BEATS ENGINEERING

INSTITUTE OF ENGINEERING

MODEL ENTRANCE EXAM

(SET – 11)

Instructions:

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

Date : 2081/04/19
(August 03)

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

SECTION – A (1 marks) (1*60 = 60)

1) A man is sitting with folded hands on a revolving table. Suddenly, he stretched his arms. Angular speed of table would:
a) increase b) decrease c) remains same d) become zero

2) A wire of length L and area of cross section A is stretched through a certain length l. If Y is Young's modulus of the material of the wire, then force constant of the wire is:
a) $\frac{YL}{A}$ b) $\frac{Yl}{A}$ c) $\frac{YA}{l}$ d) $\frac{YA}{L}$

3) The coefficient of linear expansion of a crystal in one direction is α_1 and that in every direction perpendicular to it is α_2. The coefficient of cubical expansion is:
a) $3\alpha_1$ b) $3\alpha_2$ c) $\alpha_1 + 2\alpha_2$ d) $2\alpha_1 + \alpha_2$

4) Monochromatic light of wavelength λ gets refracted from vacuum to a medium of refractive index μ. The ratio of wavelength of the incident and refracted wave is:
a) $1:\mu$ b) $1:1$ c) $\mu:1$ d) $\mu^2:1$

5) A standing wave having 3 nodes and 2 antinodes is formed between two atoms having a distance 1.21 Å between them. The wavelength of the standing wave is:
a) 1.21 Å b) 2.42 Å c) 6.05 Å d) 3.63 Å

6) An ammeter has a resistance G Ω and a range i Ampere. The value of resistance used in parallel to convert it into an ammeter of range 'ni' Ampere is:
a) nG b) $\frac{G}{n}$ c) $(n-1)G$ d) $\frac{G}{n-1}$

7) If an electron and a photon propagates in the form of waves having the same wavelength, it implies that they have the same:
a) energy b) momentum c) velocity d) angular momentum

8) Barrier potential of p-n junction diode does not depend upon:
a) diode design b) temperature c) forward bias d) doping density

9) If the tension in the cable supporting an elevator is equal to the weight of elevator. The elevator may be:
a) going up with uniform speed b) going up with increasing speed
c) going down with increasing speed d) all of above

10) A coin is placed on a rotating turnable when it is placed at a distance of 9 cm from centre remain stationary. If the angular velocity of the turnable is tripled, it just slip if distance from the centre is:
a) 27 cm b) 9 cm c) 3 cm d) 1 cm

11) Velocity of sound is 320 m/s. A pipe closed at one end of length 1 m. The air column can resonate for sound of frequency:
a) 10 Hz b) 200 Hz c) 240 Hz d) 380 Hz

12) Two cells of same emf E have internal resistance r_1 and r_2. They are connected in series with an external resistance 'R' and potential difference across first cell is found zero, then the value of 'R' is:
a) $r_1 - r_2$ b) $r_1 + r_2$ c) $r_2 - r_1$ d) $2r_1 - r_2$

13) A rectangular block of glass of thickness 'd' is placed on mark made on the surface of table and viewed from vertical position of eye. If refractive index of glass is μ, then mark will appear to be raised by:
a) $\frac{(\mu+1)}{\mu}d$ b) $\frac{(\mu-1)}{\mu}d$
c) $\frac{\mu+1}{\mu d}$ d) $(\mu+1)\frac{\mu}{d}$

14) Monohromatic light incident on a metal surface emits electrons with kinetic energies from zero to 2.6 eV. What is the least energy of the incident photon if the tightly bound electron needs 4.2 eV to remove?
a) 1.6 eV b) 4.4 eV c) 6.8 eV d) 8.3 eV

15) Graphite belongs to:
a) cubic system b) tetragonal system
c) rhombohedral system d) hexagonal system

16) The sum of mole fractions of A, B and C in a solution containing 0.1 mole each of A, B and C is:
a) 0.1 b) 0.3 c) 1.0 d) 1/3

17) If same amount of electricity is passed through aqueous solution of $AgNO_3$ and $CuSO_4$ and the number of Ag and Cu atoms deposited are x and y respectively. Then:
a) $x = y$ b) $x < y$ c) $y = 2x$ d) $x = 2y$

18) The reaction $2N_2O_5 \rightarrow 2N_2O_4 + O_2$ is:
a) bimolecular and second order b) unimolecular and first order
c) bimolecular and first order d) bimolecular and zero order

