BEATS ENGINEERING

INSTITUTE OF ENGINEERING

MODEL ENTRANCE EXAM

(SET – 6)

Instructions:

There are 100 multiple-choice questions, each having four choices of which only one choice is correct.

Date : 2081/03/15
(June 29)

Duration : 2 hours
Time : 8 A.M. – 10 A.M.

SECTION – A (1 marks) (1*60 = 60)

1) Three sets A, B, C are such that $A = B \cap C$ and $B = C \cap A$, then:
a) $A \subset B$ b) $A \supset B$ c) $A = B$ d) $A \subset B'$

2) A square non-singular matrix A satisfies $A^2 - A + 2I = 0$, then $A^{-1} =$
a) $I - A$ b) $\frac{1}{2}(I - A)$ c) $I + A$ d) $\frac{1}{2}(I + A)$

3) How many signals can be made by 5 flags from 8 flags of different colours?
a) ${}^8C_5$ b) ${}^8C_5 \times 5!$ c) 5^8 d) 8^5

4) The area of the triangle is 40 cm^2 and its perimeter is 8 cm, then the radius of inscribed circle is:
a) 20 cm b) 10 cm c) 15 cm d) 12 cm

5) The probability of sure event and impossible events are respectively:
a) 0, 1 b) 1, 0 c) 1/2, 1/2 d) 1, -1

6) The radius of the circle passing through the point (6, 2), two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is:
a) 10 b) $2\sqrt{5}$ c) 6 d) 4

7) The value of $\lim_{n\to\infty} \frac{1^3+2^3+\cdots+n^3}{n^4}$ is:
a) 1/2 b) 1 c) 1/4 d) 1/8

8) If the rate of change of volume of a sphere is equal to the rate of change of its radius, then its radius is equal to:
a) 1 unit b) $\sqrt{2\pi}$ unit c) $\frac{1}{\sqrt{2\pi}}$ unit d) $\frac{1}{2\sqrt{\pi}}$ unit

9) $\int \frac{1}{\sqrt{x^2+2}} d(x^2 + 2)$ is equal to:
a) $2\sqrt{x^2 + 2} + c$ b) $\sqrt{x^2 + 2} + c$ c) $\frac{1}{(x^2+2)^{3/2}} + c$ d) $2\sqrt{x^2 + 2} + c$

10) The non-zero vectors $\vec{b}$ and $\vec{c}$ are related by $\vec{a} = 8\vec{b}$ and $\vec{c} = -7\vec{b}$. Then the angle between $\vec{a}$ and $\vec{c}$, is:
a) 0 b) $\pi/4$ c) $\pi/2$ d) π

11) Let z be a purely imaginary number such that $\mathrm{Im}(z) > 0$. Then, arg (z) is equal to:
a) π b) $\pi/2$ c) 0 d) $-\pi/2$

12) The angle between the lines $x = \alpha$ and $y = \beta$ is:
a) $|\alpha - \beta|$ b) $\sin^{-1}(\alpha - \beta)$ c) $\tan^{-1}(\alpha - \beta)$ d) $\pi/2$

13) Distance between the parallel planes $x + y + z + 3 = 0$ and $2x + 2y + 2z + 5 = 0$ is:
a) 2 b) $\frac{1}{2}$ c) $\frac{1}{2\sqrt{3}}$ d) $\frac{1}{\sqrt{3}}$

14) A function $f(x) = \frac{1}{x-5}$ is :
a) continuous at $x = 5$
b) discontinuous at $x \neq 5$
c) continuous at every point on R except at $x = 5$
d) continuous on R

15) If $ax^2 + 2hxy + by^2 = 1$, then $\frac{dy}{dx} =$
a) $-\frac{ax+by}{hx+by}$ b) $-\frac{2ax}{by}$ c) $\frac{h(x+y)}{ax+by}$ d) $\frac{y}{x}$

16) The harmonic mean of the roots of the equation $(5 + \sqrt{2})x^2 - (4 + \sqrt{5})x + (8 + 2\sqrt{5}) = 0$ is:
a) 2 b) 4 c) 7 d) 8

17) If $A = \{1, 2, 3\}, B = \{x, y\}$, then the number of functions that can be defined from A into B is:
a) 12 b) 8 c) 6 d) 3

18) If $x\epsilon[0, 2\pi]$, then the solution set of the inequation $4sin^2x - 8\sin x + 3 \leq 0$, is:
a) $[0, \pi/6]$ b) $[0, 5\pi/6]$ c) $[5\pi/6, 2\pi]$ d) $[\pi/6, 5\pi/6]$

