

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

M.Tech. (Green Energy Technology)

COURSE CODE : 307

Register Number :

Signature of the Invigilator
(with date)

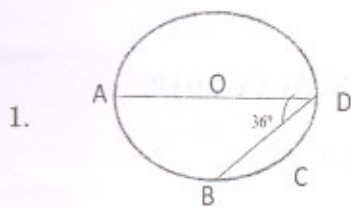
COURSE CODE : 307

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 of the 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.



In the circle in figure above, AD is a diameter with centre O and $AO = 5$. What is the length of arc BCD?

- (A) 3π (B) π (C) $\pi/2$ (D) $3\pi/2$

2. If $xy = 2$ and $xy^2 = 8$, what is the value of x ?

- (A) 2 (B) 4 (C) $1/2$ (D) 8

3. If X is an odd integer, which of the following must be an odd integer?

- (A) $4n + 1$ (B) $3n + 1$ (C) $n + 1$ (D) $n - 1$

4. If a and b are integers greater than 100 such that $a + b = 300$, which of the following could be the exact ratio of a to b ?

- (A) 9 to 1 (B) 5 to 2 (C) 4 to 1 (D) 3 to 2

5. If $f(x)$ is an odd function, then $|f(x)|$ is

- (A) An odd function (B) An even function
(C) Neither odd nor even (D) Even and odd

6. $\int \cos(x)$ is

- (A) $\sin(x)$ (B) $-\sin(x)$ (C) $\sec(x)$ (D) $\tan(x)$

7. Rank of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is

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

8. The graph of $y = f(x)$ passes through the point (1, 4). If $\frac{dy}{dx} = 3x^2$, which of the following would be an expression for y ?

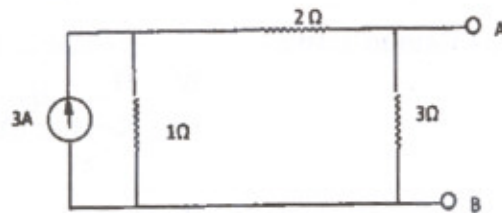
- (A) $y = x^3 + 3$ (B) $y = x^3 - 63$ (C) $y = 6$ (D) $y = 3x^2 + 1$

9. Which of the following would be the gradient of the tangent to the curve?
 $y = -4x^2 + 3x^2 - 2$ at $x = -2$
- (A) 150 (B) -6 (C) -8 (D) -18
10. A line has equation $3y = x + 6$ any line parallel to this line will have gradient
- (A) -3 (B) 1 (C) -1/3 (D) 1/3
11. Two functions defined on suitable domains are given by $f(x) = 3x^2 - 2$ and $g(x) = 1 - x$. The value of $f(g(2))$ is
- (A) -9 (B) -5 (C) -1 (D) 1
12. If $f(x) = \frac{1}{x^3}$ and $x \neq 0$ then $nf(x) =$
- (A) $\frac{1}{3x^3}$ (B) $-\frac{3}{x^4}$ (C) $-\frac{3}{x^2}$ (D) $-\frac{1}{2x^2}$
13. For which real values of x is the function f given by $f(x) = \frac{1}{\sqrt{1-x^2}}$ defined on the set of real numbers
- (A) all x except 1 and -1 (B) $x < 1$ only
 (C) $x > 1, x < -1$ only (D) $-1 < x < 1$ only
14. The line joining points $(-2, -3)$ and $(6, K)$ has gradient equal to $2/3$ the value of K is
- (A) $\frac{14}{3}$ (B) $\frac{7}{3}$ (C) $-\frac{1}{3}$ (D) -9
15. The quadratic equation $4kx^2 - 8x + k = 0$ has equal roots. The value of k is
- (A) 4 (B) 2 (C) 1 (D) 0.5
16. What is solution to $2(x-3)(x+5) > 0$
- (A) $2 < x < 5$ (B) $x < -5$ or $x > 3$
 (C) $-5 < x < 3$ (D) $x < -3$ or $x > 5$
17. Given the points $A(-3, 2)$ and $B(4, 1)$ which of the following given the exact value of for the length of the line joining A and B
- (A) $5\sqrt{2}$ (B) $4\sqrt{3}$ (C) $2\sqrt{5}$ (D) $-\frac{1}{7}$

18. Inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is
- (A) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -i & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} i & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & i \end{bmatrix}$
19. How many real solutions does the equation $x^7 + 14x^5 + 16x^3 + 30x - 560 = 0$ have?
 (A) 1 (B) 4 (C) 7 (D) 5
20. A polynomial for all real values of x is
 (A) Continuous (B) Discontinuous (C) Convergent (D) Divergent
21. Which element has the electron configuration $[Ar]3d^7 4s^2$?
 (A) Fe (B) Co (C) Cr (D) Zn
22. Germanium is an example of a/an
 (A) n-type semiconductor (B) p-type semiconductor
 (C) intrinsic semiconductor (D) none of the above
23. The element with most electronegative is
 (A) Arsenic (B) Carbon (C) Selenium (D) Oxygen
24. In the reaction ${}_4\text{Be}^9 + X \rightarrow {}_6\text{C}^{12} + {}_0\text{n}^1$ the X represents
 (A) an α particle (B) a β particle (C) an electron (D) a proton
25. Which radioactive isotope is used in geological dating?
 (A) Uranium - 238 (B) Iodine - 131
 (C) Cobalt - 60 (D) Technetium - 99
26. The half life of ${}^{231}\text{Pa}$ is 3.25×10^4 years. How much of an initial 10.40 microgram sample remains after 3.25×10^5 years?
 (A) 0.0102 micrograms (B) 0.0240 micrograms
 (C) 2.18 micrograms (D) 0.0240 micrograms
27. When ${}^{59}\text{Cu}$ undergoes positron emission. What is the immediate nuclear product?
 (A) ${}^{59}\text{Ni}$ (B) ${}^{58}\text{Ni}$ (C) ${}^{58}\text{Cu}$ (D) ${}^{59}\text{Zn}$

28. Which one of the alkali metal ions in aqueous solutions has the maximum ionic mobility?
 (A) K^+ (B) Rb^+ (C) Li^+ (D) Na^+
29. The lattice energy of ionic compounds depends upon
 (A) Charge on the ion and the size of ion (B) Charge on the ion only
 (C) Size of the ion only (D) Packing of the ions only
30. An alloy of copper and Zinc is called as
 (A) Bronze (B) Brass
 (C) Gun Metal (D) Stainless steel
31. Which is the heaviest metal?
 (A) Gold (B) Silver (C) Copper (D) Iron
32. Which of the following is Raman active?
 (A) CO_2 (B) H_2
 (C) Both (A) and (B) (D) Neither (A) and (B)
33. Two hypothetical acid HA and HB have the dissociation constant 1×10^{-3} and 1×10^{-5} in water respectively. How many time HA is stronger than HB?
 (A) 100 times (B) 10 times (C) 0.5 times (D) Not definite
34. The correct Henderson Equation is
 (A) $p^H = pK_a - \log \frac{[Acid]}{[Salt]}$ (B) $p^H = pK_a + \log \frac{[Salt]}{[Acid]}$
 (C) $p^H = pK_a - \log \frac{[Salt]}{[Acid]}$ (D) Both (A) and (B)
35. For the reaction $2A + B \rightarrow C + 2D$, which is first order in A and also first order in B, the rate is given by
 (A) $K[A][B]$ (B) $K[A]^2[B]$ (C) $K[A][B]^2$ (D) $K[C][D]^2$
36. If one mole of ideal gas expands isothermally and reversibly at 300 K from 10 to 100 liters then
 (A) $\Delta G = -1382 \text{ cal}$ (B) $\Delta E = \Delta G = -764 \text{ cal}$
 (C) $\Delta H = \Delta G = -2764 \text{ cal}$ (D) $\Delta S = \Delta G = 0 \text{ cal}$
37. What is the oxidation number for carbon in CaC_2O_4 ?
 (A) +3 (B) +2 (C) +4 (D) 0

