M.tech
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ENTRANCE EXAMINATION FOR ADMISSION, MAY 2011.

M.Tech. (GREEN ENERGY TECHNOLOGY)

COURSE CODE : 307

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 307

Time : 2 Hours Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you –1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. Pauli's exclusion principle states that quantum mechanically
   (A) Identical charges stay together
   (B) Identical charges cannot stay together
   (C) Identical charges recombine
   (D) Identical charges generate photons

2. Energy of a Photon is
   (A) hc/λ (B) $h\omega/\lambda$
   (C) h/λ (D) E/λ

3. The following is the example of optical waveguide
   (A) Optical fiber (B) Glass
   (C) Quartz (D) Silicon

4. Electric motor works under the
   (A) Faraday's rule (B) Einstein's rule
   (C) Fleming's left hand rule (D) Richard Feynman's rule

5. Inverter is a device that converts
   (A) DC power to DC power (B) AC power to DC power
   (C) DC power to AC power (D) Optical to electrical power

6. An electrical transformer works under the principle of
   (A) mutual induction (B) self induction
   (C) biased induction (D) coil induction

7. Conductivity of metal arises due to the presence of
   (A) Free atoms (B) Free electrons
   (C) Free holes (D) Impurities

8. The cyclotron frequency (ω_c) of an electron rotating under Lorenz force is equal to
   (A) B/m (B) ω/m
   (C) eB/m (D) e/m

9. Ferrite rods are used to sense the
   (A) Optical signal (B) Microwave signal
   (C) Electrical signal (D) Electromagnetic signal

10. The electron "gas" in a metal is not directly responsible for its

(A) electrical conductivity (B) thermal conductivity

(C) surface luster (D) strength

11. A superconducting material when placed in a magnetic field will

(A) attract the magnetic field toward its centre

(B) repel all the magnetic lines of forces passing through it

(C) attract the magnetic field but transfer it into a concentrated zone

(D) not influence the magnetic field

12. In a ferromagnetic material, susceptibility is

(A) very small and positive (B) very small and negative

(C) very large and positive (D) very large and negative

13. The depletion region in an open circuited *p-n* junction contains

(A) electrons (B) holes

(C) uncovered immobile impurity ions (D) neutralized impurity atoms

14. Light Emitting Diode (LED) is a semiconductor device in which the p-n junction is

(A) reverse biased (B) forward biased

(C) unbiased (D) none of these

15. The factor responsible for spontaneous polarization is

(A) free electrons (B) atoms

(C) permanent dipoles (D) none of these

16. Piezoelectric effect is the production of electricity by

(A) chemical effect (B) varying field

(C) temperature (D) pressure

17. A laser beam of wavelength 740 nm has coherence time 4×10^{-5}s. What is its coherence length?

(A) 12 km (B) 2 km

(C) 12 m (D) 2 m

18. A thermocouple is made from two metals, Antimony and Bismuth. If one junction is kept hot and other junction is kept cold then, an electric current will Answer

(A) flow from Antimony to Bismuth at the cold junction

(B) flow from Antimony to Bismuth at the hot junction

(C) flow from Bismuth to Antimony at the cold junction

(D) flow from Bismuth to Antimony at the hot junction

19. A block of mass 0.50 kg is moving with a speed of 2.00 m/s on a smooth surface. It strikes another mass of 1.00 kg and then they move together as a single body. The energy loss during the collision is

(A) 0.16 J (B) 1.00 J (C) 0.67 J (D) 0.34 J

20. Visible light's wavelength range

(A) 0.39 – 0.77 mm (B) 0.39 – 0.77 μm

(C) 0.39 – 0.77 nm (D) 0.39 – 0.77 cm

21. Fluorescence occurs within

(A) 10^{-5} s. (B) 10^{-5} ms. (C) 10^{-5} μs. (D) 10^{-5} ns

22. Sky looks blue because the sun light is subjected

(A) Rayleigh scattering (B) Compton scattering

(C) Diffraction of light (D) Absorption of light

23. Optical fiber operates on the principle of

(A) Total internal reflectance (B) Tyndall effect

(C) Photo-electric effect (D) Laser technology

24. Light is produced in electric discharge lamps by

(A) heating effect of current (B) magnetic effect of current

(C) ionization in a gas or vapor (D) carbon electrodes

25. Lumen/watt is the unit of

(A) Light flux (B) Luminous intensity

(C) Brightness (D) Luminous efficiency

26. The ability of a microscope to reveal closely adjacent points as separate & distinct

(A) Magnification (B) Resolution

(C) Power (D) f-number

27. The coefficient matrix of the linear equation $5x - 2y + c = 0$ is

(A) [5 –2] (B) [5 –2 0] (C) [5 –2 1] (D) [5 2 1]