19) Family of curves $y = Ax + A^3$ is represented by the differential equation of degree:
a) 3 b) 2 c) 1 d) 0

20) The arithmetic mean of ${}^nC_0$, ${}^nC_1$, …, ${}^nC_n$ is:
a) $\frac{1}{n}$ b) $\frac{2^n}{n}$ c) $\frac{2^{n-1}}{n}$ d) $\frac{2^{n+1}}{n}$

21) The oxidation number of Iron in $[Fe(H_2O)_5NO]SO_4$ is:
a) 1 b) 2 c) 3 d) 0

22) Which of the following contains both covalent and co-ordinate bond?
a) CO b) CO_2 c) $CaCl_2$ d) C_2H_6

23) The substance which causes permanent hardness in water is:
a) NaCl b) $NaHCO_3$ c) $MgCl_2$ d) K_2SO_4

24) When concentrated H_2SO_4 is added to dry KNO_3, brown fumes evolve. These fumes are of:
a) SO_2 b) SO_3 c) NO_2 d) NO

25) In order to prevent the hot metal filament from getting burnt, when the electric current is switched on, the bulb is filled with:
a) Cl_2 b) H_2 c) NH_3 d) an inert gas

26) The purpose of smelting an ore is to:
a) reduce the ore b) oxidize the ore
c) obtain an alloy d) separate volatile impurities

27) Excess of NaOH reacts with zinc to form:
a) $Zn(OH)_2$ b) ZnO c) ZnH_2 d) Na_2ZnO_2

28) A signature written with carbon pencil weighs 1mg. What is the number of carbon atoms present in the signature?
a) 6.02×10^{20} b) 0.502×10^{20} c) 5.62×10^{23} d) 5.02×10^{20}

29) Which of the following represent correct set of quantum number of 4d electron?
a) 4, 3, 2, +1/2 b) 4, 2, 1, 0 c) 4, 3, -2, +1/2 d) 4, 2, 1, -1/2

30) In face centered arrangement, the number of atoms per unit cell is:
a) 8 b) 2 c) 1 d) 4

31) Which among the following is not a state function?
a) Internal energy b) Free energy c) Work d) Enthalpy

32) A liquid decomposes at its boiling point. It can be purified by:
a) sublimation b) steam distillation
c) vacuum distillation d) fractional distillation

33) Chloroform on warming with Ag powder, gives:
a) C_2H_6 b) C_3H_6 c) C_2H_4 d) C_2H_2

34) Formalin is 40% aqueous solution of:
a) methanoic acid b) methanal c) methanol d) methanamine

35) The dimensions of physical quantity X in the equation $\text{Force} = \frac{X}{\text{Density}}$ is given by:
a) $M^1L^4T^{-2}$ b) $M^2L^{-2}T^{-1}$ c) $M^2L^{-2}T^{-2}$ d) $M^1L^{-2}T^{-1}$

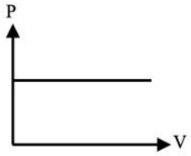
36) If action and reaction forces are always equal in magnitude, then these forces:
a) will produce accelerations of equal magnitudes
b) may not produce accelerations of equal magnitudes
c) produce velocities of equal magnitudes
d) will not produce accelerations of equal magnitudes

37) The velocity of centre of mass of the system remains constant, if the total external force acting on the system is:
a) minimum b) maximum c) unity d) zero

38) In motion of an object under the gravitational influence of another object, which of the following quantities is not conserved?
a) angular momentum b) mass of an object
c) total mechanical energy d) linear momentum

39) The circular motion of a particle with constant speed is:
a) periodic and simple harmonic b) simple harmonic but not periodic
c) neither periodic nor simple harmonic d) periodic but not simple harmonic

40) Which of the following process is correct for given P-V diagram?



a) Adiabatic process b) Isothermal process
c) Isobaric process d) Isochoric process

41) If λ_m denotes the wavelength at which the radiative emission from a black body at a temperature T K is maximum, then:
a) $\lambda_m \propto T$ b) $\lambda_m \propto T^{-1}$
c) $\lambda_m \propto T^{-2}$ d) λ_m is independent on T

42) The phenomenon of beats can take place for:
a) longitudinal waves only b) transverse waves only
c) sound waves only d) both longitudinal and transverse waves

43) The electric field at a point is:
a) always continuous
b) continuous if there is no charge at that point
c) discontinuous if there is a charge at that point
d) both b and c are correct

