

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2013.

M.Tech. (NANO SCIENCES AND TECHNOLOGY)

COURSE CODE : 305

Register Number :

Signature of the Invigilator
(with date)

COURSE CODE : 305

Time : 2 Hours

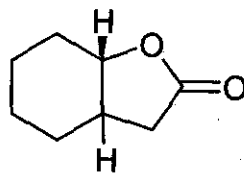
Max : 400 Marks

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.

- Which one of the following aqueous solution will exhibit highest boiling point?
 (A) 0.01M Na_2SO_4 (B) 0.01M KNO_3
 (C) 0.015 Urea (D) 0.015 Glucose
- Which of the following pair will show positive deviation from Raoult's law?
 (A) Water – Hydro Chloric Acid (B) Benzene – Methanol
 (C) Water – Nitric Acid (D) Acetone – Chloroform
- Which one of the following amines does not undergo a acylation?
 (A) $\text{C}_2\text{H}_5\text{NH}_2$ (B) $(\text{CH}_3)_2\text{NH}$ (C) $(\text{CH}_3)_3\text{N}$ (D) CH_3NH_2
- Which substance shows antiferromagnetism?
 (A) ZrO_2 (B) CdO (C) CrO_2 (D) Mn_2O_3
- Which of the following on hydrolysis form acetic acid?
 (A) CH_3CN (B) $\text{C}_2\text{H}_5\text{OH}$ (C) $\text{C}_2\text{H}_5\text{NH}_2$ (D) CH_3OH
- Piperidine is
 (A) Homolytic compound (B) Homolytic aromatic compound
 (C) Homolytic alicyclic compound (D) None of the above
- Among the following the strongest base is
 (A) $\text{C}_6\text{H}_5\text{NH}_2$ (B) $p\text{-NO}_2\text{-(C}_6\text{H}_4\text{)NH}_2$
 (C) $m\text{-NO}_2\text{-(C}_6\text{H}_4\text{)NH}_2$ (D) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
- $\text{C}_6\text{H}_5\text{CONHCH}_3$ can be converted into $\text{C}_6\text{H}_5\text{CH}_2\text{NHCH}_3$ by
 (A) NaBH_4 (B) $\text{H}_2\text{-Pd}$ (C) LiAlH_4 (D) Zn-Hg/HCl
- Amongst the following the most basic compound is
 (A) Benzylamine (B) Aniline
 (C) Acetanilide (D) $p\text{-Nitroaniline}$
- Which of the following is/are monosaccharides?
 (A) Glucose (B) Lactose (C) Cellulose (D) Starch

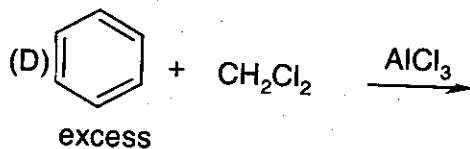
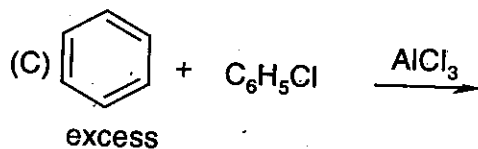
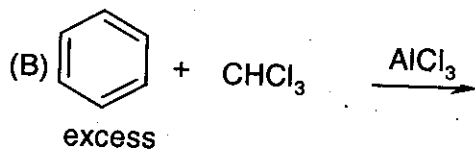
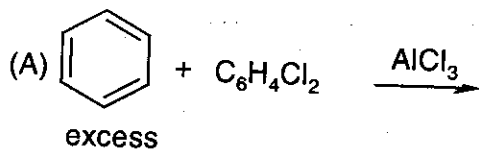
11. Low oxidation state complexes are often air-sensitive, but are rarely water sensitive because
- (A) Air is reducing in nature while water is inert
 (B) Both air and water are oxidizing in nature
 (C) Both air and water are no π -acceptors
 (D) Complexes with low oxidation states will easily lose electrons to O_2 but will not bind to a π -donor molecules like H_2O
12. The final product of the reaction $[Mn(CO)_6]^+ + CH_3Li \rightarrow$ is
- (A) $[Mn(CO)_6]^+ CH_3^-$ (B) $[Mn(CO)_5 CH_3]$
 (C) $[Mn(CO)_6]$ (D) $[(CH_3CO) Mn(CO)_5]$
13. The reaction between NH_4Br and Na metal in liquid ammonia (solvent) results in the products
- (A) $NaBr, HBr$ (B) $NaBr, H_2$ (C) H_2, HBr (D) NBr_3, H_2
14. The material that exhibits the highest electrical conductivity among the following sulphur-nitrogen compounds is
- (A) S_4N_4 (B) S_7NH (C) S_2N_2 (D) $(SN)_x$
15. Uranium fluorides co-precipitate with
- (A) CaF_2 (B) AgF (C) LiF (D) MgF_2
16. The actual magnetic moment shows a large deviation from spin-only formula in the case of
- (A) Ti^{3+} (B) V^{3+} (C) Gd^{3+} (D) Sm^{3+}
17. In the IR spectrum, carbonyl absorption band for the following compound appear at