38. A neutral molecule having the general formula AB_3 has two unshared pair of electrons on A. what is the hybridization of A?
 (A) sp^3d (B) sp^3 (C) sp^2 (D) sp
39. Allenes exhibit optical isomerism due to the presence of
 (A) Asymmetric carbon atom (B) Conjugated double bond
 (C) Cumulated double bond (D) Isolated double bond
40. The order of stability of the rotamers of ethane is
 (A) Eclipsed > Skew > Staggered (B) Eclipsed > Staggered > Skew
 (C) Staggered > Skew > Eclipsed (D) Staggered > Eclipsed > Skew
41. The Thevenin's equivalent of the circuit shown below is



- (A) 0.75 V, 1.5 Ω (B) 1.5 V, 1.5 Ω (C) 1.5 V, 0.75 Ω (D) 5.0 V, 1.5 Ω
42. A signal of 10 V is applied to a 50 ohm coaxial transmission line, terminated in a 100 ohm load. The voltage reflection coefficient is
 (A) 1/4 (B) 1/3 (C) 1/2 (D) 1
43. The power required to drive a turbo-compressor for a given pressure ratio decreases when
 (A) Air is heated at entry (B) Air is cooled at entry
 (C) Air is cooled at exist (D) Air is heat at exist
44. A metal plate has a surface area of 2 m^2 , thickness 10 mm and a thermal conductivity of 200 W/mk. What is the thermal resistance of the plate?
 (A) $4 \times 10^4 \text{ K/W}$ (B) $2.5 \times 10^{-3} \text{ K/W}$
 (C) $1.5 \times 10^{-5} \text{ K/W}$ (D) $2.5 \times 10^{-5} \text{ K/W}$
45. If the volume of moist air with 50% relative humidity is isothermally reduced to half its original volume, then relative humidity of moist air becomes
 (A) 25% (B) 60% (C) 75% (D) 100%

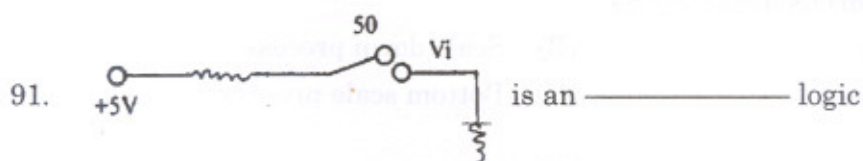
46. Consider the following :
- | | |
|----------------------|----------------|
| i. Superheater | ii. Economizer |
| iii. Air – preheater | iv. Condenser |
- Which of the above improve overall steam power plant efficiency?
- (A) Only i, ii and iii (B) Only ii and iii
(C) Only i and iii (D) i, ii, iii and iv
47. A magnetic field \bar{B} of 2T is normal to a copper strip 0.5 mm thick carrying an electron current of 40A. If the electron density is 10×10^{28} per cubic metre, then voltage across the strip in microvolt is
- (A) 40 (B) 30 (C) 20 (D) 10
48. A semiconductor has a band gap of 2ev. The Wavelength of radiation emitted from the semiconductor when electrons and holes recombine is
- (A) 625 nm (B) 625 μ m (C) 625 mm (D) 625 cm
49. In a steam nozzle, to increase the velocity of steam above sonic velocity by expanding steam below critical pressure
- (A) Vacuum pump is added
(B) Ring diffusers are used
(C) Divergent portion of the nozzle is necessary
(D) Abrupt change in cross – section is needed
50. Air at 35° C DBT and 25°C dew point temperature passes through the water shower whose temperature is maintained at 20° C. What is the process involved?
- (A) Cooling and humidification (B) Sensible cooling
(C) Cooling and dehumidification (D) Heating and humidification
51. The restriking voltage is measured in
- (A) RMS value (B) Peak value
(C) Instantaneous value (D) Average value
52. Which of the following counter results in least delay?
- (A) Ring counter (B) Ripple counter
(C) Synchronous counter (D) Asynchronous counter
53. An engine using octane – air mixture has N_2 , O_2 , CO_2 , CO and H_2O as constituents in the exhaust gas. Which are of the following can be concluded?
- (A) Supply mixture is stoichiometric
(B) Supply mixture has incomplete combustion
(C) Supply mixture is rich
(D) Supply mixture is lean

