निर्धारित समय : 3 घंटे (दृष्टिबाधित उम्मीदवारों के लिए : 4 घंटे)
Time Allowed : 3 Hours (For V.H. Candidates : 4 Hours)

अधिकतम अंक : 120
Maximum Marks : 120

रोल नं.
Roll No. :

उत्तरशीट सं.:
Answer Sheet No. :

प्रश्नों के उत्तर देने से पहले निम्नलिखित अनुदेशों को ध्यान से पढ़ लें, इस पुस्तिका में प्रश्न अंग्रेजी में दिए गए हैं।
Read the following instructions carefully before you begin to answer the questions. This booklet contains questions in English.

उम्मीदवारों के लिए अनुदेश

1. प्रश्न के उत्तर देने से पहले आप इस पुस्तिका की जाँच करके देख लें कि इसमें पूरे पृष्ठ (1-16) हैं तथा कोई पृष्ठ या उसका भाग कम या दुबारा तो नहीं आ गया है। उम्मीदवारों को यह भी जाँच करनी है कि उनको केवल उस स्ट्रीम की परीक्षा-पुस्तिका मिली है जिसके लिए उन्होंने आवेदन किया है अर्थात कंप्यूटर साइंस / इंजीनियरिंग भाग या सूचना प्रौद्योगिकी भाग या इलेक्ट्रॉनिक्स और कम्युनिकेशन / टेलीकम्युनिकेशन भाग या भौतिकी / इलेक्ट्रॉनिक्स / एप्लाइड इलेक्ट्रॉनिक्स भाग। यदि आप इस पुस्तिका में कोई त्रुटि पाएं, तो *तत्काल* इसके बदले दूसरी पुस्तिका से लें।

2. निरीक्षक द्वारा आपको ओ एम आर उत्तर-शीट अलग से दी जाएगी। ओ एम आर उत्तर-शीट में विवरण भरने से पहले, आपको ओ एम आर उत्तर शीट पर मुद्रित अनुदेशों को सावधानीपूर्वक पढ़ना चाहिए। आपको ओ एम आर उत्तर-पुस्तिका में दिए गए अनुदेशों के अनुसार सावधानी पूर्वक उसमें विवरण और कोड लिखने चाहिए। प्रश्नों के उत्तर वास्तविक रूप में लिखना आरंभ करने से पहले आपको ओ एम आर उत्तर-पुस्तिका में निर्धारित स्थान पर अपने हस्ताक्षर करने चाहिए। इन अनुदेशों का पूर्ण अनुपालन किया जाना चाहिए, ऐसा न किये जाने पर आपकी ओ एम आर उत्तर-शीट का मूल्यांकन नहीं किया जायेगा। (दृष्टिहीन उम्मीदवारों के लिए यह विवरण लेखक द्वारा भरे जायेंगे। फिर भी, सभी दृष्टिहीन उम्मीदवारों को ओ एम आर उत्तर-शीट में निर्धारित स्थान पर अपने बाएं हाथ के अंगूठे का निशान अवश्य लगाना चाहिए। इसके अतिरिक्त, जो दृष्टिहीन उम्मीदवार अपना हस्ताक्षर कर सकते हैं, वे अंगूठे के निशान के अलावा अपने हस्ताक्षर भी करें।)

3. इस प्रश्न-पुस्तिका में 120 बहुविकल्पीय प्रश्न हैं, प्रत्येक प्रश्न के 4 विकल्प दिए गए हैं (A), (B), (C) और (D) प्रत्येक प्रश्न का केवल एक विकल्प ही सही उत्तर है। यदि आपको एक से अधिक विकल्प सही लगें तो सबसे अधिक उचित विकल्प का चुनाव करें और उत्तर पुस्तिका में प्रश्न के सामने वाले उपयुक्त गोले को काला करें।

4. प्रत्येक सही उत्तर के लिए 1 अंक दिया जाएगा, गलत देने पर **0.25 अंक काट लिया जाएगा**।

5. उम्मीदवार को दोनों भाग अनिवार्य रूप में हल करने हैं।

6. गोले को काला करने के लिए केवल काले/नीले बॉल प्वाइंट पेन का प्रयोग करें। गोले को एक बार काला करने के बाद इसको मिटाने या बदलने की अनुमति नहीं है। यदि किसी प्रश्न के सामने एक से ज्यादा गोले काले किये गए हों तो मशीन द्वारा उसके लिए **शून्य अंक** दिया जाएगा।

7. किसी भी स्थिति में उत्तर शीट को न मोड़ें।

8. कोई रफ कार्य उत्तर-पुस्तिका पर नहीं करना है। रफ कार्य के लिए इस पुस्तिका में स्थान दिया गया है।

