



**INSTITUTE OF ENGINEERING**

**MODEL ENTRANCE EXAM**

**(SET – 8)**

**Instructions:**

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

**Date :** 2081/03/29  
(July 13)

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



- 16) Number of atoms of oxygen present in 10.6 g of  $\text{Na}_2\text{CO}_3$  will be:  
a)  $6.02 \times 10^{22}$  b)  $12.04 \times 10^{22}$   
c)  $1.806 \times 10^{23}$  d)  $31.80 \times 10^{28}$
- 17) Based on lattice energy and other considerations, which one of the following alkali metal chlorides is expected to have the highest melting point?  
a) LiCl b) NaCl c) KCl d) RbCl
- 18) The oxidation number of Ni in  $\text{Ni}(\text{CO})_4$  is:  
a) -4 b) +4 c) 0 d) +2
- 19) The coordination number of sodium in  $\text{Na}_2\text{O}$  is:  
a) 2 b) 4 c) 6 d) 8
- 20) Which of these species has a standard enthalpy of formation equal to zero?  
a)  $\text{F}_2(\text{g})$  b)  $\text{F}(\text{g})$  c)  $\text{F}^-(\text{aq})$  d)  $\text{HF}(\text{aq})$
- 21) Activation energy of a reaction:  
a) is independent of temperature b) increases with temperature  
c) decreases with temperature d) gets doubled for every  $10^\circ$  rise in temperature
- 22) An atom with high electronegativity has:  
a) large size b) high ionization potential  
c) low electron affinity d) low ionization potential
- 23) Which one of the following metals is extracted on smelting of its ore in blast furnace?  
a) Fe b) Na c) K d) Mg
- 24) Which of the alkaline earth metal hydroxides is least soluble?  
a)  $\text{Be}(\text{OH})_2$  b)  $\text{Mg}(\text{OH})_2$  c)  $\text{Sr}(\text{OH})_2$  d)  $\text{Ba}(\text{OH})_2$
- 25) Which of the following gas mixtures is used by the divers inside the sea?  
a)  $\text{O}_2 + \text{He}$  b)  $\text{O}_2 + \text{Xe}$  c)  $\text{O}_2 + \text{Ar}$  d)  $\text{O}_2 + \text{N}_2$
- 26) Gun metal is an alloy of:  
a) Mg, Zn b) Cu, Sn c) Cu, Sn, Zn d) Cu, Ni, Fe, Mn
- 27) If Force (F), velocity (v) and time (T) are taken as fundamental units, then the dimensions of mass are:  
a)  $FvT^{-1}$  b)  $FVT^{-2}$  c)  $Fv^{-1}T^{-1}$  d)  $Fv^{-1}T$
- 28) The circular motion of a particle with constant speed is:  
a) simple harmonic but not periodic b) periodic and simple harmonic  
c) neither periodic nor simple harmonic d) periodic but not simple harmonic
- 29) The slope of a graph drawn between threshold frequency and stopping potential is:  
a) e b) h c) h/e d) he
- 30) An intrinsic semiconductor is converted into n-type extrinsic semiconductor by doping it with:  
a) Germanium b) Phosphorous c) Aluminium d) Silver
- 31) A black body is heated from  $127^\circ\text{C}$  to  $327^\circ\text{C}$ , then the ratio of their energies of radiation is:  
a) 8:27 b) 2:3 c) 4:9 d) 16:81
- 32) When liquid changes into vapour, on increasing pressure the boiling point of the liquid:  
a) increases b) decreases  
c) cannot be predicted d) may increase or decrease
- 33) SONAR emits which of the following waves?  
a) radio waves b) ultrasonic waves  
c) light waves d) magnetic waves
- 34) What causes chromatic aberration?  
a) non paraxial rays  
b) paraxial rays  
c) variation of focal length with colour  
d) difference in radii of curvature of the bonding surface of the lens