- (A) 1810 cm^{-1} (B) 1770 cm^{-1} (C) 1730 cm^{-1} (D) 1690 cm^{-1}
18. The hybridisation of orbitals of N atom in NO_3^- , NO_2^+ , and NH_4^+ are respectively
- (A) sp^2, sp^3, sp (B) sp, sp^2, sp^3 (C) sp^2, sp, sp^3 (D) sp, sp^3, sp^2

19. Which of the following is achiral?
- (A) Alanine (B) Glycine
(C) Proline (D) Phenylalanine

20. Tri phenyl methane can be prepared by



21. Find the values of x in $2x^2 - 7x = 39$

- (A) $\left\{\frac{13}{2}, -3\right\}$ (B) $\{-13, -6\}$ (C) $\{-13, -3\}$ (D) $\{-13, 3\}$

22. Solution set for the equation $\left(\frac{x}{x-1}\right) + \left(\frac{x-1}{x}\right) = 2\frac{1}{2}$ is

- (A) (-2, 1) (B) (2, -1) (C) (1, 2) (D) (1, -2)

23. The Quadratic equation whose solution set is (-2,3)

- (A) $x^2 + x + 6 = 0$ (B) $-x^2 + x - 6 = 0$
(C) $x^2 - x - 6 = 0$ (D) $x^2 + x - 6 = 0$

24. The solution set for the two simultaneous equations $x=3y+1$ and $5(3y+1)^2 + 6(3y+1) - 8=0$

- (A) (-1, -1/15) (B) (-1, 1/15) (C) (1, 1/15) (D) (1, -1/15)

25. $A = \begin{pmatrix} 5 & 4 \\ 3 & -1 \end{pmatrix}$, $B = \begin{pmatrix} -3 & 2 \\ 1 & 0 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & 1 \\ 0 & 4 \end{pmatrix}$ then $A+B-C$ is
 (A) $\begin{pmatrix} 4 & 2 \\ 2 & 3 \end{pmatrix}$ (B) $\begin{pmatrix} 10 & 3 \\ 2 & 3 \end{pmatrix}$ (C) $\begin{pmatrix} 4 & 7 \\ 2 & 1 \end{pmatrix}$ (D) $\begin{pmatrix} 4 & -7 \\ -2 & 3 \end{pmatrix}$
26. Transpose of matrix $\begin{pmatrix} 3 & -2 \\ 7 & 4 \end{pmatrix}$
 (A) $\begin{pmatrix} 3 & 7 \\ -2 & 4 \end{pmatrix}$ (B) $\begin{pmatrix} -2 & 3 \\ 4 & 7 \end{pmatrix}$ (C) $\begin{pmatrix} 3 & -2 \\ 4 & 7 \end{pmatrix}$ (D) $\begin{pmatrix} 7 & 4 \\ 3 & -2 \end{pmatrix}$
27. $\cos(A+B)$ is
 (A) $\sin(A)\cos(B) + \cos(A)\sin(B)$ (B) $\sin(A)\cos(B) - \cos(A)\sin(B)$
 (C) $\cos(A)\cos(B) - \sin(A)\sin(B)$ (D) $\cos(A)\cos(B) + \sin(A)\sin(B)$
28. $\cos(A-B)$ is
 (A) $\sin(A)\cos(B) + \cos(A)\sin(B)$ (B) $\sin(A)\cos(B) - \cos(A)\sin(B)$
 (C) $\cos(A)\cos(B) + \sin(A)\sin(B)$ (D) $\cos(A)\cos(B) + \sin(A)\sin(B)$
29. $\tan(A+B)$ is
 (A) $\frac{\tan(A) - \tan(B)}{1 + \tan(A)\tan(B)}$ (B) $\frac{\tan(A) + \tan(B)}{1 - \tan(A)\tan(B)}$
 (C) $\frac{\tan(A) - \tan(B)}{\tan(A)\tan(B)}$ (D) $\frac{1 + \tan(A)\tan(B)}{\tan(A) + \tan(B)}$
30. $\sin(3x)$ is
 (A) $3\sin(x) - 4(\sin(x))^3$ (B) $4\sin(x) - 3(\sin(x))^3$
 (C) $3\sin(x) - 4(\cos(x))^3$ (D) $\sin(x) - 3(\sin(x))^3$
31. $\int \sec(x)\tan(x)dx$ is
 (A) $\csc(x)\cot(x)$ (B) $-\sec(x)$
 (C) $(\sec(x))^2(\tan(x))^2$ (D) $\sec(x)$
32. $\int \log(x)dx$ is
 (A) $x(\log(x-1))$ (B) x
 (C) $x\log(x) - 1$ (D) $\frac{1}{x} + \log(x)$

