



## INSTITUTE OF ENGINEERING

### MODEL ENTRANCE EXAM

(SET – 1)

#### Instructions:

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

**Date :** 2081/02/12  
(May 25)

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



- 20) The rate of diffusion of methane is twice that of X. The molecular mass of X is:  
a) 16                                      b) 32                                      c) 80                                      d) 64
- 21) Acidity of  $\text{BF}_3$  can be explained on the basis of which of the following concept?  
a) Arrhenius concept                                      b) Bronsted-Lowry concept  
c) Lewis concept                                      d) Bronsted-Lowry as well as Lewis concept
- 22) Which of the following does not form sodium bisulphite addition product with sodium bisulphite solution?  
a)  $\text{HCHO}$                                       b)  $\text{C}_6\text{H}_5\text{COCH}_3$   
c)  $\text{C}_6\text{H}_5\text{CHO}$                                       d)  $\text{CH}_3\text{CHO}$
- 23) Which one of the following is the most basic in nature?  
a)  $\text{NH}_3$                                       b)  $\text{CH}_3\text{NH}_2$   
c)  $(\text{CH}_3)_2\text{NH}$                                       d)  $(\text{CH}_3)_3\text{N}$
- 24) The metallurgical process in which a metal is obtained in a fused state is called:  
a) smelting                                      b) roasting                                      c) calcination                                      d) froth floatation
- 25) The products formed when an aqueous solution of  $\text{NaBr}$  is electrolyzed in a cell having inert electrodes are:  
a)  $\text{Na}$  and  $\text{Br}_2$                                       b)  $\text{Na}$  and  $\text{O}_2$   
c)  $\text{H}_2$ ,  $\text{Br}_2$  and  $\text{NaOH}$                                       d)  $\text{H}_2$  and  $\text{O}_2$
- 26) Passivity of iron is due to the formation of:  
a)  $\text{Fe}_2\text{O}_3$                                       b)  $\text{Fe}_3\text{O}_4$                                       c)  $\text{FeSO}_4$                                       d)  $\text{Fe}(\text{OH})_3$
- 27) The quark combination for antineutron is:  
a)  $udd$                                       b)  $uud$                                       c)  $\bar{u}\bar{d}\bar{d}$                                       d)  $\bar{u}\bar{u}\bar{d}$
- 28) The dimensions for quantity of electricity are:  
a)  $\text{M}^0\text{L}^0\text{T}\text{A}$                                       b)  $\text{MLT}^{-2}\text{A}^0$   
c)  $\text{ML}^2\text{T}^{-2}\text{A}^0$                                       d)  $\text{M}^0\text{L}^0\text{T}^2\text{A}^2$
- 29) The moment of inertia of a circular ring of mass  $M$  and radius  $R$  about its diameter is:  
a)  $\text{MR}^2$                                       b)  $\text{MR}^2/2$                                       c)  $3.2 \text{MR}^2$                                       d)  $2/3 \text{MR}^2$
- 30) Young's modulus of a perfectly elastic body is:  
a) zero                                      b) infinity                                      c) 1                                      d) finite
- 31) The clouds float in atmosphere because of:  
a) their low temperature                                      b) their low viscosity  
c) their low-density                                      d) creation of low pressure
- 32) 50 g of benzene weighs:  
a) more in summer than in winter                                      b) equal in summer and in winter  
c) less in summer than in winter                                      d) more or less according to purity
- 33) The pressure of a gas in an enclosure is increased from 1 atmosphere to 4 atmosphere, the root mean square speed of gas molecules:  
a) remains same                                      b) becomes twice  
c) becomes four times                                      d) becomes half
- 34) The wavelength of monochromatic beam of light in vacuum is  $6000 \text{ \AA}$ . When this beam enters in a medium of refractive index 2.0, the wavelength will become/remains:  
a)  $6000 \text{ \AA}$                                       b)  $3000 \text{ \AA}$                                       c)  $4500 \text{ \AA}$                                       d)  $12000 \text{ \AA}$
- 35) Oil floating in water shows become coloured fringes due to:  
a) interference of light                                      b) refraction of light  
c) diffraction of light                                      d) polarization of light
- 36) The fundamental frequency of a closed organ pipe of length 0.25 m, is (speed of sound = 340 m/s):  
a) 170 Hz                                      b) 340 Hz                                      c) 680 Hz                                      d) 1360 Hz

