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SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY
THIRUVANANTHAPURAM—695 011

ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2018

PROGRAMME: Ph.D. PHYSICAL SCIENCES STREAM

Time: 120 Minutes

Max.Marks: 100

(Select the most appropriate answer)

(There are **no negative** marks for wrong answers)

1) If 'a' is the smallest prime number greater than 39 and 'b' is the largest prime number less than 10, then ab =

- (a) 299 (b) 287 (c) 229 (d) 261

2) Find the odd number from the series 8, 64, 99, 216, 343, 729, 1728

- (a) 64 (b) 216 (c) 729 (d) 99

3) Which of the following options is the closest in meaning to the word 'ephemeral'?

- (a) short-lived (b) effeminate (c) oppose (d) ghostly

4) A person has the capability of thinking 100 lines of code in five minutes and can type 100 lines of code in 10 minutes. He takes a break for five minutes after every ten minutes. How many lines of codes will he complete typing after an hour?

- (a) 100 (b) 250 (c) 350 (d) 600

5) GENEALOGY: ANCESTRY, ETYMOLOGY: _____

- (a) Words (b) Insects (c) Fossils (d) Inscriptions

6) Complete the equation by correctly identifying the incomplete number of the calculation from the list of options given below.

Equation: $(4.25 + 2.75)^2 + \underline{\quad} = 5^3 - (9 \times 8)$

- (a) 2 (b) 4 (c) 6 (d) 8

7) Cobalt-60 is used in the radiation therapy of cancer and can be produced by bombardment of cobalt-59 with which of the following?

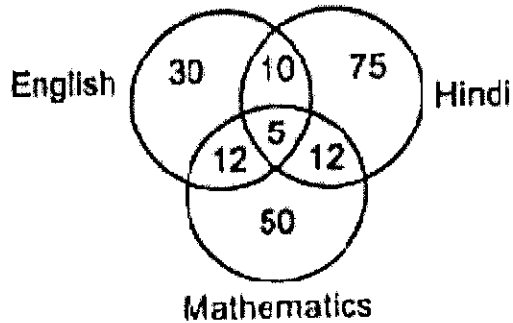
- (a) Neutrons (b) Alpha particles (c) Beta particles (d) X-rays

8) When you reverse the age of the father you will get the age of the son. One year ago the age of the father was twice that of son's age. What are the current ages of son and father?

- (a) 37 and 73 (b) 24 and 42 (c) 13 and 31 (d) 15 and 51

- 9) Which of the following microorganism does not cause disease in human beings?
 (a) *Vibrio cholerae* (b) *Salmonella typhi* (c) *Clostridium titani*
 (d) *Brevibacterium linens*
- 10) The anhydride of $\text{Ba}(\text{OH})_2$ is
 (a) BaOH (b) BaO (c) BaO_2 (d) Ba
- 11) Inheritance of acquired characteristics is called _____
 (a) Lamarckism (b) Neo-Lamarckism (c) Mendelism (d) Darwinism
- 12) A buffer is made from equal concentrations of a weak acid and its conjugate base. Doubling the volume of the buffer solution by adding water has what effect on its pH?
 (a) It has little effect.
 (b) It significantly increases the pH
 (c) It significantly decreases the pH
 (d) It changes the pH asymptotically to the pK_a of the acid.
- 13) All proteins absorb electromagnetic radiation of wavelength around 190 nm, which corresponds to an excitation in the protein molecule. In which region of the spectrum is this wavelength found?
 (a) X-ray (b) Ultraviolet (c) Microwave (d) Infrared
- 14) What will be the pH of 10^{-8} M HCl?
 (a) 7.22 (b) 7.14 (c) 7.0 (d) 6.98
- 15) Which of the following is not having an electromagnetic nature?
 (a) X-rays (b) UV-rays (c) β -rays (d) Microwave
- 16) Which number comes next in this sequence? 1, 1.5, 2.5, 4, ____?
 (a) 9 (b) 8 (c) 7 (d) 6
- 17) If 3 less than twice a certain number is equal to 2 more than 3 times the number, then 5 less than 5 times the number is
 (a) -30 (b) -20 (c) -5 (d) 0
- 18) What is the greatest value of x for which $(3x-2)(x+1) = 0$?
 (a) -1 (b) $-\frac{2}{3}$ (c) $\frac{2}{3}$ (d) 1
- 19) If the average of 5 numbers is 36 and the average of four of those numbers is 34, then what is the value of the fifth number?
 (a) 2 (b) 34 (c) 35 (d) 44
- 20) The surface tension of a liquid vanishes at
 (a) triplet point (b) the boiling point (c) critical temperature (d) none of the above