44) The force between two parallel current carrying wires is independent of:
a) their distance of separation b) the length of the wires
c) the magnitude of currents d) the radii of the wires

45) Lenz's law is a consequence of the law of conservation of:
a) charge b) energy c) induced emf d) induced current

46) In Young's double slit experiment, if yellow light is replaced by blue light, the interference fringes become:
a) wider b) brighter c) narrower d) darker

47) When the velocity of an electron increases, its de Broglie wavelength:
a) increases b) decreases
c) remains same d) may increase or decrease

48) To obtain electrons as majority charge carriers in a semiconductor, the impurity mixed is:
a) monovalent b) divalent c) trivalent d) pentavalent

49) The number of recommendations made by her _____ mentioning.
a) are worth b) have been worth c) is worth d) were worth

50) I needed _____ hard for the exams.
a) working b) work c) to working d) to work

51) While Mother was cooking dinner, I _____ for my exams.
a) studied b) study c) had studied d) was studying

52) The manager would rather _____ at his office than stayed at home last week.
a) have worked b) work c) had worked d) working

53) Don't take advantage _____ the situation.
a) of b) for c) at d) with

54) "To hit below the belt" means _____.
a) attack suddenly b) criticize somebody
c) find a weak spot d) use unfair means

55) The passive voice of, "Do you imitate others?" is:
a) Are others imitated by you? b) Are others being imitated by you?
c) Were others being imitated by you? d) Have others been imitated by you?

56) Auspicious (Antonym):
a) favoring b) fortunate c) sinister d) timely

57) Grotesque (Synonym):
a) graceful b) eccentric c) natural d) realistic

58) Transform the given sentence into complex sentence.
"My ambition is to serve the country."
a) My ambition is that I should serve my country.
b) My ambition is that I shall serve my country.
c) To serve my country is my ambition.
d) I serve my country is my great ambition.

59) The word 'homogeneous' has a stress on its _____ syllable.
a) second b) third c) fourth d) fifth

60) Which of the following does not have /ʊ/ sound?
a) put b) wood c) boot d) could

SECTION – B (2 marks) (2*40=80)

61) The function $f: [0, \infty) \to R$ given by $f(x) = \frac{x}{x+1}$, is:
a) one-one and onto b) one-one but not onto
c) onto but not one-one d) neither one-one nor onto

62) The sum of the series $1 + 3x + 6x^2 + 10x^3 + \cdots \infty, |x| < 1$ is:
a) $\frac{1}{(1-x)^2}$ b) $\frac{1}{1-x}$ c) $\frac{1}{(1+x)^2}$ d) $\frac{1}{(1-x)^2}$

63) The co-efficient of x^{30} in the expansion $(1+x)^{50}(1-x+x^2)^{50}$ is:
a) $C(50, 9)$ b) $C(50, 29)$ c) $C(50, 40)$ d) $C(50, 30)$

64) If ${}^nC_r$ denotes the number of combinations of n things taken r at a time, then the expression ${}^nC_{r+1} + {}^nC_{r-1} + 2\,{}^nC_r$ =
a) ${}^{n+2}C_r$ b) ${}^{n+2}C_{r+1}$ c) ${}^{n+1}C_r$ d) ${}^{n+1}C_{r+1}$

65) The probability that the two digit numbers formed by digits $1, 2, 3, 4, 5$ is divisible by 4 will be:
a) 1/30 b) 1/20 c) 1/40 d) 1/5

66) If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$, then $x =$
a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $-\frac{1}{2}$ d) $-\frac{\sqrt{3}}{2}$

67) The pair of lines passing through the point (3, -2) and perpendicular to the lines $5x^2 - 8xy + 3y^2 = 0$ is:
a) $3x^2 - 8xy + 5y^2 - 2x - 4y - 1 = 0$ b) $3x^2 + 8xy + 5y^2 - 2x - 4y - 1 = 0$
c) $3x^2 + 8xy - 5y^2 + 2x + 4y + 1 = 0$ d) $3x^2 + 8xy + 5y^2 - 2x - 4y + 1 = 0$

68) The length of latus rectum of the parabola $y^2 = 4ax$ if the line $2x + 3y = 1$ touches it is:
a) 4/3 b) 4 c) 8 d) 8/9

69) The equation of the parabola whose vertex is at the centre of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and the focus coincide with the focus of the ellipse on the positive side of the major axis of the ellipse is:
a) $y^2=3x$ b) $y^2=4x$ c) $y^2=5x$ d) $y^2=12x$

