Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Fourth Semester)
(NEP) EXAMINATION, 2025-26
PHYSICS
(Nuclear Physics—II)

Paper Code							
B	0	1	1	0	0	2	T

Questions Booklet Series
B

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. The quarks have a spin angular momentum of :

(A) Two third of $\hbar$ (h cut)

(B) One fourth of $\hbar$ (h cut)

(C) One third of $\hbar$ (h cut)

(D) One half of $\hbar$ (h cut)

2. The Gravitational attraction is always :

(A) Attractive

(B) Repulsive

(C) Both (A) and (B)

(D) None of the above

3. In general, in SU (3) Symmetry there are :

(A) $3 \times 3 = 9$ Operators but with restriction of one

(B) $3 \times 3 = 9$ Operators but with restriction of two

(C) $3 \times 3 = 9$ Operators but with restriction of three

(D) $3 \times 3 = 9$ Operators but with restriction of four

4. Artificial nuclear transmutation was given by :

(A) Rutherford

(B) Bohr

(C) Thomson

(D) Graham Bell

5. The basic difference between photon and neutrino is :

(A) Spin of photon is 1/2 and that of neutrino is 1.

(B) Spin of photon is 1 and that of neutrino is 1/2.

(C) Spin of photon is 1/2 and that of neutrino is 1/2.

(D) Spin of photon is 1 and that of neutrino is 1

6. The inverse square law is valid for :

(A) Weak and strong interactions only

(B) Gravitational, weak, electromagnetic and strong interactions

(C) Electromagnetic and strong interactions only

(D) Weak interactions only.