- 35) Light is incident at an angle  $i$  on a glass slab. The refracted ray is completely polarised. The angle of refraction is:  
 a)  $90 - i$                       b)  $180 - i$                       c)  $90 + i$                       d)  $i$
- 36) Bernoulli's theorem is a consequence of:  
 a) conservation of mass                      b) conservation of energy  
 c) conservation of linear momentum                      d) conservation of angular momentum
- 37) For steel,  $Y = 2 \times 10^{11} \text{ N/m}^2$ . The force required to double the length of a steel wire of area  $1 \text{ cm}^2$  is:  
 a)  $2 \times 10^7 \text{ N}$                       b)  $2 \times 10^6 \text{ N}$                       c)  $2 \times 10^8 \text{ N}$                       d)  $2 \times 10^5 \text{ N}$
- 38) The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of  $10 \Omega$  is:  
 a)  $0.8 \Omega$                       b)  $1.0 \Omega$                       c)  $0.2 \Omega$                       d)  $0.5 \Omega$
- 39) Electric field intensity at a point in between two parallel sheets with like charges of same surface charge densities ( $\sigma$ ) is:  
 a)  $\frac{\sigma}{2\epsilon_0}$                       b)  $\frac{\sigma}{\epsilon_0}$                       c) zero                      d)  $\frac{2\sigma}{\epsilon_0}$
- 40) The magnetic induction at the centre of a current carrying circular coil of radius  $r$  is:  
 a) directly proportional to  $r$                       b) inversely proportional to  $r$   
 c) directly proportional to  $r^2$                       d) inversely proportional to  $r^2$
- 41)  $\cot x$  is defined for all  $x$  in:  
 a)  $\mathbb{R}$                       b)  $\mathbb{R} - \{n\pi, n \in \mathbb{1}\}$   
 c)  $\mathbb{R} - \{(2n + 1)\pi/2 : n \in \mathbb{1}\}$                       d)  $\mathbb{R} - 2n\pi$
- 42) The domain of the function  $y = \sqrt{9 - x^2}$  are:  
 a)  $\{0 < x < 3\}$                       b)  $\{-3 \leq x \leq 3\}$                       c)  $\{-1 < x < 1\}$                       d)  $\{-3 < x < 0\}$
- 43) The quadratic equation  $8\sec^2 x - 6\sec x + 1 = 0$  has:  
 a) 1 root                      b) 2 roots                      c) no roots                      d) infinite roots
- 44)  $\lim_{x \rightarrow \infty} \left(\frac{x+6}{x+1}\right)^{x+4} =$   
 a)  $e^3$                       b)  $1/e$                       c)  $2e$                       d)  $e^5$
- 45)  $\int \frac{\cos(\log x)}{x} dx =$   
 a)  $\sin(\log x) + c$                       b)  $-\sin(\log x) + c$   
 c)  $\frac{\sin(\log x)}{x} + c$                       d)  $\log(\sin x) + c$
- 46) If  $f(x) = \log|x|, x \neq 0$ . Then,  $f'(x)$  equals:  
 a)  $\frac{1}{|x|}$                       b)  $\frac{1}{x}$                       c)  $-\frac{1}{x}$                       d)  $\frac{1}{x^2}$
- 47) Inverse of a diagonal matrix is a:  
 a) skew symmetric matrix                      b) symmetric matrix  
 c) unit matrix                      d) diagonal matrix
- 48) If  $\vec{u}$  and  $\vec{v}$  are unit vectors and  $\theta$  is the acute angle between them, then  $2\vec{u} \times 3\vec{v}$  is a unit vector for:  
 a) no value of  $\theta$                       b) exactly one value of  $\theta$   
 c) exactly two value of  $\theta$                       d) more than two value of  $\theta$
- 49) Equation of  $x - y - z$  axis is:  
 a)  $\frac{x}{1} = \frac{y}{1} = \frac{z}{1}$                       b)  $\frac{x}{0} = \frac{y}{1} = \frac{z}{1}$                       c)  $\frac{x}{1} = \frac{y}{0} = \frac{z}{0}$                       d)  $\frac{x}{0} = \frac{y}{0} = \frac{z}{1}$
- 50) If the area of equilateral triangle ABC is  $\Delta$ , then the area of triangle formed by joining the midpoints of its side is equal to:  
 a)  $\Delta$                       b)  $4\Delta$                       c)  $\Delta/4$                       d)  $2\Delta$
- 51) Two dice are rolled once. What is the probability of getting a total of 8?  
 a)  $5/6$                       b)  $5/36$                       c)  $7/36$                       d)  $1/18$