9. परीक्षा हॉल/कमरों में मोबाइल फोन तथा बेतार संचार साधन पूरी तरह निषिद्ध हैं, उम्मीदवारों को उनके अपने हित में सलाह दी जाती है कि मोबाइल फोन/किसी अन्य बेतार संचार साधन को स्विच ऑफ करके भी अपने पास न रखें। इस प्रावधान का अनुपालन न करने पर परीक्षा में अनुचित उपायों का प्रयोग माना जायेगा और उनके विरुद्ध कार्यवाही की जाएगी, जिसमें उनकी उम्मीदवारी रद्द करना भी शामिल है।

10. परीक्षार्थी को अपनी उत्तर-पुस्तिका शीट निरीक्षक को सौंपे बिना और उपस्थिति पत्रिका पर हस्ताक्षर किये बिना परीक्षा हॉल/कमरा नहीं छोड़ना चाहिए, ऐसा नहीं करने पर अयोग्य घोषित कर दिया जाएगा।

Instructions to the Candidates

1. Before you start to answer the questions you must check up this booklet and ensure that it contains all the pages (1-16) and see that no page or portion thereof is missing or repeated. Candidates are also required to check that they have got the right question book strictly from the stream candidate has applied for i.e. Computer Science / Engineering Part OR Information Technology Part OR Electronics and Communication / Telecommunication Part OR Physics' / Electronics / Applied Electronics Part. If you find any defect in this Booklet, you must get it replaced *immediately*.

2. You will be supplied the OMR Answer-Sheet separately by the Invigilator. Read the instructions printed on OMR Answersheet carefully before filling the information on the OMR Answer-sheet. You must complete and code the details as per the instructions given in the OMR answer sheet carefully. You must also put your signature on the OMR Answer-Sheet at the prescribed place before you actually start answering the questions. These instructions must be fully complied with, failing which, your Answer-Sheet will not be evaluated. (For V.H. candidates these details will be filled in by the scribe. However, all V.H. candidates must put their left-hand thumb impression at the space provided in the OMR Answer-Sheet. In addition, those V.H. candidates who can sign should also put their signatures in addition to thumb impression.)

3. This booklet consists of 120 Multiple choice questions. Each question has 4 (four) alternatives (A), (B), (C), and (D). In any case only one alternative will be the correct answer. In case if you find more than one correct answer, then choose the most appropriate single option and darken the appropriate circle in the answer sheet in front of the related question.

4. For each correct answer One mark will be given and for each incorrect answer 0.25 marks will be deducted.

5. Candidate has to attempt both parts compulsorily.

6. Use Black/Blue ball point Pen to darken the circle. Answer once darkened is not allowed to be erased or altered. Against any question if more than one circle is darkened, machine will allot zero mark for that question.

7. Do not fold answer sheet in any case.

8. No rough work is to be done on the Answer Sheet. Space for rough work has been provided in this booklet.

9. Mobile phones and wireless communication devices are completely banned in the examination hall/rooms. Candidates are advised not to keep mobile phones/any other wireless communication devices with them even switching it off, in their own interest. Failing to comply with this provision will be considered as using unfair means in the examination and action will be taken against them including cancellation of their candidature.

10. Candidate should not leave the examination hall/room without handing over his/her Answer sheet to the invigilator and without signing on the attendance sheet. Failing in doing so, will amount to disqualification.

जब तक आप से कहा न जाए तब तक प्रश्न-पुस्तिका न खोलें
DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

उम्मीदवार का नाम/Name of Candidate : ....

उम्मीदवार के हस्ताक्षर/Signature of Candidate : ....

Choose the most appropriate option.

Direction Q.No. 1 - 2 :

In the following questions choose the word opposite in meaning to the given word.

1. Antagonism :

   (A) Cordiality
   (B) Animosity
   (C) Hostility
   (D) Enmity

2. Hasten :

   (A) Dash
   (B) Dawdle
   (C) Hurry
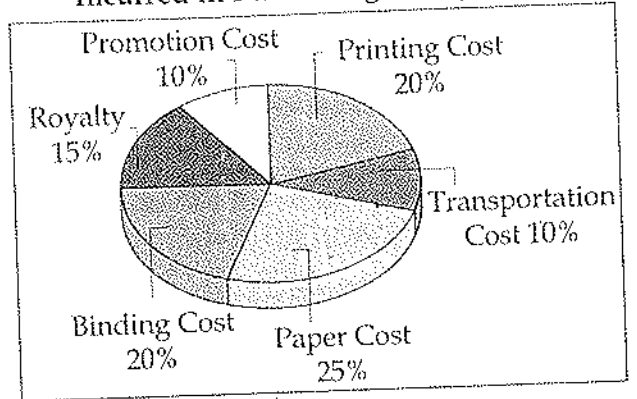   (D) Scurry

Direction Q.No. 3 - 4 :

In the following questions, out of the four alternatives, choose the one which best expresses the meaning of the given word.