19) Which of the following is used as a foaming agent in froth floatation process?
a) pine oil b) amyl xanthate c) $CuSO_4$ d) KCN

20) Passing H_2S gas through nitric acid produces:
a) rhombic sulphur b) colloidal sulphur
c) amorphous sulphur d) plastic sulphur

21) Which of the following halogens has the highest bond energy?
a) F_2 b) Cl_2 c) Br_2 d) I_2

22) When primary amine reacts with chloroform in ethanolic KOH, the product is:
a) an isocyanide b) an aldehyde c) a cyanide d) an alcohol

23) In which of the following reactions, new carbon-carbon bond is not formed?
a) Cannizzaro reaction b) Wurtz reaction
c) Aldol condensation d) Friedel-Craft reaction

24) In the Hoffman's method for separation of 1˚, 2˚ and 3˚ amines, the reagent used is:
a) acetyl chloride b) benzene sulphonyl chloride
c) diethyl oxalate d) nitrous acid

25) The angular momentum of an electron present in the excited state of hydrogen is $\frac{1.5h}{\pi}$. The electron is present in:
a) third orbit b) second orbit c) fourth orbit d) fifth orbit

26) CO_2 is not isostructural with:
a) $HgCl_2$ b) $SnCl_2$ c) C_2H_2 d) $ZnCl_2$

27) Blister copper is:
a) ore of Cu b) pure Cu
c) alloy of Cu d) Cu containing 1% impurity

28) Reaction between propene and HCl to form isopropyl chloride takes place through:
a) nucleophilic addition b) nucleophilic substitution
c) electrophilic addition d) electrophilic substitution

29) If $\sin^{-1} x = \frac{\pi}{5}$ for $x \in [-1, 1]$, then $\cos^{-1} x =$
a) $\frac{9\pi}{10}$ b) $\frac{3\pi}{10}$ c) $\frac{7\pi}{10}$ d) $\frac{5\pi}{10}$

30) The range of the function f: R → R defined by:
$f(x) = \begin{cases} \frac{|x|}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$ is:
a) R b) $R - \{0\}$ c) $\{1, 0, -1\}$ d) $\{1, -1\}$

31) If $f(x) = 0$ has roots α and β, then $f\left(\frac{1}{x}\right) = 0$ has roots:
a) $\alpha\beta$ b) $\frac{1}{\alpha}, \frac{1}{\beta}$ c) $-\alpha, -\beta$ d) $-\frac{1}{\alpha}, \beta$

32) For a square matrix A, which of the following is true?
a) $|A| = |A^T|$ b) $|A^{-1}| = |A|$ c) $|A^{-1}| = \left|\frac{1}{A}\right|$ d) $A(\text{adj } A) = |A|$

33) If $f'(x) = e^x + \frac{1}{1+x^2}$ and $f(0) = 1$, then $f(x)$ equals:
a) $e^x + \tan^{-1} x$ b) $e^x + \tan^{-1} x + 1$
c) $e^x + \sin^{-1} x$ d) $e^x + \tan^{-1} x - 1$

34) $\lim_{x\to 0} \frac{1-\cos x}{1+\cos x} =$
a) 0 b) 1 c) 1/2 d) -1

35) $\frac{d}{dx} \cosh^{-1} \sec x =$
a) $\sec x$ b) $\sin x$ c) $\tan x$ d) $\text{cosec } x$

36) The angle between two lines represented by $x^2 - 2xy = 0$ is:
a) $\tan^{-1}\frac{1}{2}$ b) $\cot^{-1}\frac{1}{2}$ c) $\tan^{-1}\frac{3}{4}$ d) $\cot^{-1}\frac{3}{4}$

37) If the planes $x + 2y + kz = 0$ and $2x + y - 2z = 0$ are at right angles, then the value of k is:
a) 4 b) 2 c) -2 d) 1

38) If $(\vec{a} + \vec{b} + \vec{c}) = 0$, then the angle θ between $\vec{b}$ and $\vec{c}$ is given by:
a) $\cos\theta = \frac{a^2-b^2-c^2}{2bc}$ b) $\cos\theta = \frac{b^2+c^2-a^2}{2bc}$
c) $\cos\theta = \frac{a^2+b^2-c^2}{2ab}$ d) $\cos\theta = \frac{a^2-b^2+c^2}{2ab}$

39) The value of x when $\log_2(x^2 + 7) = 3$ is:
a) ± 4 b) ± 3 c) ± 2 d) ± 1

40) The value of k so that $k + 2, 4k - 6$ and $3k - 2$ are consecutive terms of an A.P. is:
a) 1 b) 2 c) 4 d) 3