28. The inner product of two orthogonal vectors A & B is

(A) 1 (B) 0 (C) $|A| \cdot |B|$ (D) $(|A| \cdot |B|)/2$

29. $A \times (B + C)$ is

(A) $(C + A) \times B$ (B) $(B \times A) + C$ (C) $(A + B) \times C$ (D) $(A \times B) + (A \times C)$

30. $\log_{10} 4 + 2 \log_{10} 2$ is equal to

(A) $4 \log_{10} 2$ (B) $2 \log_{10} 4 + \log_{10} 2$

(C) $4 \log_{10} 4$ (D) $\log_{10} 6$

31. If $a = e^b$ then which of the following is true?

(A) $a = 1$ for $b = -\infty$ (B) $a = 0$ for $b = -\infty$

(C) $\log_e b = a$ (D) $a = 1$ for $b = \infty$

32. The value of $e^{(i\pi/2)}$ is

(A) 1 (B) –1 (C) i (D) $-\sqrt{3}/2$

33. When A is a matrix and if $A = A^T$ then A is

(A) Real (B) Unitary (C) Symmetric (D) Orthogonal

34. If $x > 1$ and $\frac{\sqrt{x}}{x^3} = x^m$ what is the value of m?

(A) $-\frac{3}{2}$ (B) $-\frac{5}{2}$ (C) 2 (D) –2

35. The function $f(x) = x^2 - x$, at $x = 0.5$ has

(A) maxima (B) minima

(C) saddle point (D) salient point

36. Find two numbers whose sum is 26 and whose product is 165

(A) 9 and 17 (B) 10 and 16

(C) 2 and 14 (D) 11 and 15

37. Complex conjugate of $i / (1 - i)$ is

(A) $\frac{1}{2}(1+i)$ (B) $\frac{1}{2}(1-i)$ (C) $-\frac{1}{2}(1+i)$ (D) $-\frac{1}{2}(1-i)$

38. The solution to the equation ln (x) + ln (2) = 3 is

(A) $e^3 / \ln(2)$ (B) $e^3 / 2$ (C) $3^e / 2$ (D) $3 / \ln(2)$

39. The equation of a straight line that passes through point A(1,-1) and has a slope equal to -1 is

(A) $y = -x$ (B) $y = 1 - x$ (C) $y = 1/x$ (D) $y = x + 1$

40. S is a surface of constant value for the function f(x,y,z) then the gradient of f is

(A) normal to the level surface (B) tangential to level surface

(C) arbitrary (D) curvilinear to the level surface

41. The mean of first ten even positive integers is

(A) 5 (B) 10

(C) 11 (D) none of these

42. Rank of the matrix $\begin{pmatrix} i & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & i \end{pmatrix}$ where i is an imaginary number

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

43. When two vectors A(i) and B(j) are orthonormal then

(A) A(i).B(j)=0 (B) A(i).B(j)=1

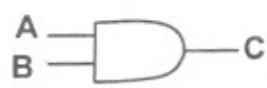
(C) A(i).B(j)=δ_{ij} (D) None of the above

44. How many ways can a cricket team of 11 players be chosen from 15 players?

(A) 15 (B) 165

(C) 1365 (D) none of these

45. In the gate given below what is the output C when the input A = 0



(A) always 1 (B) always 0

(C) either 0 or 1 (D) cannot be predicted

46. What decimal number equivalent of the binary number $(1011)_2$?

(A) 2022 (B) 10 (C) 0 (D) 11

47. What is the probability of getting 1 or 3 when rolling a dice?

(A) 1/6 (B) 2/6 (C) 3/6 (D) 1

48. Material of gold particle of 1 mm diameter is transformed into 10 nm diameter size particles. Number of fold increase in surface area of the material is