7. The heavier group of fermions is often called :

(A) Leptons

(B) Baryons

(C) Meson

(D) Pions

8. Which one is Boson ?

(A) Alfa particle

(B) Beta Particle

(C) Positron

(D) Neutron

9. The 'color charge' of quarks is analogous to which concept in electromagnetism ?

(A) Electric charge

(B) Spin

(C) Velocity

(D) Mass

10. What is the total color charge of a baryon (three quarks) ?

(A) White

(B) Blue

(C) Green

(D) Red

11. The existence of fine hyperstructure can be explained :

(A) By nuclear spin only

(B) By isotope effect only

(C) Neither by isotope effect nor by nuclear spin

(D) Either by isotope effect or by nuclear spin

12. A particle having any spin value is called :

(A) Fermions

(B) Electron

(C) Boson

(D) Classical particle

13. The hypercharge conservation law is of the nature of :

(A) Multiplicative

(B) Subtractive

(C) Additive

(D) Null

14. All the bosons are the quanta of :

(A) Electric field

(B) Gauge fields

(C) Gravitational fields

(D) Magnetic field

15. Angular momentum is conserved if the system is :

(A) Variant with respect to the angular displacement in the space

(B) Invariant with respect to the angular displacement in the space

(C) Variant with respect to the time in the space

(D) Invariant with respect to the time in the space

16. Leptons has the spin :

(A) 1

(B) 1/2

(C) 0

(D) None of the above

17. Which one is a Lepton ?

(A) Electron

(B) Proton

(C) Neutron

(D) Photon

18. Which of the following is an exact conservation law in nuclear physics ?

(A) Baryon number

(B) Charge conjugation

(C) Nucleon number

(D) Parity

19. Which quantity is conserved in both nuclear and chemical reactions ?

(A) Total momentum

(B) Total mass

(C) Electric charge

(D) Kinetic energy

20. The size of the nucleus and atom are :

(A) 10^{-15} meter and 10^{-10} meter

(B) 10^{-10} meter and 10^{-15} meter

(C) 10^{-15} milli meter and 10^{-10} milli meter

(D) 10^{-10} milli meter and 10^{-15} milli meter

21. According to the liquid drop model nucleons in any nucleus interact only with :

(A) All the neighbors

(B) Except nearest neighbors

(C) Nearest neighbors

(D) None of the above

22. The lighter group of fermions is often called :

(A) Leptons

(B) Baryons

(C) Meson

(D) Pions

23. If the Q-value is positive in a nuclear reaction, which of the following is true ?

(A) Total mass-energy is conserved

(B) Mass is generated

(C) Kinetic energy is generated

(D) Total momentum is conserved

24. Which one is correct statement ?

(A) Positron is as stable as a proton

(B) Positron is as stable as an electron

(C) Positron is not as stable as an electron

(D) None of the above

25. In all nuclear reactions, which of the following remains constant ?

(A) Total kinetic energy

(B) Electric charge

(C) Nucleon number

(D) Total mass energy

26. The principle of conservation of nucleon number implies that in a nuclear reaction :

(A) The atomic mass is conserved

(B) The number of neutrons is conserved

(C) The number of protons is conserved

(D) The total number of protons and neutrons is conserved

27. Which physical quantity is not conserved in nuclear reaction ?

(A) Momentum

(B) Parity

(C) Magnetic dipole moment

(D) Mass

28. Exchange Theory was given by :

(A) Yukawa

(B) Anderson

(C) Bohr

(D) Fermi

29. The nuclear shell model works best when considering :

(A) Only the surface nucleons

(B) Collective rotation of the nucleus

(C) A single particle moving in an average potential of others

(D) A large number of particles interacting strongly

30. Which quantity is NOT necessarily conserved in a nuclear reaction ?

(A) Isospin

(B) Electric charge

(C) Nucleon number

(D) Total energy

31. The antiparticle of electron is :

(A) Alfa particle

(B) Beta particle

(C) Proton

(D) Positron

32. Which of the following is NOT a magic number ?

(A) 12

(B) 02

(C) 08

(D) 28

33. Elementary particles are of the nature of :

(A) Stable

(B) Unstable

(C) Stable or unstable

(D) None of the above

34. Which of the following is used as a moderator in a nuclear reactor ?

(A) Cadmium

(B) Plutonium

(C) Heavy water

(D) Uranium

35. The energy generation in stars is due to :

(A) Chemical reactions

(B) Burning of coal

(C) Burning of gases

(D) Fusion of Light nuclei

36. Alfa rays are :

(A) Non-ionized atom

(B) Ionized atom

(C) Gas atom

(D) Helium nuclei

37. The strongly interacting fermions are :

(A) Meson

(B) Leptons

(C) Baryons

(D) Bosons

38. The spin of the electron is :

(A) + 1/2

(B) 0

(C) – 1/2

(D) None of the above

39. The first induced nuclear transmutation was given by :

(A) Lord Kelvin

(B) Lord Rutherford

(C) Muller

(D) Anderson

40. Which are nucleons ?

(A) Proton

(B) Neutron

(C) Both (A) and (B)

(D) None of the above

41. The Nuclear force is :

(A) Weakest among all

(B) Strongest among all

(C) Weaker than gravitational force

(D) Weaker than electromagnetic force

42. The approximate value of the nuclear radius is :

(A) $1.2 \times 10^{-15} A^{1/3}$

(B) $1.2 \times 10^{-10} A^{1/3}$

(C) $1.2 \times 10^{-15} A^{1/2}$

(D) $1.2 \times 10^{-19} A^{1/3}$

43. Which one of the following particles obey Pouli's Exclusion principle ?

(A) Meson

(B) Pions

(C) Fermions

(D) Bosons

44. In p-p scattering at low temperature the scatterer and scattered particles are :

(A) Identical

(B) Different

(C) Mixture of both (A) and (B)