3. Camouflage :

   (A) Disguise
   (B) Cover
   (C) Demonstrate
   (D) Fabric

4. Yearn :

   (A) Deny
   (B) Accept
   (C) Confront
   (D) Crave

Direction 5 - 8 :

The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a magazine. Study the pie-chart and answer the questions based on it.

Various Expenditures (in percentage) Incurred in Publishing a Magazine

Promotion Cost 10%
Printing Cost 20%
Royalty 15%
Transportation Cost 10%
Binding Cost 20%
Paper Cost 25%

5. What is the central angle of the sector corresponding to the expenditure incurred on Royalty ?

   (A) 15°
   (B) 24°
   (C) 54°
   (D) 48°

6. The price of the magazine is marked 20% above the C.P. If the marked price of the magazine is ₹ 180, then what is the cost of the paper used in a single copy of the magazine ?

   (A) ₹ 36
   (B) ₹ 37.50
   (C) ₹ 42
   (D) ₹ 44.25

7. If for a certain quantity of magazine, the publisher has to pay ₹ 30,600 as printing cost, then what will be amount of royalty to be paid for these magazines ?

   (A) ₹ 19,450
   (B) ₹ 21,200
   (C) ₹ 22,950
   (D) ₹ 26,150

SPACE FOR ROUGH WORK

8. Royalty on the magazine is less than the printing cost by :

   (A) 5%

   (B) $33\frac{1}{5}\%$

   (C) 20%

   (D) 25%

Direction 9 - 11 :

The table given here shows production of five types of cars by a company in the year 2010 to 2015. Study the table and answer the questions.

Production of Cars by a Company

Year/Type	2010	2011	2012	2013	2014	2015	Total
P	8	20	16	17	21	6	88
Q	16	10	14	12	12	14	78
R	21	17	16	15	13	8	90
S	4	6	10	16	20	31	87
T	25	18	19	30	14	27	133
Total	74	71	75	90	80	86	476

9. In which year the total production of cars of types P and Q together was equal to the total production of cars of types R and S together ?

   (A) 2011

   (B) 2012

   (C) 2015

   (D) None of the above

10. In which year the production of cars of all types taken together was approximately equal to average during the period ?

    (A) 2010   (B) 2012

    (C) 2014   (D) 2015

11. The production of which type of cars was 25% of the total production of all types of cars during 2014 ?

    (A) S   (B) R

    (C) Q   (D) P

Direction Q.No. 12 - 14 :

Read the following information carefully and answer the questions given below :

(i) P, Q, R, S, T and U six members of a family, each of them engaged in a different profession Doctor, Lawyer, Teacher, Engineer, Nurse and Manager.

(ii) Each of them remains at home on a different day of the week from Monday to Saturday.

(iii) The lawyer in the family remain at home on Thursday.

(iv) R remains at home on Tuesday.

(v) P, a Doctor, does not remain at home either on Saturday or on Wednesday.

(vi) S is neither the doctor nor the Teacher and remains at home on Friday.

(vii) Q is the Engineer and T is the Manager.

12. Which of the following combinations is **correct** ?

    (A) Lawyer - Tuesday

    (B) Nurse - Friday

    (C) Manager - Friday

    (D) Engineer - Thursday

13. Which of the following combinations is **not** correct ?

    (A) R - Teacher   (B) Q - Engineer

    (C) T - Manager   (D) S - Lawyer

14. Who is the Nurse ?

   (A) S   (B) R

   (C) U   (D) Data inadequate

Direction Q.No. 15 :

Three of the words will be in the same classification, the remaining one will not be. Your answer will be the one word that does NOT belong in the same classification as the others.

15. Which word does NOT belong to the others ?

   (A) Tape   (B) Twine

   (C) Cord   (D) Yarn

Direction Q.No. 16 - 18 :

Study the following information's carefully and answer the questions given below :   .

(i)   Six persons A, B, C, D, E and F are taking their breakfast in two groups facing one another.

(ii)   D and A are not in the same row.

(iii) E is to the left of F and faces C.

(iv)   B is in the middle of a group.

(v)   D is to the left of B.