70) Angle between the planes $3x-4y+5z=0$ and $2x-y-2z=5$ is:
a) $\pi/3$ b) $\pi/2$ c) $\pi/6$ d) $\pi/4$

71) If $x^y=e^{(x-y)}$, then $\frac{dy}{dx}=$
a) $\frac{y}{(1+x)^2}$ b) $\frac{x}{(1+\log x)^2}$ c) $\frac{\log x}{(1+\log x)^2}$ d) $\frac{(1+\log x)^2}{y}$

72) If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}+\vec{b}|<|\vec{a}-\vec{b}|$, then $\vec{a}$ and $\vec{b}$ are inclined at:
a) an acute angle b) an obtuse angle
c) a right angle d) a straight angle

73) $\int\frac{x^5}{\sqrt{1+x^3}}dx$ is equal to:
a) $\frac{2}{9}(1+x^3)^{3/2}+c$ b) $\frac{2}{9}(1+x^3)^{3/2}+\frac{2}{3}(1+x^3)^{1/2}+c$
c) $\frac{2}{9}(1+x^3)^{3/2}-\frac{2}{3}(1+x^3)^{1/2}+c$ d) $\frac{2}{9}(1+x^3)^{1/2}+\frac{2}{3}(1+x^3)^{1/2}+c$

74) Maximum value of $x(1-x)^2$ when $0\le x\le 2$ is:
a) 4/27 b) 2/27 c) 5/27 d) 7/27

75) For $0\le x\le\pi$, the area bounded by $y=x$ and $y=x+\sin x$ in square unit is:
a) 2 b) 4 c) 6 d) 8

76) A body starts from rest with an acceleration a_1. After 2 seconds, another body B starts from rest with an acceleration a_2. If they travel equal distances in the 5th second, after the start of A, then the ratio a_1:a_2 is equal to:
a) 5:9 b) 5:7 c) 9:5 d) 9:7

77) A hiker stands on the edge of a cliff 490 m above the ground and throws a stone horizontally with a speed of 15 ms^{-1}. The time taken by the stone to reach the ground is:
a) 5 s b) 10 s c) 12 s d) 15 s

78) The surface tension of a soap solution at a temperature 20˚C is $2.5\times10^{-2}\ Nm^{-1}$. The excess pressure (in Pa) inside a bubble of soap solution of radius 6 mm is:
a) 12.5 b) 14.2 c) 15.5 d) 16.7

79) The volume of a metal sphere increases by 0.24% when its temperature is raised by 40˚C. The coefficient of linear expansion of the metal is:
a) $2\times10^{-5}°C^{-1}$ b) $6\times10^{-5}°C^{-1}$ c) $18\times10^{-5}°C^{-1}$ d) $1.2\times10^{-5}°C^{-1}$

80) 1 mole of gas expands isothermally at 37˚C. The amount of heat absorbed by it until its volume is doubled is ($R=8.31\ Jmol^{-1}K^{-1}$):
a) 411.25 cal b) 418.50 cal c) 420.25 cal d) 425.40 cal

81) The acceleration due to gravity on the surface of the moon is 1.7 ms^{-2}. The time period of a simple pendulum on the moon if its time period on the earth is 3.5 s is:
a) 2.2 s b) 4.4 s c) 8.4 s d) 16.8 s

82) The equation of a wave is given by $y=10\sin\left(\frac{2\pi}{45}t+\alpha\right)$. If the displacement is 5 cm at $t=0$, then the total phase at $t=7.5\ s$ is:
a) $\pi/3$ b) $\pi/2$ c) $\pi/6$ d) π

83) A capacitor of capacitance C_1 is charged to a potential V and then connected in parallel to an uncharged capacitor of capacitance C_2. The final potential difference across each capacitor will be:
a) $\frac{C_1V}{C_1+C_2}$ b) $\frac{C_2V}{C_1+C_2}$ c) $1+\frac{C_1}{C_2}$ d) $1+\frac{C_2}{C_1}$

84) When a current of 2 A flows in a battery from negative to positive terminal, the potential difference across it is 12 V. If a current of 3 A flowing in the opposite direction produces a potential difference of 15 V, the emf of the battery is:
a) 12.6 V b) 13.2 V c) 13.5 V d) 14.0 V

85) The vertical component of Earth's magnetic field at a place is $\sqrt{3}$ times the horizontal component, the value of angle of dip at this place is:
a) 30° b) 45° c) 60° d) 90°