(A) 10 (B) 10^6 (C) 10^{10} (D) 10^{12}

49. Which of the following arrangements will produce H_2 at cathode during electrolysis?

(A) aqueous solution of NaCl using Pt electrodes

(B) dil H_2SO_4 with copper electrodes

(C) aqueous $AgNO_3$ with Ag electrodes

(D) dil H_2SO_4 with Pt electrodes

50. The half life of tritium is 12.5 yrs. If we start out with 1 g of tritium, after 25 years there will be

(A) no tritium left (B) $\frac{1}{4}$ g of tritium left

(C) $\frac{1}{2}$ g of tritium left (D) a total of 2 g of tritium left

51. Radioactive isotopes that have an excessive neutron-proton ratio generally exhibit which one of the following?

(A) Alpha emission (B) Beta emission

(C) Positive capture (D) K-capture

52. Which one of the following compounds will show optical isomerism?

(A) $[Pt(NH_3)_2Cl_2]$ (B) $[CO(NH_3)_5NO_2]Cl$

(C) $[CO(NH_3)_4NO_2]Cl$ (D) $CO[(en)_2Cl_2]$ Cl

53. Water gas is an equimolar mixture of

(A) CO and N_2 (B) CO and H_2O

(C) CO_2 and N_2 (D) CO and H_2

54. Which of the following is destroying the ozone layer present in stratosphere?

(A) Oxides of nitrogen (B) CH_4

(C) CFC (D) All of the above

55. IUPAC name of $K_3 Al(C_2O_4)_3$ is

(A) Potassium aluminium trioxalate

(B) Potassium aluminium (III) trioxalate

(C) Potassium aluminium trioxalate aluminate (III)

(D) Potassium aluminium tris(oxalate)aluminate (III)

56. Which one of the following bonds has the higher average bond energy (kcal/mole)?

(A) S = O (B) C = C (C) C ≡ N (D) N ≡ N

57. The reaction of erythro 1-bromo 1,2-diphenyl propane with alcoholic KOH gives

(A) (Z) –1,2 – diphenyl –1 – propene

(B) (E) –1,2 – diphenyl – 1 – propene

(C) Both (Z) and (E) – 1,2 – diphenyl –1 – propene

(D) 1,2 – diphenyl – 1 – propanol

58. Which of the following does not have sp^2 hybridised carbon?

(A) Acetone (B) Acetic acid

(C) Acetonitrile (D) Acetamide

59. Anti-Markovnikov's addition of HBr is not observed in

(A) propene (B) 1-Butene

(C) 2- Butene (D) 2-pentene

60. The unit of second order reaction rate constant is

(A) lit^{-1} mol sec^{-1} (B) lit^2 mol^2 sec^{-1}

(C) lit $mol^{-1}sec^{-1}$ (D) mol sec^{-1}

61. The units of rate and rate constant for a certain reaction are the same. The order of reaction is

(A) first (B) zero

(C) second (D) third

62. When sucrose is oxidized with con. nitric acid, it gives

(A) Tartaric acid (B) Succinic acid

(C) Oxalic acid (D) Laerulic acid

63. For which one of the following processes is intersystem crossing (ISC) essential?

(A) Fluorescence (B) Phosphorescence

(C) Chemiluminescence (D) Radioactive decay

64. For an ideal gas PV^γ = Constant is

(A) Adiabatic process (B) Polytrophic process

(C) Constant temperature process (D) Isentrophic process

65. The correct configuration of $_{29}Cu$ is

(A) [Ar] $4s^1$ (B) [Ar] $4s^2$ (C) [Ar] $3d^{10}\ 4s^1$ (D) [Ar] $3d^9\ 4s^2$

66. Which molecule has the largest dipole moment?

(A) HCl (B) HI (C) HBr (D) HF

67. In an octahedral structure, the pair of d-orbitals involved in d^2sp^3hybridization is?

(A) $d_{x^2-y^2}, d_{z^2}$ (B) dx^{2-y^2}, d_{x^2} (C) d_{z^2}, d_{zx} (D) d_{xy}, d_{y^2}

68. Which of the following species is the strongest Bronsted –Lowry base in water?

(A) NH_3 (B) NH_2^- (C) F^- (D) CO_3^{2-}

69. Camphor is often used in molecular weight determination because

(A) It is high cryoscopic constant

(B) It is readily available

(C) It is volatile

(D) It is a solvent for many organic substances

70. Pure silicon doped with phosphorus atom is an

(A) metallic conductor (B) n-type semi conductor

(C) p-type semi conductor (D) insulator

71. The relation between the solubility of a gas and its pressure is known as

(A) Ostwald's law (B) Raoult's law

(C) Henry's law (D) Distribution law

72. The hydrated sodium sulphate is an example of

(A) one compound system (B) two compound system

(C) three compound system (D) four compound system

73. Besides CO2, other green house gas is

(A) N_2 (B) CH_4 (C) Ar (D) He

74. End-to-end length of a bacteriophage DNA having 48kbp is

(A) 15.4μm (B) 1.54μm (C) 1.50μm (D) 150μm

75. Which of the following can be classified as second messenger molecule?

(A) G protein
(B) cyclic adenosine monophophate
(C) adenylecyclase
(D) phospholipase