- 37) An air capacitor is connected to a battery. The effect of filling the space between the plates with a dielectric is to increase:
- the charge and the potential difference
  - the potential difference and the electric field
  - the electric field and the capacitance
  - the charge and the capacitance
- 38) An electron moves with uniform velocity  $v$  and enters a region of uniform magnetic field  $B$ . If  $v$  and  $B$  are parallel to each other, then the electron will:
- continue to move in the same direction
  - move in a direction perpendicular to  $B$
  - move in a circular path
  - stop immediately
- 39) Which of the following is true for a wattless circuit?
- inductance is zero
  - capacitance is zero
  - resistance is zero
  - net reactance is zero
- 40) When a radioactive nucleus emits a  $\beta$ -particle, the mass number of an atom:
- increases by one
  - remains same
  - decreases by one
  - decreases by four
- 41) If the sum of roots of the equation  $(a + 1)x^2 + (2a + 3)x + 3a + 4 = 0$  is  $-3$ , then the product of roots is:
- 1
  - 4
  - 3
  - $-2$
- 42)  $1 + \frac{(\log x)^2}{2!} + \frac{(\log x)^2}{4!} + \dots =$
- $x$
  - $\frac{1}{x}$
  - $\frac{x+x^{-1}}{2}$
  - $\frac{e^x + e^{-x}}{2}$
- 43) The  $n^{\text{th}}$  term of a G.P. is 128 and the sum of its  $n$  terms is 255. If its common ratio is 2, then its first term is:
- 1
  - 2
  - 3
  - 4
- 44) Let  $E$  be the set of all integers with 1 at their unit places. The probability that a number chosen from  $\{2, 3, 4, \dots, 50\}$  is an element of  $E$ , is:
- $\frac{5}{49}$
  - $\frac{4}{49}$
  - $\frac{3}{49}$
  - $\frac{2}{49}$
- 45) Let  $A$  be a square matrix of order  $n \times n$ . Then  $A$  is called a symmetric matrix if:
- $|A| = 0$
  - $|A| \neq 0$
  - $A^T = A$
  - $A^T = -A$
- 46) In a hall, there are 10 bulbs and their 10 buttons. In how many ways this hall can be enlightened?
- $10^2$
  - 1023
  - $2^{10}$
  - $10!$
- 47) The period of  $f(x) = \cos 4x + \tan 3x$  is:
- $\frac{\pi}{3}$
  - $\frac{\pi}{2}$
  - $\frac{\pi}{6}$
  - $\pi$
- 48)  $\lim_{x \rightarrow \infty} \frac{\tan x}{x}$  equals:
- 1
  - 0
  - $\infty$
  - does not exist
- 49) If  $y = \tan^{-1}(\cot x) + \cot^{-1}(\tan x)$ , then  $\frac{dy}{dx} =$
- 1
  - 0
  - 1
  - 2
- 50) The tangent to a given curve is parallel to x-axis if:
- $\frac{dy}{dx} = 0$
  - $\frac{dy}{dx} = 1$
  - $\frac{dx}{dy} = 0$
  - $\frac{dx}{dy} = 1$
- 51)  $\int_{\pi/6}^{\pi/2} \frac{\cos x}{\sin^2 x} =$
- 0
  - 1
  - 1
  - 2

- 52) The equation of line which passes through the point  $(-2, 5)$  and cuts off equal intercepts on the axes is:  
 a)  $x + y - 3 = 0$       b)  $x - y + 3 = 0$       c)  $x + y + 3 = 0$       d)  $x - y - 3 = 0$
- 53) The equation  $ax^2 + 3xy - 7y^2 = 0$  represents two lines inclined at an angle  $\pi$  if  $a =$   
 a)  $7/9$       b)  $9/7$       c)  $2$       d)  $3/7$
- 54) If the parabola  $y^2 = 4ax$  passes through  $(3, 2)$ , then length of latus rectum is:  
 a)  $2/3$       b)  $4/3$       c)  $9/2$       d)  $4$
- 55) If  $5x^2 + \lambda y^2 = 20$  represents a rectangular hyperbola, then  $\lambda =$   
 a)  $5$       b)  $-5$       c)  $3$       d)  $-4$
- 56) The equation of a plane through the point  $(1, -1, 2)$  and parallel to the plane  $2x - 3y + z = 0$  is:  
 a)  $2x - 3y + z = 7$       b)  $2x + 3y - z = 7$   
 c)  $2x - 3y + z = 2$       d)  $2x + 3y - z = 2$
- 57) The value of  $\tan(180^\circ + \theta) \cdot \tan(90^\circ - \theta)$  is:  
 a)  $1$       b)  $-1$       c)  $0$       d)  $2$
- 58) The number of solutions of  $\sin^2 \theta + 3 \cos \theta = 3$  in  $[-\pi, \pi]$  is:  
 a)  $4$       b)  $2$       c)  $0$       d)  $1$
- 59) If  $\cos(2 \sin^{-1} x) = \frac{1}{9}$ , then  $x$  is equal to:  
 a)  $2/3$       b)  $-2/3$       c)  $\pm 2/3$       d)  $4/5$
- 60) The vectors  $\vec{a} = 5\hat{i} + 4\hat{j}$  and  $\vec{b} = -20\hat{i} - 60\hat{j}$  are  
 a) coincident      b) parallel  
 c) perpendicular      d) neither parallel nor perpendicular

### SECTION - B

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

By using tiny probes as neural prostheses, scientists may be able to restore nerve function in quadriplegics and make the blind see or the deaf hear. Thanks to advanced techniques, a single, small, implanted probe can stimulate individual neurons electrically or chemically and then record responses. Preliminary results suggest that the microprobe telemetry systems can be permanently implanted and replace damaged or missing nerves.