41) If $y = 2x + k$ is normal to $y^2 = 4x$, then k =
a) 12 b) -12 c) -8 d) 16

42) If α, β and γ be direction cosines of a line, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma + 3 =$
a) 2 b) 5 c) 6 d) 7

43) The function $f(x) = 3x + 1$ is increasing in the interval:
a) $(3, \infty)$ b) $(-\infty, 3)$ c) $(-\infty, \infty)$ d) $(-3, 3)$

44) The function $f(x) = \begin{cases} \frac{\sin 5x}{3x} & x \neq 0 \\ k & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is:
a) 3/5 b) 1/5 c) 5/3 d) 0

45) $\int e^{\log \sec^2(2x+7)} dx =$
a) $\frac{1}{\tan(2x+7)} + c$ b) $\tan(2x + 7) + c$
c) $\frac{\tan(2x+7)}{2} + c$ d) $\frac{\sec^2(2x+7)}{2} + c$

46) The multiplicative inverse of complex number $z = 1 + i$ is:
a) $\frac{1+i}{2}$ b) $\frac{1}{1-i}$
c) $\frac{1-i}{2}$ d) $\frac{2}{1-i}$

47) $\sec^{-1}(-x) =$
a) $\sec^{-1} x$ b) $\pi - \sec^{-1} x$
c) $-\sec^{-1} x$ d) $\frac{\pi}{2} - \sec^{-1} x$

48) If $y = -\left(x^3 + \frac{x^6}{2} + \frac{x^9}{3} + \cdots\right)$, then $x =$
a) $\frac{1+e^y}{3}$ b) $\frac{1-e^y}{3}$ c) $(1-e^y)^{1/3}$ d) $(1-e^y)^3$

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 total number of protons in 10 g of calcium carbonate is ($N_A = 6.023 \times 10^{23}$)
a) 1.5057×10^{24} b) 2.0478×10^{24}
c) 3.0115×10^{24} d) 4.0956×10^{24}

62) Which one of the following solutions of sulphuric acid will exactly neutralize 25 mL of 0.2 M sodium hydroxide solution?
a) 12.5 mL of a 0.1 M solution b) 25 mL of a 0.1 M solution
c) 25 mL of a 0.2 M solution d) 50 mL of a 0.2 M solution

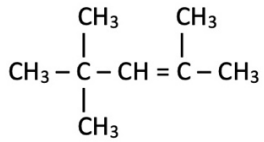
63) The solubility product of a salt having general formula MX_2 in water is 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is:
a) 2×10^{-6} M b) 1×10^{-4} M c) 1.6×10^{-4} M d) 4×10^{-10} M

64) The standard enthalpies of formation of $A(NH_3), B(CO_2), C(HI)$ and $D(SO_2)$ are respectively $-46.19, -393.4, +24.94$ and -296.9 kJmol^{-1}. The increasing order of their stability is:
a) $B < D < A < C$ b) $C < A < D < B$
c) $D < B < C < A$ d) $A < C < D < B$

65) A metal M readily forms water soluble sulphate MSO_4, water insoluble hydroxide $M(OH)_2$ and oxide MO which becomes inert on heating. The hydroxide is soluble in NaOH; M is:
a) Be b) Mg c) Ca d) Sr

66) In the following reaction; $PCl_5 \xrightarrow{H_2O} HCl + A$, the product A is:
a) $H_2P_2O_4$ b) $H_2P_2O_7$ c) H_3PO_4 d) H_3PO_3

67) The IUPAC nomenclature of the following compound is:



a) 2,4,4–trimethylpent-2-ene b) 2,4,4-trimethylpent-3-ene
c) 2,2,4-trimethylpent-3-ene d) 2,2,4-trimethylpent-2-ene

68) The products obtained when anisole is heated in a sealed tube with HI are:
a) $C_6H_5I + CH_3OH$ b) $C_6H_5I + C_6H_5OH$
c) $CH_3I + C_6H_5OH$ d) $CH_3OH + CH_3I$

69) Two paper screens A and B are separated by a distance of 200 m. A bullet pierces A and then B. The hole in B is 40 cm below the hole in A. If the bullet is travelling horizontally at the time of hitting A, then the velocity of the bullet at A is:
a) 200 m/s b) 400 m/s c) 600 m/s d) 700 m/s