- 52) The standard deviation of some temperature data in °C is 5. If the data were converted into °F, the variance would be:  
 a) 81                                      b) 57                                      c) 36                                      d) 25
- 53)  $1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots =$   
 a)  $\frac{e^x - e^{-x}}{2}$                                       b)  $\frac{e^x + e^{-x}}{2}$                                       c)  $\frac{e^{-x} - e^x}{2}$                                       d)  $-\left(\frac{e^x + e^{-x}}{2}\right)$
- 54) If  $|z_1| = |z_2| = |z_3| = 1$  and  $z_1 + z_2 + z_3 = \sqrt{2} + i$ , then the complex number  $z_2\bar{z}_3 + z_3\bar{z}_1 + z_1\bar{z}_2$  is:  
 a) purely real                                      b) purely imaginary  
 c) a positive real number                                      d) an integer
- 55) The value of  $\lim_{x \rightarrow 2} \frac{e^{3x-6}-1}{\sin(2-x)}$  is:  
 a) 3/2                                      b) 3                                      c) -3                                      d) -1
- 56) If  $y = t^{10} + 1, x = t^8 + 1$ , then  $\frac{dy}{dx} =$   
 a)  $\frac{5}{2}t$                                       b)  $\frac{5}{4}t^2$                                       c)  $20t^8$                                       d)  $\frac{5}{16}t^6$
- 57)  $\int_1^2 e^x \left(\frac{1}{x} - \frac{1}{x^2}\right) dx =$   
 a)  $e\left(\frac{e}{2} - 1\right)$                                       b)  $e(e - 1)$                                       c) 0                                      d)  $e^2$
- 58) The length of perpendicular from  $(x_1, y_1)$  on the line  $y - y_1 = m(x - x_1)$  is:  
 a) 0                                      b)  $x_1y_1$                                       c)  $mx_1y_1$                                       d)  $\frac{1}{x_1y_1}$
- 59) The differences of distances of any point on hyperbola  $\frac{x^2}{16} - \frac{y^2}{25} = 1$  from foci:  
 a) 16                                      b) 25                                      c) 8                                      d) 10
- 60) The angle made by plane  $ax + by + cz + d = 0$  with  $x - axis$  is:  
 a) 0                                      b)  $\sin^{-1}\left(\frac{a}{\sqrt{a^2+b^2+c^2}}\right)$   
 c)  $\cos^{-1}\left(\frac{a}{\sqrt{a^2+b^2+c^2}}\right)$                                       d)  $\pi/2$

**SECTION – B ( 2 marks)** (2\*40=80)

Read the following passage and answer the questions given below (61-64):

Stammering is a habit disorder linked with lack of self-confidence. Basically, for a child to understand a language, there are four stages. The first is learning to understand the spoken language and the second is speaking. Both of these usually develop around the age of two.

The third stage is speaking complex sentences, which develops at around 3rd and the 4th is when the child recognises the written alphabet. In 80% of children while the 3rd and 4th stage are at play, the first two get disturbed because something new is being incorporated in the mind.