54. Which is the nature of shear stress in a rectangular beam?
 (A) Linear (B) Parabolic (C) Hyperbolic (D) Elliptic
55. The transition temperature of Mercury at which it becomes Superconductive is
 (A) 4.12° F (B) 4.12° C (C) 4.12 K (D) 41.2K
56. Consider the following statements about Superconductors:
 (i) The temperature at which the conductor becomes a Superconductor is called transition temperature.
 (ii) Superconductors are repel magnetic flux lines
 (iii) All Superconductors are paramagnetic materials
 (iv) Superconductors become normal when placed in a magnetic field of certain critical value
 Which of the statements are correct?
 (A) i and ii only (B) ii and iv only (C) i, ii and iv only (D) i, ii, iii and iv
57. Increase in the applied reverse voltage to a p – n junction results in increase in the
 (A) Depletion width (B) Barrier height
 (C) Depletion width and barrier height (D) Junction temperature
58. The vanes of a centrifugal pump are generally
 (A) Radial (B) Curved backward
 (C) Curved forward (D) Twisted
59. A Carnot refrigerator has a cop of 6. What is the ratio of the lower to the higher absolute temperatures?
 (A) 1/6 (B) 7/8 (C) 6/7 (D) 1/7
60. A 12 cm diameter straight pipe is laid at a uniform downgrade and flow rate is maintained such that velocity head in the pipe is 0.5m. If the pressure in the pipe is observed to be uniform along the length when the down slope of the pipe is 1 in 10, what is the friction factor for the pipe?
 (A) 0.012 (B) 0.024 (C) 0.042 (D) 0.050
61. Which of the following is saturated fatty acid?
 (A) Oleic acid (B) Linolenic acid
 (C) Linoleic acid (D) Stearic acid
62. RNA polymerase binds to a specific site on a DNA that signals the start of transcription of a gene is called
 (A) Promoter (B) Enhancer (C) Repressor (D) ORF Region

63. If mutation changes codon in such a way that there is no effect on functioning and overall structure of protein. This type of mutation is termed as
 (A) Missense (B) Frameshift (C) Silent (D) Transition
64. TATA box binding proteins are termed as
 (A) Co – regulators (B) Enhancers
 (C) Transcriptional factors (D) Inhibitors
65. The hormone secreted by adrenal gland is
 (A) Thyroxine (B) Epinephrine (C) Melatonin (D) Endorphins
66. Chlorophyceae include
 (A) Green Algae (B) Herbal plants (C) Lichens (D) Fungi
67. Ethidium bromide used for DNA analysis is a
 (A) Base-pairing compound (B) Intercalating compound
 (C) Minor-groove binding compound (D) Cross-linking compound
68. Which of the following is the universal recipient of blood group?
 (A) A (B) B (C) AB (D) O
69. Which is not the part of forebrain?
 (A) Cerebellum (B) Thalamus (C) Hypothalamus (D) Cerebrum
70. Which one of the following hormone is not secreted by pituitary Gland?
 (A) Prolactin (B) Melatonin
 (C) Thyroid stimulating hormone (D) Follicle stimulating hormone
71. The secondary structure of a single stranded DNA is
 (A) α –Helix and β –sheet (B) Hair-pains and loops
 (C) Supercoil (D) Linear rods
72. Hyperglycemia refers to
 (A) Increased glycerol level in blood (B) Increased blood cholesterol
 (C) Increased blood sugar level (D) Increased RBC count
73. Function of Xylem tissue in plants is to
 (A) Transport water (B) Transport food
 (C) Store nutrient (D) Store starch