33. $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$
 (A) 0 (B) 1 (C) ∞ (D) π
34. $\lim_{x \rightarrow 0} \frac{\tan(x)}{x}$
 (A) 0 (B) ∞ (C) π (D) 1
35. The line perpendicular to $2x - 3y + 5 = 0$ is
 (A) $3x + 2y + k = 0$ (B) $2x - 3y + k = 0$
 (C) $3x + 2y - k = 0$ (D) $2x + 3y + k = 0$
36. Length of a perpendicular from a given point (x_1, y_1) to a given line $ax + by + c = 0$ is
 (A) $\frac{x_1 + y_1 + c}{\sqrt{a^2 + b^2}}$ (B) $\frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}}$
 (C) $\frac{ax_1 + by_1 + c}{a^2 + b^2}$ (D) $\frac{ax_1 + by_1 + c}{\sqrt{a+b}}$
37. If a vector makes angles α, β and γ with OX, OY, OZ respectively then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ is equal to
 (A) 2 (B) 3 (C) 1 (D) 0
38. If D, E, F are the mid points of the sides BC, CA, AB respectively of a triangle ABC, then the value of $\vec{AD} + \vec{BE} + \vec{CF}$ is
 (A) 1 (B) 2 (C) 0 (D) 3
39. The value of determinant $\begin{pmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{pmatrix}$
 (A) $a(b+c) + b(c+a) + c(a+b)$ (B) $ab + bc + ca$
 (C) $a^2 + b^2 + c^2$ (D) 0
40. The length of the verandah is 3 meters more than its breadth. The numerical value of its area is equal to the numerical value of its perimeter. What is the breadth of the verandah?
 (A) 4 meters (B) 3 meters (C) 5 meters (D) 6 meters

41. If $F = m \frac{dv}{dt} = 0$, then
- (A) Acceleration is constant
 (B) velocity is constant
 (C) both acceleration and velocity are constants
 (D) Force is constant
42. When an object of length L is travelling with a speed close to the velocity of light, then for the observer its length appears to be
- (A) L (B) greater than L
 (C) less than L (D) None of these
43. In the given condition, $\frac{\mu_1}{\mu_2} = \frac{\sin \theta_1}{\sin \theta_2}$; θ_2 is called as Brewster's angle when the reflected light to be
- (A) Polarized (B) Specular (C) Unpolarized (D) Diffused
44. What statement is true:
- (A) Electric field lines intersect (B) Magnetic field lines intersect
 (C) Electric field lines do not intersect (D) $\nabla \cdot \mathbf{B} \neq 0$
45. Expectation value of x in the simple harmonic oscillator is
- (A) $\hbar/2\pi$ (B) $x^2 - 2x$ (C) greater than 0 (D) 0
46. Number of degeneracy in the first excited state of a particle in 1-D potential well is
- (A) 0 (B) 1 (C) 2 (D) 3
47. Which of the following is having a spin $-1/2$?
- (A) Electron (B) Bosons (C) Quark (D) None
48. In an adiabatic change,
- (A) $PV = \text{constant}$ (B) $PV^2 = \text{constant}$
 (C) $\frac{PV}{T} = R$ (D) $PV = T$
49. A good absorber of radiation is also a good reflector
- (A) Uncertain (B) False (C) True (D) None