21) Five hundred candidates appeared for the test conducted for English, Mathematics and Hindi. The below diagram gives the number of candidates failed at different tests. What is the percentage of students who failed for at least two tests?



- a) 0.078% b) 1.0% c) 6.8% d) 7.8%

22) A worker may claim Rs15 for each km he travelled in taxi and Rs 5 for each km he travelled in his own car. If in a month he is claiming Rs 500 for travelling 80km, how much does he travelled by taxi?

- a) 10 b) 20 c) 70 d) 40

23) At the end of a business conference ten people shook hands each other. Then how many handshakes were there altogether?

- a) 100 b) 55 c) 10 d) 45

24) A number of people decided to go to picnic and spent Rs.96 on eatables. At the end, four people did not turn up. As a result, others had to contribute Rs. 4 each extra. The number of those who attended the meeting was

- a) 12 b) 8 c) 10 d) 6

25) A bus starts from city X. The number of women in the bus is equal to half the number of men in the bus. When the bus reached city Y, 10 men left the bus and 5 women boarded it. Now, the number of women and men in the bus become equal. If so, how many passengers entered the bus in the beginning from city X.

- a) 15 b) 30 c) 36 d) 45

26) Today is Wednesday, after 62 days it would be

- a) Monday b) Tuesday c) Wednesday d) Saturday

Choose the appropriate word closest to meaning of word given in italics (questions 27 & 28)

27) A *baffling* problem

- a) Simple b) Puzzling c) Difficult d) Fresh

28) *Posthumous* child

- a) illegitimate b) Brilliant c) Born after death of father d) physically weak

Choose the appropriate word closest to meaning of word given in italics (questions 29 to 32)

29) *Hooligan*

- a) Tin Whistle b) Thug c) Street gang d) commotion

30) *Modus vivendi*

- a) Way of work b) Way of life c) Way of Operation d) Way of game

31) *Elucidate*

- a) Clarify b) Interpret c) Confuse d) Contradict

32) *Claustrophobia*

- a) Fear of spider b) Fear of computers c) Fear of being in enclosed area d) Fear of foreigners

33) The length of the side of a square is represented by $x+2$. The length of the side of an equilateral triangle is $2x$. If the square and the equilateral triangle have equal perimeter, then the value of x is

- _____.
- a) 3 b) 5 c) 6 d) 4

34) The area of the circle is increasing at the rate of $0.7 \text{ cm}^2/\text{sec}$. What is the rate of increase of its circumference?

- a) 0.84 b) 1.4 c) 0.7 d) 1

35) The frequency of the second harmonic of 60 Hz is:

- a) 60 Hz b) 180 Hz c) 100 Hz d) 120 Hz

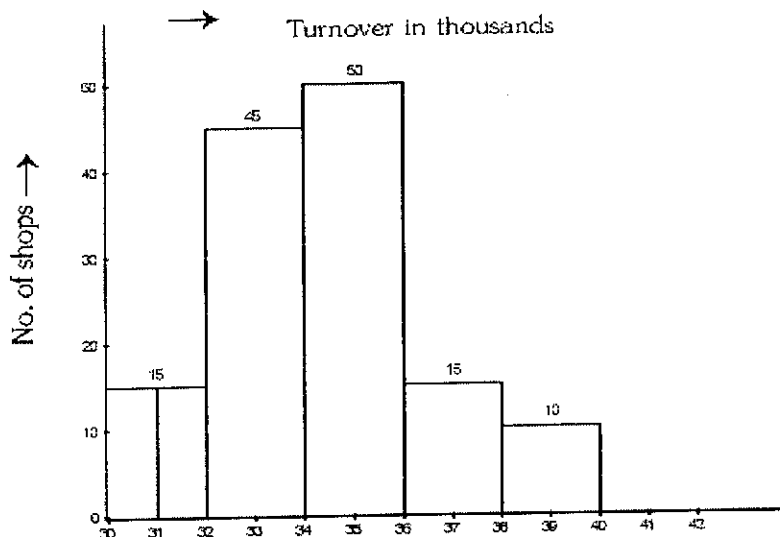
36) If $a - b = 3$ and $a^2 + b^2 = 29$. Find the value of ab .

- a) 10 b) 12 c) 15 d) 18

37) An accurate clock shows o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?

- a) 144° b) 160° c) 168° d) 180°

The results of a survey done on the monthly turnover of some shops are represented as a bar diagram below. Study the chart carefully and answer the questions 38 & 39.



- 38) What percentage of shops has turnover of over Rs.36000?
 a) 20% b) 25% c) 5% d) 23%
- 39) How many shops have turnover between Rs.32000 and Rs.38000?
 a) 35 b) 95 c) 110 d) 55
- 40) Find the word which is nearly opposite in meaning for the word "Extrinsic"
 a) Severe b) Shallow c) Incidental d) Inherent
- 41) If a generalized co-ordinate has the dimensions of momentum, the generalized velocity will have the dimension of
 a) Velocity b) Acceleration c) Force d) Torque
- 42) The product of any generalized momentum and the associated (or conjugate) co-ordinate must have the dimensions of
 a) Energy b) Angular momentum c) Linear momentum d) Force
- 43) The co-ordination number in case of FCC is
 a) 6 b) 8 c) 12 d) 4
- 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 corresponding to a rotation is cyclic, rotation of the system about given axis remains invariant then the following quantity is conserved
 a) Linear momentum
 b) Angular momentum
 c) Kinetic energy
 d) Potential energy

- 46) For attractive inverse square forces, the shape of orbit will be
- Elliptic
 - Parabolic
 - Hyperbolic
 - All of these
- 47) X-rays consists of
- Negatively charged particles
 - Positively charged particles
 - Electromagnetic radiation
 - A stream of neutrons
- 48) A body is freely falling on the earth's surface; the body deflects by
- 3 cm towards west
 - 3 cm towards east
 - 3 cm towards south
 - 3 cm towards north
- 49) A ball is released from rest from a great height above the ground in Delhi. It will fall on the ground
- Exactly below the point of release
 - Slightly east of the vertical
 - Slightly west of the vertical
 - Slightly north of the vertical
- 50) In the normal co-ordinates of the system, each of the new co-ordinates involves ----- resonant frequencies
- One
 - Two
 - Three
 - Four
- 51) When a negative charge is placed at the centre of the sphere, then the direction of electric field on the Gaussian Surface is
- Radially outward
 - Radially inward
 - Along the tangent to the surface
 - None of the above
- 52) The electric field intensity on the surface of a charged conductor is
- Zero
 - Directed normally to the surface
 - Directed tangentially to the surface
 - Directed along 45 degrees to the surface
- 53) The temperature at which a gas liquefies is called
- Critical temperature
 - Boyle's temperature
 - Melting point
 - Boiling point