This is absolutely normal. But what over cautious mothers do is fret a lot and the child develops a fear which later manifests itself as stammering. In fact, most text books on stammering state in bold that “Had there not been any over cautious mothers, hardly any one would have suffered from stammering.” Fluency can be incorporated in the speech of such patients through hypnosis.

- 61) Stammering is caused because of:  
 a) physical disorder                                      b) hindered growth  
 c) lack of self-confidence                                      d) lack of understanding
- 62) The second stage of a child’s understanding the language is:  
 a) speaking                                      b) writing                                      c) listening                                      d) reading

- 63) Fluency in such patients can be incorporated in the speech of such patients through:  
a) hypnosis                      b) slap                      c) punishment                      d) symbiosis
- 64) By the time the child becomes two years old he/she can:  
a) speak complex sentences                      b) only understand spoken language  
c) understand and speak simple language                      d) write the alphabets
- 65) Consider the ground state of Cr atom ( $Z = 24$ ). The number of electrons with the azimuthal quantum number  $l = 1$  and  $l = 2$  are respectively:  
a) 12 and 4                      b) 16 and 5                      c) 16 and 4                      d) 12 and 5
- 66) The volume of 0.1 M NaOH that is needed to completely neutralize 20 mL of 0.05 M oxalic acid is:  
a) 10 mL                      b) 40 mL                      c) 20 mL                      d) 80 mL
- 67) If mass of two molecules each of A and B are 100 kg 64 kg respectively and rate of diffusion of A is  $12 \times 10^{-3}$ , then what will be the rate of diffusion of B?  
a)  $15 \times 10^{-3}$                       b)  $64 \times 10^{-3}$                       c)  $5 \times 10^{-3}$                       d)  $46 \times 10^{-3}$
- 68) The  $pK_a$  of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is:  
a) 7.0                      b) 4.5                      c) 2.5                      d) 9.5
- 69) In the catalytic oxidation of ammonia, an oxide is formed which is used in the preparation of  $HNO_3$ . This oxide is:  
a)  $N_2O$                       b)  $NO_2$                       c)  $N_2O_4$                       d)  $N_2O_5$
- 70) The correct order of the thermal stability of hydrogen halides ( $H - X$ ) is:  
a)  $HI > HBr > HCl > HF$                       b)  $HF > HCl > HBr > HI$   
c)  $HCl > HF > HBr > HI$                       d)  $HI > HCl > HF > HBr$
- 71) The number of  $\sigma$  and  $\pi$  bonds in but - 1 - en - 3 - yne are:  
a)  $5\sigma$  and  $5\pi$                       b)  $7\sigma$  and  $3\pi$                       c)  $8\sigma$  and  $2\pi$                       d)  $6\sigma$  and  $4\pi$
- 72) In a set of reactions, propionic acid yielded a compound D.  
 $CH_3CH_2COOH \xrightarrow{SOCl_2} (B) \xrightarrow{NH_3} (C) \xrightarrow{Br_2+4KOH} (D)$ . The structure of (D) would be:  
a)  $CH_3CH_2CONH_2$                       b)  $CH_3CH_2NHCH_3$                       c)  $CH_3CH_2NH_2$                       d)  $CH_3CH_2CH_2NH_2$
- 73) A nucleus with mass number 240 breaks into two fragments each of mass number 120, the binding energy per nucleon of unfragmented nuclei is 7.6 MeV while that of fragments is 8.5 MeV. The total gain in the Binding Energy in the process is:  
a) 0.9 MeV                      b) 9.4 MeV                      c) 804 MeV                      d) 216 MeV
- 74) A bird is 30 cm above the water surface and the fish is 20 cm below the water surface. Then, the distance of bird as seen by the fish will be (refractive index of water =  $4/3$ ):  
a) 45 cm                      b) 60 cm                      c) 50 cm                      d) 70 cm
- 75) In Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index  $4/3$  without disturbing the geometry arrangement, the new fringe width will be:  
a) 0.2 mm                      b) 0.1 mm                      c) 0.3 mm                      d) 0.4 mm
- 76) A source of sound moves away from stationary listener with equal to half of the velocity of sound. If actual frequency of sound produced by the source be 'f', then the change in frequency will be:  
a)  $f/4$                       b)  $f/2$                       c)  $f$                       d)  $f/3$
- 77) A bar magnet is hung by a thin cotton thread in a uniform horizontal magnetic field and is in equilibrium state. The energy required to rotate it by  $60^\circ$  is  $W$ . Now, the torque required to keep the magnet in this new position is:  
a)  $\frac{2W}{\sqrt{3}}$                       b)  $\frac{W}{\sqrt{3}}$                       c)  $\sqrt{3}W$                       d)  $\frac{\sqrt{3}W}{2}$