16. Who faces B ?

   (A) C   (B) A

   (C) E   (D) F

17. Who of the following are sitting in the same row ?

   (A) AEB   (B) EFB

   (C) DEF   (D) AEF

18. Which of the following pairs are facing each other ?

   (A) CA   (B) BA

   (C) DA   (D) DE

19. Find the missing number in the following question.
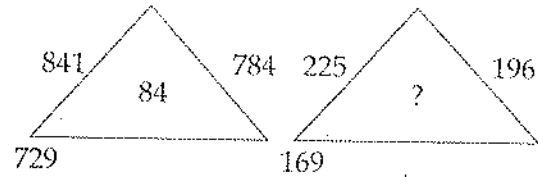
   (A) 32   (B) 42

   (C) 62   (D) 82

20. If ÷ means +, − means ÷, × means − and + means ×, then

$$\frac{(3 \times 4) - 8 \times 4}{4 + 8 \times 2 + 16 \div 1} = ?$$

   (A) 1   (B) −1

   (C) 2   (D) 0

Direction Q.No. 21 - 22 :

In each of the following letter series, some of the letters are missing which are given in that order as one of the alternatives below it. Choose the correct alternative.

21. aaa_bb_ aab_baaa_bb

   (A) abab   (B) bbaa

   (C) babb   (D) baab

22. abca_bcaab_aa_caa_c

   (A) bbac   (B) bbaa

   (C) acbb   (D) acac

In each of the following questions, one term in the number series is wrong. Find out the wrong term.

23. 125, 126, 124, 127, 123, 129

    (A) 123   (B) 124

    (C) 126   (D) 129

24. 52, 51, 48, 43, 34, 27, 16

    (A) 51   (B) 48

    (C) 34   (D) 43

Direction Q.No. 25 - 27 :

In each of the following questions, a series is given with one term missing. Choose the correct alternative that will continue the same pattern and fill in the blank space.

25. 6, 25, _____, 123, 214, 341.

    (A) 65   (B) 70

    (C) 72   (D) 62

26. 71, 76, 69, 74, 67, 72, _____.

    (A) 65   (B) 76

    (C) 77   (D) 80

27. 50, 49, 46, 41, 34, _____.

    (A) 32   (B) 25

    (C) 21   (D) 19

Direction Q.No. 28 - 29 :

In each of the following questions, find out the correct answer from the given alternatives.

28. If in a certain language MECHANICS is coded as HCEMASCIN, how is POSTER coded in that code ?

    (A) OPTSRE   (B) SOPRET

    (C) RETSOP   (D) TERPOS

29. If TABLE is coded as GZYOV, how is JUICE coded ?

    (A) OZLFJ   (B) QFRXV

    (C) HOFAD   (D) QZHMT

Direction Q.No. 30 - 32 :

In each of the following questions, there is a certain relation between two given words on one side of : : and one word is given on another side of : : while another word is to be found from the given alternatives, having the same relation with this word as the words of the given pair bear. Choose the best alternative.

30. Engineer : Map : : Bricklayer : ?

    (A) Design   (B) Templet

    (C) Mould   (D) Cement

31. Major : Battalion : : Colonel : ?

    (A) Company   (B) Regiment

    (C) Army   (D) Soldiers

32. Virology : Virus : : Semantics : ?

    (A) Amoeba   (B) Language

    (C) Nature   (D) Society

Direction Q.No. 33 - 35 :

The following questions consist of two words each that have a certain relationship to each other, followed by four lettered pairs of words. Select the lettered pair that has the same relationship as the original pair of words.

33. Symphony : Music
    - (A) Mural : Painting
    - (B) Ode : Prose
    - (C) Preface : Book
    - (D) Editorial : Journal

34. Medicine : Capsule
    - (A) Pearl : Shell
    - (B) Passenger : Bus
    - (C) Heart : Lungs
    - (D) Car : Vehicle

35. Identity : Anonymity
    - (A) Flow : Perfection
    - (B) Careless : Mistake
    - (C) Truth : Lie
    - (D) Fear : Joy

Direction Q.No. 36 - 37 :

Each of the following questions the first two words have definite relationship. Choose one word out of the given four alternatives which will fill in the blank space and show the same relationship with the third word as between the first two.

36. Cobra is related to Snake in the same way as Leopard is related to _____ .
    - (A) Tiger
    - (B) Lion
    - (C) Cat
    - (D) Zebra

37. Memorise is to Amnesia as Movement is to _____ .
    - (A) Lubrication
    - (B) Lethargy
    - (C) Paralysis
    - (D) Hermit

Direction Q.No. 38 - 41 :

In each of the following questions, three out of four alternatives contain alphabet placed in a particular form. Find the one that does not belong to the group.