70) A cord is used to lower vertically a block of mass M at a distance d at a constant downward acceleration of g/4. Then the work done by the cord on the block is:
a) $\frac{Mgd}{4}$ b) $\frac{3}{4}Mgd$ c) $-\frac{3}{4}Mgd$ d) Mgd

71) Two equal masses 'm' and 'm' are hung from a balance whose scale pans differ in height by 'h'. The mean density of earth is ρ, then the difference in weight is:
a) zero b) $\frac{4\pi G\rho mh}{3}$ c) $\frac{8\pi G\rho mh}{3}$ d) $\frac{2\pi G\rho mh}{3}$

72) There is a small hole in a hollow sphere. The water enters in it when it is taken to a depth of 40 cm under water. The surface tension of water is 7.0×10^{-2} N/m, the diameter of hole is ($g = 9.8$ m/s^2):
a) $\frac{1}{28}$ mm b) $\frac{1}{7}$ mm c) 14 mm d) $\frac{1}{14}$ mm

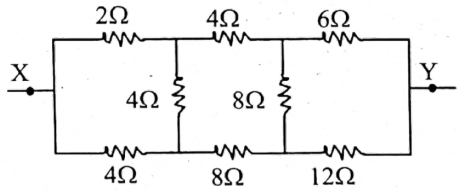
73) During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio C_p/C_v for a gas is:
a) 4/3 b) 2 c) 5/3 d) 3/2

74) A ray incident at 15˚ on one refracting surface of a prism of angle 60˚ suffers a deviation of 55˚. What is the angle of emergence?
a) 100˚ b) 85˚ c) 45˚ d) 30˚

75) In Young's double slit experiment, the ratio of maximum to minimum intensities of the fringe system is 4:1. The amplitude of the coherent sources are in the ratio:
a) 4:1 b) 3:1 c) 2:1 d) 1:1

76) A whistle revolves in a circle with angular speed $\omega = 20$ rad/s using a string of length 50 cm. If the frequency of sound from the whistle is 385 Hz, what is the minimum frequency heard by an observer which is far away from the centre (velocity of sound in air = 340 m/s):
a) 385 Hz b) 374 Hz c) 394 Hz d) 333 Hz

77) The figure below shows a net work of resitance. The equivalent resistance between X and Y is:



a) 36 Ω b) 8 Ω c) 6 Ω d) 16 Ω

78) A current of 10 ampere is flowing in a wire of length 1.5 metre. A force of 15 N acts on it when it is placed in a uniform magentic field of 2 T. The angle between the magnetic field and the direction of the current is:

a) 30° b) 45° c) 60° d) 90°

79) When current changes from +2 A to -2 A in 0.05 s on emf of 8 V is induced in a coil. The coefficient of self inductance of the coil is:

a) 0.2 H b) 0.4 H c) 0.8 Hz d) 0.1 Hz

80) An ac of frequency of 50 Hz is connected in series to an inductance of 0.5 H and resistance of 157 Ω. The phase difference between current and voltage is:

a) 60° b) 45° c) 75° d) 90°

81) Particle A has charge +q and particle B has charge +4q with each of them having the same mass 'm'. When allowed to fall from through the same electric p.d., the ratio of their speed $\frac{V_A}{V_B}$ will become:

a) 2:1 b) 1:2 c) 1:4 d) 4:1

82) In ΔABC, the value of $\sum \frac{r_1}{(s-b)(s-c)} =$

a) 1/r b) 3/r c) 3r d) 3Δ

83) If p^{th} term of an A.P. is q and q^{th} term is p, then r^{th} term is:

a) $p - q + r$ b) $q - p + r$
c) $p + q - r$ d) $p + q + r$

84) In a cricket championship, there are 45 matches. If each team plays one match with other, then the number of teams is:

a) 8 b) 9 c) 10 d) 17

85) If a and b are coefficients of x^n and x^{n-1} respectively in the expansion of $(1 + x)^{2n+1}$, then:

a) $a = b$ b) $a = 2b$
c) $b = 2a$ d) $a + b = (2n + 1)!$

86) If the point (1, k) lies outside the circle $x^2 + y^2 = 10$, then k =

a) $(-3, 3)$ b) $(3, \infty)$
c) $(-\infty, -3) \cup (3, \infty)$ d) $(-\infty, -3] \cup [3, \infty)$

87) $\int_0^1 \frac{dx}{\sqrt{1+x}-\sqrt{x}} =$

a) $\frac{1}{\sqrt{3}}$ b) $\frac{2\sqrt{3}}{5}$ c) $\frac{4\sqrt{2}}{3}$ d) $\frac{1}{\sqrt{2}}$