- 78) Two condensers of capacity  $0.3 \mu\text{F}$  and  $0.6 \mu\text{F}$  respectively are connected in series. The combination is connected across a potential of  $6 \text{ V}$ . The ratio of energies stored by the condensers will be:  
a) 1:2                      b) 2:1                      c) 1:4                      d) 4:1
- 79) In a series L-C-R circuit, the voltage across resistance, capacitance and inductance is  $10 \text{ V}$  each. If the capacitance is short circuited, the voltage across the inductance will be:  
a)  $\frac{10}{\sqrt{2}} \text{ V}$                       b)  $10 \text{ V}$                       c)  $10\sqrt{2} \text{ V}$                       d)  $20 \text{ V}$
- 80) A particle starting with certain initial velocity and uniform acceleration covers a distance of  $12 \text{ m}$  in first  $3 \text{ s}$  and a distance of  $30 \text{ m}$  in next  $3 \text{ s}$ . The initial velocity of the particle is:  
a)  $3 \text{ m/s}$                       b)  $2.5 \text{ m/s}$                       c)  $2 \text{ m/s}$                       d)  $1 \text{ m/s}$
- 81) A body is projected vertically upwards from the surface of earth with a velocity equal to half the escape velocity. If  $R$  be the radius of earth, maximum height attained by the body from the surface of the earth is:  
a)  $R/6$                       b)  $R/3$                       c)  $2R/3$                       d)  $R$
- 82) A pump on the ground floor of a building can pump up water to fill a tank of volume  $30 \text{ m}^3$  in  $15 \text{ min}$ . If the tank is  $40 \text{ m}$  above the ground, how much electric power is consumed by the pump?  
a)  $13.07 \text{ kW}$                       b)  $43.6 \text{ kW}$                       c)  $30.53 \text{ kW}$                       d)  $21.8 \text{ kW}$
- 83) The energy released when  $1000$  small water drops each of same radius  $10^{-7} \text{ m}$  coalesce to form one large drop is: (Surface tension of water is  $7 \times 10^{-2} \text{ N/m}$ )  
a)  $7.9 \times 10^{-9}$                       b)  $3.96 \times 10^{-12}$   
c)  $7.9 \times 10^{-12}$                       d)  $3.96 \times 10^{-9}$
- 84) A second's pendulum clock has a steel wire. The clock is calibrated at  $20^\circ\text{C}$ . How much time does the clock lose or gain in one week when the temperature is increased to  $30^\circ\text{C}$ ? ( $\alpha_{\text{steel}} = 1.2 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$ )  
a)  $0.3628 \text{ s}$                       b)  $36.28 \text{ s}$                       c)  $3.628 \text{ s}$                       d)  $362.8 \text{ s}$
- 85) A refrigerator is to maintain eatables kept inside at  $9^\circ\text{C}$ . If room temperature is  $36^\circ\text{C}$ , the coefficient of performance is:  
a)  $14.25$                       b)  $10.44$                       c)  $5.67$                       d)  $21.33$
- 86) The mean of  $5$  numbers is  $18$ . If one number is excluded, their mean becomes  $16$ . Then the excluded number is:  
a)  $16$                       b)  $25$                       c)  $26$                       d)  $30$
- 87) In  $\Delta ABC$ , the value of  $r \left( \cot \frac{B}{2} + \cot \frac{C}{2} \right)$  is equal to:  
a)  $a$                       b)  $b$                       c)  $c$                       d)  $R$
- 88) Two cards are drawn successively with replacement from a well shuffled deck of  $52$  cards. The probability of drawing two aces is:  
a)  $\frac{1}{13} \times \frac{1}{13}$                       b)  $\frac{1}{13} \times \frac{1}{7}$                       c)  $\frac{1}{52} \times \frac{1}{51}$                       d)  $\frac{1}{13} \times \frac{4}{51}$
- 89) The coefficient of the middle term in the binomial expansion, in powers of  $x$ , of  $(1 + \alpha x)^4$  and  $(1 - \alpha x)^6$  is same, if  $\alpha$  equals:  
a)  $3/5$                       b)  $10/3$                       c)  $-3/10$                       d)  $-5/3$
- 90) The point on the parabola  $y^2 = 18x$  such that the ordinate is three times the abscissa is:  
a)  $(2, 6)$                       b)  $(1, 3)$                       c)  $(-3, -9)$                       d)  $(4, 12)$
- 91) If  $2x - 3y = 0$  is the equation of the common chord of the circles  $x^2 + y^2 + 4x = 0$  and  $x^2 + y^2 + 2\lambda y = 0$ , then the value of  $\lambda$  is:  
a)  $-1$                       b)  $2$                       c)  $-3$                       d)  $3$
- 92) The number of solution of  $y' = \frac{y+1}{x-1}$  when  $y(1) = 2$  is:  
a) one                      b) two                      c) infinite                      d) no solution