50. How many dead centres are there in one cycle of a steam engine?
 (A) 1 (B) 2 (C) 3 (D) 4
51. The internal resistance of a photodiode
 (A) Increases with light intensity when reverse biased
 (B) Increases with light intensity when forward biased
 (C) Decreases with light intensity when forward biased
 (D) Decreases with light intensity when reverse biased
52. Which of the following multivibrator is used for the performance of many digital operations and in pulse generators?
 (A) Astable multivibrator (B) Monostable multivibrator
 (C) Bistable multivibrator (D) None
53. Operational amplifier can be used as
 (A) Differentiator (B) Integrator (C) Adder (D) All the above
54. Bandwidth when audio frequency 15 kHz is FM modulated with frequency deviation as 75 kHz is
 (A) 75 kHz (B) 180 kHz (C) 210 kHz (D) 240 kHz
55. The rate of deposition of positive charges in an ionization chamber is measured by
 (A) Quadrant Electrometer (B) Voltmeter
 (C) Ammeter (D) Wheatstone's bridge
56. The population inversion in He-Ne laser is produced by
 (A) photoexcitation (B) electron excitation
 (C) Inelastic atomic collisions (D) chemical reactions
57. For the Bragg reflection from a set of parallel adjacent planes separated by d , the wavelength of the x-rays must be
 (A) greater than $2d$ (B) less than $2d$
 (C) greater than d (D) less than d
58. Isotope effect is represented by
 (A) $T_c \propto \theta_D$ (B) $T_c \propto \theta_D^2$
 (C) $T_c \propto \theta_D^{-2}$ (D) $T_c \propto \theta_D^{-1}$

59. An electron is in a one-dimensional infinite square well of width 0.14 nm. The electron has an energy of 76.76 eV. What is its (electron's) state?
 (A) 1 (B) 2 (C) 3 (D) 4
60. The Bragg angle corresponding to the first order reflection from (1,1,1) planes in a crystal is 30° when x-ray of wavelength 1.75 Å are used. The interatomic spacing
 (A) 3.301 Å (B) 1.031 Å (C) 2.031 Å (D) 3.931 Å
61. The bond which arise from the large electronegativity difference (1.7) of bonding atoms is known as
 (A) Covalent (B) Co-ordinate (C) Ionic (D) Metallic
62. Cup-and-cone fracture is the typical fracture mode for _____ materials
 (A) Ductile (B) Brittle (C) Ceramic (D) Polymer
63. The ratio of lateral strain to linear strain is called
 (A) Strain ratio (B) Poisson's ratio
 (C) Modules of rigidity (D) Fluxural rigidity
64. Which one of the following will have maximum capillary rise relative to mercury?
 (A) Benzene (B) Water
 (C) Ethyl alcohol (D) Methyl alcohol
65. Deflection of a cantilever beam under load on doubling its width will _____ the deflection
 (A) Does not change (B) Reduce to half
 (C) Double (D) Triple
66. Coke oven gas is a mixture of
 (A) H_2 and CH_4 (B) CO and CO_2
 (C) H_2 and CO (D) CH_4 and CO
67. Deficiency of air during the combustion of gaseous fuels lead to
 (A) An increase in flame temperature (B) Lengthening of the flame
 (C) Shortening of the flame (D) Extinguishment of the flame
68. A rotary mechanical device that extracts energy form fluid flow and converts into useful work is known as a
 (A) Turbine (B) Compressor (C) Sensor (D) Solar cell