- 54) A plane –polarized monochromatic electro-magnetic wave incident on a plane interface at the Brewster angle gives rise to a reflected wave which is
- Partially polarized
 - Unpolarized
 - Polarized parallel to the interface
 - Polarized perpendicular to the interface
- 55) When a conducting sphere is placed in a uniform field its polarizability is ----- the product of permittivity in free space and the volume of the sphere.
- same as
 - Twice
 - Thrice
 - Four times
- 56) A free electron is placed in the path of a plane electromagnetic wave. The electron will start moving
- Along the electric field
 - Along the magnetic field
 - Along the direction of propagation of the wave
 - In a plane containing the magnetic field and the direction of propagation
- 57) Consider the reflection and refraction of a plane wave at a dielectric interface. Which of the following is true?
- The frequency of the wave does not change
 - The energy of the wave does not change
 - The polarization does not change
 - The momentum of the wave does not change
- 58) The potential which exhibit the dependence of the potentials on the velocity of the particle is known as
- Scalar potentials
 - Vector potentials
 - Lienard – Wiechert potentials
 - Retarded potentials
- 59) The slope of the Alpha decay energy versus neutron number should be
- Negative
 - Positive
 - Insufficient data
 - Zero
- 60) The Curie temperature of iron is that temperature below which it is
- Ferromagnetic
 - Electrically conducting
 - Superconducting
 - Radioactive
- 61) Particles having spin 0 are described by
- The Klein-Gordon equation
 - The Dirac equation
 - The Pauli equation
 - The Proca equation

- 62) The magnitude of electric displacement or electric induction depends on
- The applied field alone
 - The dielectric polarization
 - The applied field as well as dielectric polarization
 - None of these
- 63) Bohr postulated in his model, quantization of
- Energy
 - Linear momentum
 - Angular momentum
 - Spin
- 64) The first excitation potential of a given atom is 10.2 volt. Its ionization potential must be
- 13.6 volt
 - 20.4 volt
 - 10.2 volt
 - 30.6 volt
- 65) No two electrons will have all the four quantum numbers equal. This statement is known as
- Pauli's exclusion principle
 - Uncertainty principle
 - Hund's rule
 - Aufbau's principle
- 66) If elements with principal quantum number $n > 4$ were not allowed in nature, the number of possible elements would be
- 60
 - 32
 - 4
 - 64
- 67) Davisson and Germer experiments relate to
- Interference
 - Polarization
 - Electron diffraction
 - Phosphorescence
- 68) Which of the following statement about the energy in a quantum is true?
- Varies directly with frequency
 - Varies inversely with frequency
 - Same for all frequencies
 - None of the above
- 69) Matter waves
- Are longitudinal
 - Are electromagnetic
 - Always travel with speed of light
 - Show diffraction
- 70) According to Schrodinger, a particle is equivalent to a
- Single wave
 - Wave packet
 - Light wave
 - Cannot behave as wave
- 71) Of the following particles moving with the same velocity, the one which has largest wave length is
- An electron
 - A photon
 - A neutron
 - An alpha particle

- 72) The travelling harmonic waves which have a constant magnitude at great distances and for which the normalization integral diverges represent
- Free particles
 - Restrained waves
 - Localized waves
 - All of the above
- 73) For polyatomic gases such as hydrogen, the corresponding degree of freedom would be
- Two, three
 - Five, six
 - Three, nine
 - Three, four
- 74) The change in the internal energy of the gas is directly proportional to
- The change in volume
 - Change in pressure
 - Change in temperature
 - None of these
- 75) The first law of thermodynamics is conservation of
- Momentum
 - Energy
 - Both (a) & (b)
 - None of these
- 76) In a refrigerator, the heat exhausted to the outer atmosphere is
- Less than that absorbed from the contents of the refrigerator
 - Same as that absorbed from the contents
 - More than that absorbed from the contents
 - Any of the above depending upon the working substance
- 77) The change in entropy is
- Positive in a reversible change
 - Negative in an irreversible change
 - Positive in an irreversible change
 - Negative in a reversible change
- 78) A Physical or chemical change takes place in such a way that the entropy either decreases or remains unchanged. This statement is
- True universally
 - True only for open system
 - True only for closed system
 - Not true
- 79) Change in entropy depends
- Only on the transfer of heat
 - Only on change of temperature
 - On transfer of mass
 - On the thermodynamic state
- 80) The minimum energy required to ionize hydrogen atom from its ground state is above
- 0.236 eV
 - 1.36 eV
 - 13.6 eV
 - 136 eV