74. Half-life of bacterial mRNA *in vivo* is of the order of
 (A) 2–3 minutes (B) 20–30 minutes
 (C) ~ 1 hour (D) Few days
75. *Trypanosoma brucei* causes
 (A) Brain fever (B) Arthrosclerosis
 (C) Sleeping sickness (D) Hepatic liver dysfunction
76. 'No two species can occupy the same niche indefinitely. When resources are limiting'. This is the principle of
 (A) Competitive inclusion (B) Competitive exclusion
 (C) Symbiotic living (D) Sympatric resource partitioning
77. 'Mad Cow' disease is caused by prion protein due to
 (A) Point mutation (B) Misfolding
 (C) Denaturing (D) Over expression
78. A protein in the native state and reduced unfolded state is loaded in well A and B respectively. They are electrophoresis and stained. Which of the following result likely to be observed?
 (A) Protein in well A would have moved longer distance than that in well B
 (B) Protein in well A would have moved shorter distance than that in well B
 (C) Protein in well A and well B would moved same distance
 (D) Protein in well A and B would not more at all
79. Enzymatic amplification of DNA without thermal cycling is known as
 (A) RT-PCR (B) Gradient PCR
 (C) Loop-mediated isothermally PCR (D) Replication
80. Sites where mutation occur at rates higher than normal are known as
 (A) Suppressor sites (B) Mutator sites
 (C) Hotspots (D) Enhancer sites
81. There are _____ types of analog modulations exists
 (A) 5 types (B) 3 types (C) 4 types (D) 1 type
82. The region outside the depletion region of a *pn* junction is called as
 (A) N-type region (B) P-type region
 (C) Quasi neutral region (D) Neutral region

83. The represent table of Boolean function is called as
 (A) Vector table (B) Scalar table
 (C) Truth table (D) Data table
84. "Solid" means that its constituent particles are
 (A) Floating (B) Fixed in position
 (C) Atoms (D) Molecules
85. The precise grid pattern of the nuclear power plant where nuclear fuel can be placed is called as
 (A) Reactor vessel (B) Reactor centre
 (C) Reactor cone (D) Reactor material
86. The material that decelerate neutrons in the reactor is called as
 (A) Stopper (B) Preventer (C) Moderator (D) Accelerator
87. Rayleigh scattering in materials is caused due to the
 (A) Compositional variations (B) Electrical variations
 (C) Thermal variations (D) Electrostatic variations
88. AND, OR and NOT operations are called as
 (A) Boolean formula's (B) Boolean circuits
 (C) Boolean variables (D) Boolean operators
89. The circuit that shifts the bits from one position to other is called
 (A) Shift flip — flop (B) Shift register
 (C) Shift gate (D) Shift logic
90. According to De Morgan theorem, $(x + y)^1 =$
 (A) $x^1 + y^1$ (B) $x^1 \cdot y^1$ (C) $x^1 \times y^1$ (D) $(x^1 + y)^1$



- (A) Inverter (B) Adder (C) Register (D) Sub tractor

92. Colours in Electromagnetic spectrum occurs due to the
 (A) Difference in wavelength (B) Refraction
 (C) Diffraction (D) Transmission
93. The materials having negative temperature coefficient of conductivity is called as
 (A) Super conductor (B) Conductor
 (C) Insulator (D) Semiconductor
94. Applied electric field to a conductor results in the
 (A) Diffusion of carriers (B) Drift of carriers
 (C) Scattering of carriers (D) Emission of carriers
95. One atmosphere is equal to _____ Torr.
 (A) 133 Torr (B) 10^{-2} Torr (C) 760 Torr (D) 1023 Torr
96. Quantum Dot (QD) is _____ dimensional material
 (A) 2 Dimensional (B) 1 Dimensional
 (C) 0 Dimensional (D) 5th Dimensional
97. The band structure of a crystalline solid is the
 (A) $h - k$ relationship (B) $E - K$ relationship
 (C) $h\nu$ relationship (D) $ah\nu$ relationship
98. The conducting of a solid is defined as
 (A) $\sigma = n e \mu$ (B) $\sigma = \frac{n e \mu}{KT}$ (C) $\sigma = \frac{KT}{q}$ (D) $\sigma = \frac{n K T}{q}$
99. Undoped semiconductors exhibit their Fermi-level (E_f) at
 (A) Bottom of band gap (B) Top of band gap
 (C) Inside the of conduction band (D) Middle of the band gap
100. Growth process of materials are called as
 (A) Top down process (B) Scale down process
 (C) Bottom up process (D) Bottom scale process