(D) None of the above

45. The inter-nuclear forces are :

(A) Spin-independent

(B) Spin-dependent

(C) Orientation-independent

(D) Orientation-dependent

46. Total cross section is given by :

(A) $\sigma_{tot} = \sigma_{sc} + \sigma_a$

(B) $\sigma_{tot} = \sigma_{sc} + 2\sigma_a$

(C) $\sigma_{tot} = 2\sigma_{sc} + \sigma_a$

(D) $\sigma_{tot} = 2\sigma_{sc} + 2\sigma_a$

47. Which type of scattering cannot be studied experimentally ?

(A) Proton - Proton Scattering

(B) Neutron - Proton Scattering

(C) Neutron - Neutron Scattering

(D) All of the above

48. The electric quadrupole moment of the deuteron is :

(A) 2.82×10^{-31} m^2

(B) 3.82×10^{-31} m^2

(C) 2.82×10^{-31} C^2

(D) 3.82×10^{-31} C^2

49. Which Statistics is applicable to the Deuteron ?

(A) Classical one

(B) Maxwell- Boltzmann

(C) Fermi-Dirac

(D) Bose-Einstein

50. When two nucleons are in Free State, the scattering process is limited to :

(A) Photon-photon scattering only

(B) Neutron-neutron scattering only

(C) Neutron-proton scattering and proton-proton scattering

(D) None of the above

51. Who explained the origin of strong nuclear forces ?

(A) Yukawa

(B) Anderson

(C) Bohr

(D) Fermi

52. In a single process, the particles which cannot be produced and annihilated in any number is/are :

(A) Electrons and neutrons

(B) Photons Only

(C) Meson Only

(D) Baryons and Leptons

53. The relative magnitude of the gravitational, weak, electromagnetic and strong interactions are in the ratio :

(A) $10^{-39} : 10^{-13} : 10^{-03} : 10^{0}$

(B) $10^{0} : 10^{-3} : 10^{-13} : 10^{-39}$

(C) $10^{0} : 10^{3} : 10^{13} : 10^{39}$

(D) $10^{39} : 10^{13} : 10^{03} : 10^{0}$

54. Which statement is *correct* ?

(A) Nuclear force is short range

(B) Electromagnetic force is short range

(C) Gravitational force is short range

(D) All the fundamental interaction is long range

55. The mass of the deuteron is :

(A) 2.014735 amu

(B) 3.014735 amu

(C) 2.014735 mg

(D) 3.014735 mg

56. The most stable state in which nuclei is normally found is :

(A) Upper excited state

(B) $n = 1$ state

(C) Ground state

(D) None of the above

57. Liquid drop model was given by :

(A) N. Bohr and Kalcker

(B) Rutherford

(C) James Chadwick

(D) Muller

58. Linear momentum is conserved if the system is :

(A) Variant with respect to the displacement in the space

(B) Invariant with respect to the displacement in the space

(C) Variant with respect to the time in the space

(D) Invariant with respect to the time in the space

59. A proton is assumed to be made up of :

(A) Muon

(B) Meson

(C) Quark

(D) Positron

60. According to which statistics the energy at absolute zero cannot be zero ?

(A) M-B statistics

(B) F-D statistics

(C) B-E statistics

(D) None of the above

61. The rest mass of the photon is :

(A) 1

(B) 1/2

(C) 0

(D) 2/3

62. The correct relation for fundamental interactions is :

(A) Gravitational > Weak > Electromagnetic > Strong

(B) Gravitational < Weak < Electromagnetic < Strong

(C) Gravitational = Weak > Electromagnetic > Strong

(D) Gravitational > Weak > Electromagnetic = Strong

63. The magnetic dipole moment of the hadrons is the sum of the constituent :

(A) Quark electric moments

(B) Baryon electric moments

(C) Quark magnetic moments.

(D) Baryon magnetic moments

64. Quarks are the basic constituent particles of which elementary particles are :

(A) Accurately composed of

(B) Believed to be composed of

(C) Not accurately composed of

(D) Not believed to be composed of

65. Among fundamental interactions which one is not significant for elementary particles ?

(A) Weak interactions

(B) Electromagnetic interactions

(C) Strong interactions

(D) Gravitational interactions

66. What is the composition of Deutron ?

(A) One proton and one neutron

(B) One neutron

(C) One proton

(D) None of the above

67. Pions are :

(A) Bosons

(B) Leptons

(C) Baryons

(D) Gravitons

68. The liquid drop model says :

(A) Nucleus is regarded as a liquid drop with neutrons playing the role of molecules

(B) Nucleus is regarded as a liquid drop with protons playing the role of molecules

(C) Nucleus is regarded as a liquid drop with electrons playing the role of molecules

(D) Nucleus is regarded as a liquid drop with nucleons playing the role of molecules

69. What is the approximate binding energy of the deuteron ?

(A) 1.11 MeV

(B) 2.22 MeV

(C) 3.33 MeV

(D) 4.44 MeV

70. The magnetic moment of the deuteron is roughly equal to :

(A) Zero

(B) One

(C) The sum of the proton and neutron magnetic moments

(D) Only the magnetic moment of the electron

71. The non-zero electric quadrupole moment of the deuteron show that :

(A) The force has a non-central (tensor) component.

(B) Deuteron is unstable.

(C) Deuteron is stable.

(D) Deuteron is spherical.