- 93)  $\frac{d^2x}{dy^2}$  equals:  
a)  $\left(\frac{d^2y}{dx^2}\right)^{-1}$       b)  $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$       c)  $\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-2}$       d)  $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$
- 94) The value of  $\tan\left(\frac{1}{2}\cos^{-1}\frac{3}{5}\right)$  is equal to:  
a) 1/2      b) 1/4      c) 1/3      d) 3/4
- 95) If  $\vec{a}, \vec{b}, \vec{c}$  are mutually perpendicular unit vectors, then  $|\vec{a} + \vec{b} + \vec{c}|$  is equal to:  
a) 1      b) 3      c)  $2\sqrt{3}$       d)  $\sqrt{3}$
- 96) If the roots of the equation  $lx^2 + nx + n = 0$  are in ratio  $p:q$ , then  $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} =$   
a)  $-\sqrt{\frac{l}{n}}$       b)  $\sqrt{\frac{l}{n}}$       c)  $-\sqrt{\frac{n}{l}}$       d)  $\sqrt{\frac{n}{l}}$
- 97) The distance between the directrix of the rectangular hyperbola is 10 units. Then, the distance between the foci is:  
a) 10      b)  $5\sqrt{2}$       c) 20      d)  $10\sqrt{3}$
- 98) If the sum of the slopes of the lines  $x^2 + kxy - 3y^2 = 0$  is twice the product at the slopes, then  $k =$   
a) 1      b) 2      c) -2      d) 0
- 99)  $\int_0^{\frac{\pi}{2}} \frac{(\sin x + \cos x)^2}{\sqrt{1 + \sin 2x}} dx =$   
a) 2      b) 1      c) 0      d) 1/2
- 100) The equation of the plane through the intersection of the planes  $x + 2y + 3z - 4 = 0$  and  $4x + 3y + 2z + 1 = 0$  and passing through the origin is:  
a)  $3x + 4y + z = 0$       b)  $3x - 7y + 9z = 0$   
c)  $17x + 14y + 11z = 0$       d)  $15x + 2y + 4z + 7 = 0$

❖❖❖❖ Thank You!!! ❖❖❖❖