69. The phase transformation involving the formation of single solid phase is known as
(A) Eutectic (B) Eutectoid (C) Peritectic (D) Pertitectoid
70. Carburizing is done to improve _____ of the steel or iron.
(A) Hardness (B) Ducticity
(C) Ultimate tensile strength (D) Creep
71. Which among the following class of materials has the highest density
(A) Metals (B) Ceramics (C) Polymers (D) Compositors
72. Water has higher boiling point than methanol as a result of
(A) Ionic bonding (B) Covalent bond
(C) Hydrogen bonding (D) Co-ordinate bonding
73. Time dependent elastic behaviour is known as
(A) Plasticity (B) Super elasticity
(C) Anelasticity (D) Super plasticity
74. Single crystal turbine blades are produced by
(A) Directional solidification (B) Zone refining
(C) Casting (D) Hot isotactic pressing
75. The corrosion occurring when two metals having different compositions are electrically coupled and exposed to electrolyte is known as
(A) Galvanic corrosion (B) Crevice
(C) Pitting (D) Intergranular corrosion
76. Magnetic hysteresis curves for materials does not depend on
(A) Orientation of grains (B) Presence of second-phase particles
(C) Temperature (D) Electrical resistivity
77. The operation of attaching IC chips to lead frame plates is known as
(A) Die bonding (B) Debonding
(C) Packaging (D) Tape automated bonding
78. Water clinging to the surface of the container is known as
(A) Adhesion (B) Cohesion (C) Surface tension (D) Capillary

79. The function of alternator in an automobile is to
 (A) Supply electric power
 (B) Convert mechanical energy into electrical energy
 (C) Continuously recharge the battery
 (D) Partly convert engine power into electric power
80. The ability of the material absorb energy up to fracture is known as
 (A) Toughness (B) Resilience (C) Fatigue (D) Brazing
81. The plasma membrane is covered by a cell wall in cells of
 (A) Plants (B) Bacteria
 (C) Fungi and Algae (D) All of these
82. The layer common to two adjacent cells called MIDDLE LAMELLA is composed of
 (A) Calcium phosphate (B) Calcium sulphate
 (C) Calcium carbonate (D) Calcium pectate
83. Many folds of the inner membrane of mitochondria project into the matrix as incomplete partitions which are called
 (A) Cristae (B) Grana
 (C) Inner membrane particles (D) Plastids
84. Which of the following are colorless plastids?
 (A) Chloroplasts (B) Chromoplasts (C) Leucoplasts (D) All of these
85. Each ribosome consists of two unequal subunits composed of
 (A) RNA and proteins (B) RNA and carbohydrates
 (C) Only RNA (D) Proteins and DNA
86. Which of the following increase the free surface of the cell to enhance absorption?
 (A) Microfilaments (B) Microtubules (C) Microbodies (D) Microvilli
87. Which of the following is a non-membranous organelle?
 (A) Mitochondrion (B) Ribosome
 (C) Plastid (D) Endoplasmic Reticulum
88. Vacuoles are sap filled vesicles in the cytoplasm, covered by a membrane called
 (A) Protoplast (B) Leucoplast (C) Tonoplast (D) Chromoplast

89. The nucleoli and nuclear envelope disappear in which phase of mitosis?
 (A) Metaphase (B) Prophase (C) Anaphase (D) Telophase
90. Which of the following is formed between adjacent cell walls during cell division?
 (A) Primary cell wall (B) Secondary cell wall
 (C) Tertiary cell wall (D) Middle lamella
91. The part of the pit membrane surrounding the torus is called the
 (A) Primary pit field (B) Pit chamber
 (C) Margo (D) Pit aperture
92. The golgi complex is formed from which of the following cell organelles
 (A) Plasmalemma (B) Nuclear envelope
 (C) Endoplasmic reticulum (D) All of these
93. The cell wall of plants are made up of fibrils which predominantly contain
 (A) Glucose (B) Proteins
 (C) Phospholipids (D) Polysaccharides
94. The rough endoplasmic reticulum is also known as
 (A) Protoplasm (B) Tonoplast (C) Ergastoplasm (D) All of these
95. The outer membrane of the nuclear envelope forms finger like processes which are pinched off into the cytoplasm. This process has been called
 (A) Budding (B) Blebbing (C) Detoxification (D) None of these
96. Eukaryotic ribosomes are called
 (A) 80S Ribosomes (B) 70S Ribosomes (C) 60S Ribosomes (D) 5S Ribosomes
97. The chemical present in the cell wall is
 (A) Pectin (B) Lignin (C) Cellulose (D) All of these
98. Middle lamella contains
 (A) Cellulose (B) Pectate (C) Lignin (D) Cutin
99. Matrix of cell wall is made of
 (A) Pectin (B) Hemicellulose (C) Glycoprotein (D) Cellulose
100. Hydrophilic chemical of cell wall is
 (A) Pectin (B) Suberin (C) Fat (D) Lignin