38. (A) BCDEI   (B) PQRSW
    (C) LMNOS   (D) HIKLO

39. (A) LNMO   (B) CRDT
    (C) EUFV   (D) GWHX

40. (A) CBAZ   (B) AZYX
    (C) AZBY   (D) PONM

41. (A) JMP   (B) RUX
    (C) UYB   (D) EHK

42. A train started from Mumbai at 6.00 A.M. On the next (second) station 1/3 passengers got down and 96 got in. On the next (third) station, ½ of the total passengers present in the train, got down and 12 came in. Now there were 248 passengers in the train, when the train started from Mumbai, the number of passengers was :
    - (A) 435
    - (B) 564
    - (C) 654
    - (D) 736

43. The LCM of two numbers is 45 times their HCF. If the sum of the LCM and the HCF of these two numbers is 1150 and one of the numbers is 125, then the other number is :

(A) 256   (B) 225

(C) 250   (D) 255

Direction Q.No. 44 - 45 :

Find out the wrong term from the following series and select the number from the alternatives which will replace the wrong term in the series.

44. 299, 178, 97, 48, 24, 14, 13 :

(A) 175   (B) 295

(C) 23   (D) 10

45. 2, 9, 28, 65, 126, 216, 344 :

(A) 38   (B) 217

(C) 356   (D) 66

46. The ratio between Sumit's and Prakash's age at present is 2 : 3. Sumit is 6 years younger than Prakash. The ratio of Sumit's age to Prakash's age after six years will be :

(A) 1 : 2   (B) 2 : 3

(C) 3 : 4   (D) 3 : 8

47. If the difference between a number and $1/5^{th}$ of it is 84, what is the number ?

(A) 115   (B) 95

(C) 105   (D) 125

48. The ratio of ages of the father and his son at present is 12 : 5, the difference of their age is 28 years. What will be the ratio of their Ages after eight years ?

(A) 2 : 2   (B) 3 : 1

(C) 2 : 1   (D) 3 : 2

49. Two pipes A and B can fill a water tank in 20 and 24 minutes respectively and third pipe C can empty at the rate of 3 gallons per minute. If A, B and C opened together filled the tank in 15 minutes, the capacity (in gallons) of the tank is :

(A) 60   (B) 120

(C) 150   (D) 180

50. A can run 200 m in 35 seconds and B in 38 seconds. By what distance A beats B ?

(A) 15 m   (B) $15\dfrac{2}{3}$ m

(C) $15\dfrac{15}{19}$ m   (D) $15\dfrac{4}{19}$ m

51. A train starts at 7 a.m. from A towards B with a speed of 50 km/hr. Another train from B starts at 8 a.m. with a speed of 60 km/hr towards A. Both of them meet at 10 a.m. at C. The ratio of the distances AC to BC is :

(A) 4 : 5   (B) 5 : 4

(C) 5 : 6   (D) 6 : 5

52. The average of the husband and his wife was 23 years at the time of their marriage. After five years they have a one year old child. The average age of the family now is :

(A) 29.3 years   (B) 28.5 years

(C) 23 years   (D) 19 years

53. $1/4^{th}$ of 60% of a number is equal to $2/5^{th}$ of 20% of another number. What is the respective ratio of the first number to that of second number ?

(A) 8 : 15   (B) 5 : 9

(C) 8 : 13   (D) 4 : 7

54. A&B together have ₹ 1210. If 4/15 of A's amount is equal to 2/5 of B's amount, how much amount does B have?

(A) ₹ 664   (B) ₹ 550

(C) ₹ 484   (D) ₹ 460

55. How many one rupee coins, 50 paise coins and 25 paise coins of which the numbers are proportional to 4, 5 and 6 are together worth ₹ 32 ?

(A) 16, 20, 24   (B) 12, 16, 20

(C) 20, 24, 28   (D) 24, 28, 32

56. Two dice are thrown simultaneously. The probability of obtaining a total score of 5 is :

(A) 1/18   (B) 1/12

(C) 1/9   (D) None of these

57. A tradesman marks his goods at such price that after allowing a discount of 15% he earns a profit of 20%. Find the marked price of an article which costs him ₹ 850.

(A) ₹ 1200   (B) ₹ 1300

(C) ₹ 1250   (D) ₹ 1350

58. In a camp, there are meals for 120 men or 200 children. If 150 children have taken their meals, how many men will be catered to with the remaining meal ?