72. Who proposed the liquid drop model of the nucleus ?

(A) Rutherford

(B) Einstein

(C) J. J. Thomson

(D) George Gamow

73. Which phenomena can be explained by the liquid drop model ?

(A) Nuclear field strength

(B) Nuclear fusion

(C) Nuclear fission

(D) None of the above

74. For a stable nucleus, the Liquid Drop Model predicts that the pairing energy term should be :

(A) One
(B) Zero
(C) Infinite
(D) Negative

75. The nuclei which have odd mass numbers follow :

(A) Bose-Einstein Statistics
(B) Maxwell-Boltzmann Statistics
(C) Fermi-Dirac Statistics
(D) None of the above

76. Which particle had all the required properties to behave as the Yukawa Particle ?

(A) Pion
(B) Muon
(C) Photon
(D) Graviton

77. Energy is conserved if the system is :

(A) Variant with respect to the angular displacement in the space.
(B) Invariant with respect to the angular displacement in the space
(C) Variant with respect to the time in the space
(D) Invariant with respect to the time in the space

78. Baryons, such as protons and neutrons, are composed of how many quarks ?

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

79. Nuclear force is of the nature of :

(A) Always attraction
(B) Always repulsion
(C) Neither attraction nor repulsion
(D) May be attraction or repulsion

80. Nuclei have approximately spherical shape with a radius proportional to :

(A) $A^{1/3}$
(B) $A^{2/3}$
(C) $A^{1/2}$
(D) $A^{1/4}$

81. The nucleons are assigned the isospin T = 1/2. The proton and neutron are two states with isospin components T_3 as :

(A) – 1/2 and + 1/2 respectively
(B) + 1/2 and – 1/2 respectively
(C) + 1 and – 1 respectively
(D) – 1 and + 1 respectively

82. Elementary particles are :

(A) Quanta of mass
(B) Quanta of charge
(C) Quanta of corresponding fields
(D) None of the above

83. Which of the following is a characteristic property of quarks ?

(A) They carry color charge
(B) They are not affected by the strong force
(C) They are only found in leptons
(D) They have integer electric charges

84. The force holding quarks together inside a nucleon is mediated by :

(A) Electrons
(B) Pions
(C) Gluons
(D) Photons

85. Quarks are classified as :

(A) Fermions
(B) Leptons
(C) Baryons
(D) Mesons

86. Which model is used to obtain the semi-empirical mass formula in nuclear physics ?

(A) Wave model
(B) Alfa model
(C) Shell Model
(D) Liquid drop model

87. The Photons have :

(A) Integral Spin
(B) Zero Spin
(C) Half Spin
(D) None of the above

88. In Nuclear Physics the term SU (3) stands for :

(A) Special unitary group in three dimensions
(B) Special unitary group in two dimensions
(C) Special unitary group in one dimension
(D) None of the above

89. Yukawa theory says the nuclear force between two nucleons is the result of the exchange of :

(A) Mesons
(B) Megnons
(C) Photons
(D) Phonons

90. According to the Standard Model of Nuclear Physics, which is NOT a fundamental particle ?

(A) Electron
(B) Proton
(C) Neutron
(D) Photon

91. What is the intrinsic spin of protons and neutrons ?

(A) 1/2
(B) 1
(C) 0
(D) 2/3

92. The beta decay is governed by :

(A) Gravitational force
(B) Electromagnetic force
(C) Strong nuclear force
(D) Weak nuclear force

93. Why can a single, free quark never be observed ?

(A) Due to color confinement
(B) Due to weak interaction
(C) Due to strong interaction
(D) None of the above

94. Which one is not a fundamental particle ?

(A) Meson
(B) Proton
(C) Neutrino
(D) Electron

95. The Nuclear forces exists between :

(A) Neutron-neutron
(B) Neutron-proton
(C) Proton-proton
(D) All of the above

96. Which statement is correct ?

(A) The Photon has a mass of zero and Spin of unity.
(B) The Photon has a mass of zero and Spin of half integral.
(C) The Photon has a mass of unity and Spin of zero.
(D) The Photon has a mass of unity and Spin of unity.

97. During Nuclear Reaction which remains conserved ?

(A) Mass and energy
(B) Charge
(C) Momentum
(D) All of the above

98. The nuclei which have even mass numbers follow :

(A) Bose-Einstein Statistics
(B) Maxwell-Boltzmann Statistics
(C) Fermi-Dirac Statistics
(D) None of the above

99. In all transformations, the total number of fermions in the universe :

(A) is not conserved
(B) is conserved
(C) varies as per transformations
(D) None of the above

100. The incorrect pair of particle and antiparticle is :

(A) Meson and antimeson
(B) Electron and positron
(C) Proton and antiproton
(D) Neutrino and antineutrino

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।