76. Which of the following is not an Antigen Presenting Cell?

(A) Monocytes
(B) T cell
(C) Macrophage
(D) Thymus epithelial cells

77. Secondary structure of a single strand DNA is

(A) Bubbles and knots
(B) Hairpin & loops
(C) α helix & β sheets
(D) minor grooves and double helix

78. Which one of the following is a neurotransmitter?

(A) IP3
(B) Acetyle choline
(C) Adenosine triphosphate
(D) F-Actin

79. Number of solute molecules in one microlitre of one femtomolar solution will be approximately

(A) 10^{21} (B) 10^{9} (C) 6×10^{8} (D) 600

80. Distal DNA sequences that help in the expression of a gene is referred as

(A) expresser
(B) initiator
(C) attenuator
(D) enhancer

81. Typical duration for cell division of a laboratory Ecoli strain is

(A) 2 hours
(B) 200 minutes
(C) 20 minutes
(D) 2 minutes

82. The macromolecules that require a template for synthesis are:

(A) nucleic acids and carbohydrates
(B) proteins and carbohydrates
(C) lipids and carbohydrates
(D) proteins and nucleic acids

83. The polarity of the DNA chain is represented by

(A) 1'-3' (B) 3'-5' (C) 1'-5' (D) 3'-1'

84. Sequence on a DNA molecules that are same on both strands when read in same direction are known as

(A) sticky sites
(B) recognition sites
(C) consensus sequence
(D) palindromes

85. T cells mature in the

(A) Thyroid gland (B) Bone marrow

(C) Thymus gland (D) Lymph nodes

86. DNA sequences needed for division of eukaryotic chromatids during mitosis is

(A) telomere (B) centromere

(C) centrosome (D) kinetochore

87. The antibiotic chloramphenicol blocks the

(A) cell wall formation (B) transcription

(C) translation termination (D) polypeptide chain elongation

88. The class of green algae is classified as

(A) Phaeophyceae (B) Chlorophyceae

(C) Rhodophyceae (D) Solanaceae

89. Upper chambers of mammalian heart is called

(A) Ventricles (B) Atria

(C) Pericardium (D) Myocardium

90. In the blood pressure measurement, 120/80 represents

(A) systolic pressure/ diastolic pressure (B) diastolic/systolic pressure

(C) perstaltic/normal pressure (D) normal/peristaltic pressure

91. The harmone responsible for increase in altertness, pupilary dialation, and sweating is

(A) melatonin (B) thyroxine

(C) thymosin (D) adrenaline

92. Hyperglycemia refers to

(A) Increased RBC count (B) Increased cholesterol level

(C) Increased blood sugar level (D) Increased urea level in blood

93. Lactose upon digestion with lactase gives

(A) Glucose + Sucrose (B) Galactose + Fructose

(C) Glucose + Galactose (D) Glucose + Fructose

94. Double stranded DNA has absorption peak at

(A) 220 nm (B) 60 nm

(C) 488 nm (D) 620 nm

95. Time of flight mass spectrometer works on the principle of measurement of

(A) Time of arrival of the molecule at the detector

(B) Time of arrival of the electron at the detector

(C) Time of arrival of ion at the detector

(D) Time of arrival of proton at the detector

96. Psychrophiles are bacteria that grow in the temperature range of

(A) $-10°$ C to $20°$ C (B) $15°$ C to $45°$ C

(C) $30°$ C to $75°$ C (D) Above $100°$ C.

97. In a monolayer assay, there are 100 plaques were counted on an average for aviral diluents sample of 0.1 ml at 10^6 dilution. The plaque forming units (pfus) of the sample is

(A) 10^9 pfus (B) 10^7 pfus

(C) 10^5 pfus (D) 10^3 pfus

98. RNA Polymerase is an enzyme that

(A) Translate RNA (B) Replicate DNA

(C) Transcribe DNA (D) Replicate RNA

99. The residue which has least conformational hindrance and thus can cover most of the area of Ramachandran plot is

(A) Gly (B) Lys

(C) Ala (D) Pro

100. Autotrophic microbes

(A) Releases CO_2 (B) Fixes CO_2

(C) Releases O_2 (D) Fixes O_2