(A) 50   (B) 40

(C) 30   (D) 20

59. 56 men can complete a piece of work in 24 days. In how many days can 42 men complete the same piece of work ?

(A) 48   (B) 32

(C) 20   (D) 16

60. A boat travels upstream from P to Q and downstream from Q to P in 4 hours. If the speed of the boat in still water is 12 km/hr and the speed of the current is 4 km/hr, then what is the distance from P to Q ?

(A) $31\dfrac{1}{3}$ km   (B) $41\dfrac{1}{3}$ km

(C) $21\dfrac{1}{3}$ km   (D) $11\dfrac{1}{3}$ km

SECTION - B

PHYSICS

Choose the most appropriate option.

61. Repeatable entity of a crystal structure is known as :

(A) Crystal

(B) Lattice

(C) Unit cell

(D) Miller indices

62. The radius of the first Bohr orbit of hydrogen atom is 0.0529 nm. The quantum number of its Rydberg state of radius 0.01 mm is :

(A) 435   (B) 534

(C) 453   (D) 21

63. Blackbody radiation consists of photons populated according to :

(A) Fermi-Dirac distribution

(B) Bose-Einstein distribution

(C) Maxwell-Boltzmann distribution

(D) None

64. Special theory of relativity deals with the events in the frames of reference which move with constant :

(A) speed   (B) velocity

(C) acceleration   (D) momentum

65. Ratio of change in length with original length is known as :

(A) Stress   (B) Strain

(C) Fracture   (D) Toughness

66. In lasing action, the light amplification is done because of :

(A) Spontaneous emission

(B) Stimulated emission

(C) Absorption

(D) Ionization

67. Which of the following is correct for a gated D flip-flop ?

·(A) The Q output is either SET or RESET as soon as the D input goes HIGH or LOW.

(B) The output complement follows the input when enabled

(C) Only one of the inputs can be HIGH at a time

(D) The output toggles if one of the inputs is held HIGH

68. The Planck's constant does not have :

(A) the dimensions of action

(B) units of energy multiplied by time

(C) units of momentum multiplied by length

(D) units of angular momentum

69. Lenz's law is a consequence of the law of conservation of :

(A) mass   (B) energy

(C) momentum   (D) charge

70. The rest mass of an electron is m_0. What would be its mass if it moves with velocity $0.6c$?

(A) $3m_0/2$ (B) $4m_0/3$

(C) $5m_0/4$ (D) $6m_0/5$

71. MnO, FeO, CoO, NiO, $FeCl_3$ are :

(A) Non-magnetic

(B) Mixtures

(C) Metals

(D) Anti-ferromagnetic

72. With the positive probe on an NPN base, an ohmmeter reading between the other transistor terminals should be :

(A) open

(B) infinite

(C) low resistance

(D) high resistance

73. Two photons of light are approaching each other. Their relative speed will be :

(A) zero   (B) $c/2$

(C) c (D) less than c

74. Energy of an elastic mode of frequency f is given as :

(A) nhf (B) $(2n+1)hf/2$

(C) $(2n+1)hf$ (D) $nf/2$

75. The central frequency of a band-pass filter is always equal to the :

(A) Bandwidth

(B) -3 dB frequency

(C) bandwidth divided by Q

(D) average of the critical frequencies

76. The transconductance of an FET when $ID = 1$ mA and $VGS = 1$ V would be :

(A) 1 kS   (B) 1 mS

(C) 1 k   (D) 1 m

77. A square object moving with a relativistic speed ($0.9c$) shall appear to an observer as :

(A) square   (B) rectangle

(C) triangle   (D) circle

78. In Raman spectra of molecules :

(A) Stoke's lines are at higher frequency and of higher intensity

(B) Stoke's lines are at lower frequency and of lower intensity

(C) Stoke's lines are at higher frequency and of lower intensity

(D) Stoke's lines are at lower frequency and of higher intensity

79. The average power per unit area transported by an electromagnetic wave having electric field amplitude E_0 is given by :