86) An alternating supply of 220 V is applied across a circuit with resistance 22 Ω and impedance 44 Ω. The power dissipated in the circuit is:
a) 1100 W b) 550 W c) 2200 W d) (2200/3) W

87) A concave lens is placed in contact with a convex lens of focal length 25 cm. The combination produces a real image at a distance of 80 cm. If an object is at a distance of 40 cm, the focal length of concave lens is:
a) -400 cm b) -200 cm c) +400 cm d) +200 cm

88) The threshold frequency of a certain metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on the metal, then the cut-off voltage for photoelectric emission is:
a) 2 V b) 4 V c) 6 V d) 8 V

89) 25 mL of N/10 caustic soda solution exactly neutralizes 20 mL of an acid solution containing 7.875 g of acid per litre. The equivalent mass of the acid is:
a) 49 b) 63 c) 126 d) 98

90) When 10 g of 90% pure limestone is heated, the volume of CO_2 (in litre) liberated at STP is:
a) 22.4 L b) 2.24 L c) 20.16 L d) 2.016 L

91) The pH of a buffer solution prepared by adding 10 mL of 0.1 M CH_3COOH and 20 mL of 0.1 M sodium acetate will be (pK_a of $CH_3COOH = 4.74$):
a) 4.74 b) 3.4 c) 5.04 d) 9.26

92) Amongst the elements with following electronic configurations, which one may have the highest ionization energy?
a) $[Ne]3s^2 3p^3$ b) $[Ne]3s^2 3p^2$ c) $[Ar]3d^{10}4s^2 4p^3$ d) $[Ne]3s^2 3p^1$

93) Which amongst the following is the most stable carbocation?
a) $CH_3 - \overset{+}{C}(CH_3) - H$ b) $CH_3 - \overset{+}{C}(CH_3) - CH_3$
c) $\overset{+}{C}H_3$ d) $CH_3\overset{+}{C}H_2$

94) The IUPAC name of the organic compound is
$CH_3 - C(CH_3)(Cl) - C(=O) - CH_3$
a) 2-chloro-2-methyl-3-butanone b) 3-chloro-3-methyl-2-butanone
c) 3-chloro-3-dimethyl-3-propanone d) 1,1-dimethyl-1-chloro-propan-2-one

95) 4.5 g of Aluminium (atomic mass 27) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be
a) 44.8 L b) 22.4 L c) 11.2 L d) 5.6 L

96) The reaction X → Product follows first order kinetics. In 40 minutes, the concentration of X changes from 0.1 M to 0.025 M, then the rate of reaction when concentration of X is 0.01 M is:
a) 1.73×10^{-4} M/min b) 3.47×10^{-5} M/min
c) 3.47×10^{-4} M/min d) 1.73×10^{-5} M/min

Read the following passages and answer the questions given below (97-100):

During last year's Christmas period, shops had less than half the number of visitors they had experienced just three years before. This drop demonstrates a fundamental shift in the way people are now shopping and buying.

Whilst there were concerns about online trading in the early days, this has declined now and as confidence in the internet continues to grow and grow, so too does online shopping. Consumers have busy lives and they are only getting busier. They have less time to visit the shops as they traditionally did. Whilst a trip to the shops is still regarded by many as an enjoyable past-time, it is also regarded as a luxury. By shopping online, consumers can shop when it suits them and can also use price comparison and review websites to ensure they are getting the best deal.

97) Which of the following would best replace the word 'fundamental' in the second sentence?
a) declining b) major
c) worrying d) trending

98) Which of the following statement best describes the trend in online shopping?
a) At first, consumers thought it a great idea, but since then, they have become less sure.
b) Consumers cannot decide whether they prefer online or traditional shopping.
c) People have been forced to shop online in order to grab the best bargains.
d) People were initially wary about online shopping, but are more confident now.

99) Which of the following statements can be inferred from the passage? People now regard internet shopping as _____:
a) A way to fit more into their busy lives. b) An easier way to buy luxury goods.
c) An expensive but useful way to shop. d) A way to avoid the Christmas crowds.

100) Which of the following statement is false, based on the information in the passage?
a) There appear to have been very few changes in the way people shop in the last few years.
b) There are still many people who enjoy taking a trip to the shops nowadays.
c) Price comparison websites can help shoppers research where the best deals are.
d) Shopping online creates opportunities to shop at a time that suits you.

❖❖❖❖ Thank You!!! ❖❖❖❖