88) For the curve $x = t^2 - 1, y = t^2 - t$, then tangent line is perpendicular to x-axis, where:

a) $t = 0$ b) $t = \infty$ c) $t = \frac{1}{\sqrt{3}}$ d) $t = -\frac{1}{\sqrt{3}}$

89) If $\sqrt{x} + \sqrt{y} = 1$, then $\frac{dy}{dx}$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$ is:

a) 1/2 b) 1 c) -1 d) 2

90) If the position vector of A is $(\vec{a} + 2\vec{b})$ and $\vec{a}$ divides $\overrightarrow{AB}$ in the ratio 2:3, then the position vector of B is:

a) $\vec{c} = \vec{a} + \vec{b}$ b) $\vec{c} = \vec{a} - 3\vec{b}$ c) $\vec{c} = 2\vec{a} + \vec{b}$ d) $\vec{c} = \vec{a} - \vec{b}$

91) The value of $\tan^{-1}\left(\frac{1+\cos x}{\sin x}\right)$ is:
a) $\frac{x}{2}$ b) x
c) $\frac{\pi}{2}-\frac{x}{2}$ d) $\frac{\pi}{4}-\frac{x}{2}$

92) If $A \subset B$, $n(A) = 37$ and $n(B) = 50$, then $n(A - B)$ and $n(B - A) =$
a) 50, 37 b) 37, 0 c) 0, 13 d) 37, 13

93) A line joining the points (1, 2, 0) and (4, 13, 5) is perpendicular to the plane. Then the coefficient of x, y, z in the equation of the plane are respectively:
a) 5, 15, 5 b) 3, 11, 5
c) 3, -11, 5 d) -5, -15, 5

94) If $S = \sum_{n=0}^{\infty} \frac{(log_e x)^{2n}}{(2n)!}$, then S =
a) $x + x^{-1}$ b) $x - x^{-1}$
c) $\frac{1}{2}(x + x^{-1})$ d) $x^2 + 1$

95) Area bounded by the curve $y^2 = x, y = 0, x = 1$ and $x = 4$ is:
a) 14/3 b) 28/3 c) 7/4 d) 5/2

96) If α and β are the root oof $x^2 + 2x + 4 = 0$, then the equation whose roots are $\left(\frac{\alpha}{2}\right)^7$ and $\left(\frac{\beta}{2}\right)$ is:
a) $x^2 + 4x + 8 = 0$ b) $x^2 + x + 2 = 0$
c) $x^2 + x + 1 = 0$ d) $x^2 + 2x + 1 = 0$

Read the following passage and answer the questions given below (97-100).
Theodore Roosevelt was born with asthma and poor eyesight, yet this sickly child later won fame as a political leader, a Rough Rider, and a hero of the common people. To conquer his handicaps, Teddy trained in a gym and became a lightweight boxer at Harvard. Out west, he hunted buffalo and ran a cattle ranch. Back east, he became a civil service reformer and police commissioner. He became President McKinley's assistant Navy secretary during the Spanish-American War. Also, he led a charge of cavalry Rough Riders up San Juan Hill in Cuba. After achieving fame, he became governor of New York and went on to become the vice president.
When McKinley was assassinated, Theodore Roosevelt became the youngest president at age 42. He is famous for his motto, "Speak softly and carry a big stick." Roosevelt battled for meat inspection and pure-food laws. Also, he wanted to save the forests and break the grip that big business had on steel and oil. Roosevelt persuaded the diplomats of warring Russia and Japan to make peace.

97) Which of the following states the main idea of the passage?
a) Theodore Roosevelt was a man of many accomplishments.
b) Presidents should speak softly and carry big sticks.
c) Presidents can help countries make peace.
d) A governor can become a president.

98) What achievement illustrates Roosevelt's ability to overcome personal obstacles?
a) He led a charge of cavalry Rough Riders in Cuba.
b) He is famous for his motto, "Speak softly and carry a big stick."
c) He overcame his asthma by training in a gym, and he became a boxer.
d) He became governor of New York.

99) According to the passage, how did Roosevelt first become president?
a) He won the support of his party in a political campaign.
b) As vice president, he took over the presidency when McKinley was assassinated.
c) He won the nation's popular vote.
d) He won the necessary Electoral College votes.

100) He first worked under President McKinley in what capacity?
a) assistant Navy secretary during the Spanish-American War
b) police commissioner
c) governor of New York
d) civil service reformer

❖❖❖❖ **Thank You!!!** ❖❖❖❖