(A) $\frac{1}{2}c\epsilon_0 E_0^2$

(B) $\frac{1}{2}c\mu_0 E_0^2$

(C) $\frac{1}{2}\mu_0\epsilon_0 E_0^2$

(D) $\frac{1}{2c}\epsilon_0 E_0^2$

80. A thermodynamic system is maintained at constant temperature and pressure. In thermodynamic equilibrium, its :

(A) Gibbs free energy is minimum

(B) Enthalpy is maximum

(C) Helmholtz free energy is minimum

(D) Internal energy is zero

81. The term used to differentiate between paramagnetic, diamagnetic and ferromagnetic material is called :

(A) Neel Temperature

(B) Susceptibility

(C) Permittivity

(D) Reflectivity

82. In a refrigerator, the heat exhausted to outer atmosphere will be :

(A) Less than that absorbed from the contents of the refrigerator

(B) Same as that absorbed from the contents

(C) More than that absorbed from the contents

(D) Any of the above depending upon the working substance

83. The zero point energy of a linear harmonic oscillator of frequency 50 Hz is :

(A) 1.66×10^{-32} J

(B) 3.32×10^{-32} J

(C) 0 J

(D) 0.83×10^{-32} J

84. If d be the interplaner spacing of a crystal then the Bragg's equation for an incident X-ray beam of wavelength λ at a glancing angle θ_n in the nth order can be written as :

(A) $2d\sin\theta_n = n\lambda$

(B) $2d\sin\theta_n = n/\lambda$

(C) $nd\sin\theta_n = \lambda$

(D) $d/\sin\theta_n = n\lambda$

85. Ratio of applied force with cross-sectional area on a rod is known as :

(A) Stress

(B) Strain

(C) Fracture

(D) Toughness

86. Ferrites are :

(A) Paramagnetic

(B) Diamagnetic

(C) Ferrimagnetic

(D) Nonmagnetic

87. The band gap energy of Silicon at room temperature is :

(A) 1.1 eV direct

(B) 1.1 eV indirect

(C) 0.67 eV direct

(D) 0.7 eV indirect

88. The temperature of transformation from ferromagnetic to the paramagnetic state is known as :

(A) Curie Temperature

(B) Curie-Weiss Temperature

(C) Neel Temperature

(D) Debye Temperature

89. A particle of energy E strikes a potential step of height $V_0 > E$. The transmittance in this case would be :

(A) zero

(B) 1

(C) infinite

(D) finite non-zero

90. The drawback of a SR flip-flop is :

(A) It has no Enable input

(B) It has a RACE condition

(C) It has no clock input

(D) It has only a single output

91. In a semiconductor, the variation of resistivity with temperature can be described by the following :

(A) Resistivity increases with increasing temperature

(B) Resistivity decreases with increasing temperature

(C) Resistivity decreases with decreasing temperature

(D) Resistivity is independent of temperature

92. The energy of a photon corresponding to sodium light of wavelength 5890 Å is :

(A) 1.2 eV   (B) 2.1 eV

(C) 13.6 eV   (D) 3.2 eV

93. When 535.8 nm line of mercury arc lamp was used as the source of radiation, a Raman line is observed at 444.7 nm. The Raman shift is :

(A) 459 cm^{-1} (B) 91.1 cm^{-1}

(C) 109.7 cm^{-1} (D) 45.55 cm^{-1}

94. The malleable and ductile properties in metallic material are due to :

(A) Brittleness

(B) Coefficient of thermal expansion

(C) Dispersion

(D) Plastic deformation

95. The effective number of atoms in BCC unit cell are :

(A) 6   (B) 2

(C) 8   (D) 12

96. Debye heat capacity, C_v, at low temperature is proportional to :

(A) T   (B) T^3

(C) T^2 (D) T^4

97. If atomic radius of Neon is 0.158 nm, its electronic polarizability will be (in $F.m^2$) :

(A) 4×10^{-30} (B) 4×10^{-40}

(C) 3×10^{-40} (D) 3×10^{-30}

98. At time $t = 0$, a free particle is in the normalized state $\psi (r, 0) = A \sin (5\pi x)e^{i(6\pi y + 4\pi z)}$. The value of the linear momentum component p_y is :

(A) $6\pi\hbar$ (B) 0

(C) $4\pi\hbar$ (D) $\hbar$

99. For which of the following isotopes NMR spectroscopy is possible ?

(A) ^{12}C (B) ^{16}O

(C) ^{13}C (D) ^{32}S

100. The quantum of lattice vibration energy is called as :

(A) Polaron   (B) Photon

(C) Plasmon   (D) Phonon

101. If an ideal gas is subjected to an isothermal process, then :

(A) No work is done by the system

(B) No heat is supplied to the system

(C) The heat supplied to the system equals the change in internal energy of the gas

(D) The heat supplied to the system equals to the work done by the system

102. Ratio of stress versus strain is :

(A) Strength

(B) Young Modulus

(C) Viscosity

(D) Velocity

103. A dielectric material having electronic and ionic polarizabilities only has refractive index 1.4 and static dielectric constant 9.27. The ionic dielectric constant of the material would be :