- 81) The average translational kinetic energy of the molecules of a gas will be doubled if
- a) At constant volume, its pressure is doubled
 - b) At constant volume, its pressure is halved
 - c) At constant temperature, its pressure is doubled
 - d) At constant temperature, its pressure is halved
- 82) Kirchhoff's voltage law is satisfied in
- a) Linear circuits
 - b) Non-linear circuits
 - c) Both linear and non-linear circuits
 - d) None of these
- 83) For a given waveform, the voltage will be lowest in case of
- a) r.m.s.
 - b) Peak
 - c) To peak
 - d) Mean
- 84) A better power supply should possess
- a) Higher input impedance
 - b) Lower output impedance
 - c) Lower input impedance
 - d) Total voltage regulation
- 85) The time base of a CRO is developed by
- a) Sawtooth waveform
 - b) Square waveform
 - c) Triangular waveform
 - d) Sinusoidal waveform
- 86) A ferromagnetic core if placed inside a coil
- a) Will decrease the coil inductance
 - b) Will raise the resistance of the coil
 - c) Will lower the resistance of the coil
 - d) Will increase the coil inductance
- 87) Simple capacitor filters are good for
- a) Low current supply
 - b) High current supply
 - c) Low voltage supply
 - d) High voltage supply
- 88) Temperature coefficients of carbon resistors is
- a) Zero
 - b) Positive
 - c) Negative
 - d) Both positive and negative
- 89) The depletion region is created by
- a) Ionization
 - b) Diffusion
 - c) Recombination
 - d) All of these
- 90) When a voltmeter is placed across a forward biased diode, it will read a voltage approximately equal to
- a) The bias battery voltage
 - b) 0V

- c) The diode barrier potential
- d) The total circuit voltage

91) The positive lead of an ohmmeter is connected to the anode of a diode and the negative lead is connected to the cathode. The diode is

- a) Reversed – biased
- b) Open
- c) Forward – biased
- d) Faulty

92) The complement of a variable is always

- a) 0
- b) 1
- c) Equal to the variable
- d) The inverse of the variable

93) Digital circuit can be made by repetitive use of

- a) NOT gates
- b) OR gates
- c) AND gates
- d) NAND gates

94) On a Karnaugh map, grouping the zeros produces

- a) A product of sums expression
- b) A sum of products expression
- c) A “don’t care” condition
- d) AND-OR logic

95) The kinetic energy of an electron in atom is

- a) Twice its potential energy
- b) Half of its potential energy
- c) Equal to its potential energy
- d) Thrice its potential energy

96) The AND operation can be produced with

- a) Two NAND gates
- b) Three NAND gates
- c) One NOR gate
- d) Three NOR gates

97) The normal Zeeman effect is

- a) Observed only in atoms with an even number of electrons
- b) Observed only in atoms with an odd number of electrons
- c) Not a confirmation of space quantization
- d) A confirmation of space quantization

98) An example of a data storage device is

- a) The logic gate
- b) The flip flop
- c) The register
- d) Both (b) & (c)

- 99) A full adder is characterized by
- a) Two inputs and two outputs
 - b) Three inputs and two outputs
 - c) Two inputs and three outputs
 - d) Two inputs and one output
- 100) The source of emission of electrons in a CRT is
- a) P-N junction diode
 - b) A barium and strontium oxide coated cathode
 - c) Accelerating anode
 - d) Post-accelerating anode