispersive power of grating increases with
    a. order of the spectrum b. No. of lines/cm
    c. order and no. of lines/cm d. total no. of lines of the grating

91. Achromatic prism is ----------
    a. A combination of two prisms of different materials
    b. A prism made of flint glass
    c. A prism made of crown glass
    d. A combination of two prisms of same material

92. The term Electromagnetic spectrum is used for the range of wave length from
    a. $10^4$ m-1 $A^0$ b. $10^6$ m-0.1$A^0$ c. $10^8$m-0.01$A^0$ d. 10.1m-0.001$A^0$

93. The action of a zone plate is similar to a
    a. concave lens b. glass plate c. convex lens d. none of the above

94. A compensating plate in the path of one of the beams is used to
    a. Equalize the path in glass in both arms.
    b. Increase the path in both arms
    c. To change the amplitude
    d. None of the above

95. In case of diffraction due to a straight edge
    a. No light is present in the geometrical shadow
    b. Some light is present in the geometrical shadow
    c. Coloured light in the geometrical shadow
    d. None of the above

96. The magnetic induction $B$ is defined by the Lorentz force $F = q(u \times B)$.If $B = 2\hat{i} - 4\hat{j}$and $v = 4\hat{i} - 2\hat{j}$ then $F$ will be perpendicular to
    a. z axis b. (y -z) plane c. (x -z) plane d. (x- y) plane

97. One hundred cards are numbered from 1 to 100. The probability that a randomly chosen card has a digit 5 is
    a. 1/10 b. 1/5 c. 1/20 d. 19/100

98. Choose the wrong statement
    a. Noether's theorem cannot be applied to discrete systems
    b. According to Noether's theorem a continuous symmetry property of the

Lagrangean density leads to a conservation condition
c. The converse of the above (B) is not true
d. There exists conservation conditions that cannot correspond to any symmetry property.

99. Choose the wrong answer
a. While Hamilton's equations of motion are canonically invariant,Poissonbrackets are not
b. Hamilton's equations of motion and Poisson brackets are canonically invariant
c. Which Poisson brackets are canonically invariant Hamilton's equations are not
d. Both Hamilton's equations of motion and Poisson brackets are not

100. The number of independent coordinates needed to describe the motion of a rigid body is
a. 6 b. 5 c. 4 d. 3