(A) 7.31   (B) 3.17

(C) 3.71   (D) 1.71

104. In a molecule having centre of symmetry :

(A) Raman active vibrations may be IR active

(B) Raman active vibrations will be compulsorily IR active

(C) Raman active vibrations will be IR inactive

(D) No correlation between Raman and IR active vibrations

105. A silicon plate of thickness 1 mm, width 10 mm and length 100 mm is placed in a magnetic field of 0.5 wb/m^2, acting perpendicular to its thickness. If, 10^{-2} A current flows along its length and Hall coefficient is 3.66×10^{-4} m^3/Coulomb. Hall voltage, developed across its thickness, will be :

(A) 1.83 mV   (B) 0.83 mV

(C) 0.083 mV   (D) 7.32 mV

106. Coordination number for hexagonal closed packed crystal structure is :

(A) 16   (B) 12

(C) 6   (D) 2

107. A microscope is used to resolve two self luminous objects, separated by a distance 4000 Å. If wavelength of the incident light is 5890 Å, the numerical aperture of the objective lens will be :

(A) 0.736

(B) 0.235

(C) 0.898

(D) 0.459

108. Which polarization mechanism may take place at frequencies in the visible range of applied electric field ?

(A) Dipolar

(B) Electronic

(C) Ionic

(D) Space Charge

109. If uncertainty in the location of a particle is equal to de-Broglie wavelength, uncertainty in its velocity should be :

(A) ≥ 7.95%

(B) ≥ 50%

(C) ≥ 5.56%

(D) ≥ 1.77%

110. If the light of 500 nm is incident on the grating with 2540 lines per inch, how many orders of diffraction maxima will be visible ?

(A) 1

(B) 3

(C) 10

(D) 20

111. In a two slit interference pattern, 10th order maxima is observed at a point on the screen for a light source of wavelength 700 nm. If the source wavelength is replaced by 500 nm, what would be the order of interference maxima at the same point ?

(A) 8

(B) 14

(C) 4

(D) 22

112. The weakest bond in strength will be :

(A) van der Waals bond

(B) Covalent bond

(C) Metallic bond

(D) Ionic bond

113. The intrinsic impedance of a lossy dielectric medium is given by :

(A) $\dfrac{j\omega\mu}{\sigma}$

(B) $\dfrac{j\omega\varepsilon}{\mu}$

(C) $\sqrt{\dfrac{j\omega\mu}{\sigma + j\omega\varepsilon}}$

(D) $\sqrt{\dfrac{\mu}{\varepsilon}}$

114. The intrinsic carrier concentration of silicon (Si) at 300K is $1.5 \times 10^{16}/m^3$. If Si is doped with phosphorous of concentration 10^{23} atoms/m^3, the hole concentration in it at equilibrium will be :

(A) $2.25 \times 10^{19} /m^3$

(B) $1.5 \times 10^{39}/m^3$

(C) $2.25 \times 10^{9}/m^3$

(D) None of these

115. A plane electromagnetic wave of frequency ω is incident normally on an air-dielectric interface. The dielectric is linear, isotropic, non-magnetic and its refractive index is n. The reflectance (R) is :

(A) $\left(\dfrac{n-1}{n+1}\right)^2$

(B) $\left(\dfrac{n-1}{n+1}\right)$

(C) $\left(\dfrac{n-1}{n+1}\right)^3$

(D) $\left(\dfrac{n-2}{n+3}\right)^2$

116. Which of the following is not an application of piezoelectric effect ?

(A) Ultrasonic Cleaner
(B) Buzzer inside pager
(C) Humming in electric transformer
(D) Electronic Igniter

117. Optical fiber operates on the phenomenon of :

(A) Laser technology
(B) Tyndall effect
(C) Photoelectric effect
(D) Total internal reflectance

118. The time independent Schrodinger equation is :

(A) $\left[-\dfrac{\hbar^2}{2m}\nabla^2 + V\right]\psi = i\hbar\dfrac{\partial \psi}{\partial t}$

(B) $\left[-\dfrac{\hbar^2}{2m}\nabla^2 + (E-V)\right]\psi = 0$

(C) $\left[-\dfrac{\hbar^2}{2m}\nabla^2 + V\right]\psi = E\psi$

(D) $-\dfrac{\hbar^2}{2m}\nabla^2\psi = E\psi$

119. What does a high resistance reading in both forward- and reverse-bias directions of diode indicate ?

(A) A good diode
(B) A shorted diode
(C) A defective ohmmeter
(D) An open diode

120. In Compton scattering, the scattered x-ray has :

(A) higher frequency
(B) higher velocity
(C) lower frequency
(D) lower velocity

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