The tissue-compatible microprobes represent an advance over the typical aluminum wire electrodes used in studies of the cortex and other brain structures. Researchers accumulate much data using traditional electrodes, but there is a question of how much damage they cause to the nervous system. Microprobes, which are about as thin as a human hair, cause minimal damage and disruption of neurons when inserted into the brain.

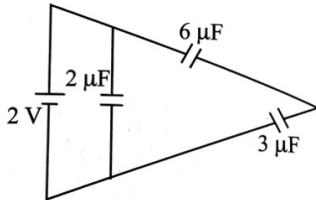
In addition to recording nervous-system impulses, the microprobes have minuscule channels that open the way for delivery of drugs, cellular growth factors, neurotransmitters, and other neuroactive compounds to a single neuron or to groups of neurons. Also, patients who lack certain biochemicals could receive doses via prostheses. The probes can have up to four channels, each with its own recording/stimulating electrode.

- 61) One similar feature of microprobes and wire electrodes is:  
 a) a minimal disturbance of neurons.      b) the density of the material.  
 c) the capacity for multiple leads.      d) their ability to generate information.
- 62) Which of the following best expresses the main idea of the passage?  
 a) Microprobes require further techno-logical advances before they can be used in humans.  
 b) Wire electrodes are antiquated as a means for delivering neuroactive compounds to the brain.  
 c) Microprobes have great potential to help counteract neural damage.  
 d) Technology now exists that may enable repair of the nervous system.

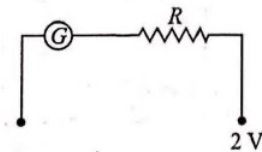


- 79)  $\lim_{x \rightarrow 1} \frac{ab^x - a^x b}{x-1} =$   
 a)  $ab \log(ab)$       b)  $ab \log\left(\frac{a}{b}\right)$       c)  $ab \log\left(\frac{b}{a}\right)$       d)  $\frac{a}{b} \log(ab)$
- 80) If  $\sin y = x \sin(a + y)$ , then  $\frac{dy}{dx}$  equals:  
 a)  $\sin(a + y)$       b)  $\sin^2(a + y)$       c)  $\frac{\sin(a+y)}{\sin a}$       d)  $\frac{\sin^2(a+y)}{\sin a}$
- 81) The angle of intersection between the curves  $x^2 = 32y$  and  $y^2 = 4x$  at the point (16, 8) is:  
 a)  $60^\circ$       b)  $90^\circ$       c)  $\tan^{-1}\left(\frac{3}{5}\right)$       d)  $\tan^{-1}\left(\frac{4}{3}\right)$
- 82)  $\int \frac{dx}{\sqrt{x(3+x)}} =$   
 a)  $\frac{1}{\sqrt{3}} \tan^{-1} \frac{\sqrt{x}}{3} + c$       b)  $\frac{2}{\sqrt{3}} \tan^{-1} \sqrt{\frac{x}{3}} + c$       c)  $\frac{1}{\sqrt{3}} \sin^{-1} \sqrt{\frac{x}{3}} + c$       d)  $\frac{2}{\sqrt{3}} \cos^{-1} \frac{\sqrt{x}}{3} + c$
- 83) The area enclosed within the curve  $|x| + |y| = 1$  is:  
 a) 1      b)  $2\sqrt{2}$       c)  $\sqrt{2}$       d) 2
- 84) The value of h for which the equation  $3x^2 + 2hxy - 3y^2 - 40x + 30y - 75 = 0$  represents a pair of straight lines are:  
 a) 4, 4      b) 4, 6      c) 4, -4      d) 0, 4
- 85) If the circle  $x^2 + y^2 + 4x + 22y + c = 0$  bisects the circumference of the circle  $x^2 + y^2 - 2x + 8y - d = 0$ , then  $c + d =$   
 a) 60      b) 50      c) 40      d) 56
- 86) If for the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , y-axis is the minor axis and the length of latus rectum is one half of the length of its minor axis, then its eccentricity is:  
 a)  $1/2$       b)  $1/\sqrt{2}$       c)  $\sqrt{3}/2$       d)  $3/4$
- 87) A line makes angles  $\frac{\alpha}{2}, \frac{\beta}{2}, \frac{\gamma}{2}$  with the positive direction of coordinate axes, then  $\cos \alpha + \cos \beta + \cos \gamma$  is equal to:  
 a) 1      b) -1      c) 2      d) -2
- 88) An aeroplane flying horizontally with a speed of 360 km/hr releases a bomb at a height of 490 m from the ground. If  $g = 9.8 \text{ m/s}^2$ , it will strike the ground at:  
 a) 10 km      b) 100 km      c) 1 km      d) 16 km
- 89) A solid sphere of mass m and radius R is rotating about its diameter. A solid cylinder of the same mass and same radius is also rotating about its geometrical axis with an angular speed twice that of the sphere. The ratio of their kinetic energies of rotation ( $E_{\text{sphere}}/E_{\text{cylinder}}$ ) will be:  
 a) 2:3      b) 1:5      c) 1:4      d) 3:1
- 90) A particle of mass m is placed at the centre of a uniform spherical shell of mass 3m and radius R. The gravitational potential on the surface of shell is:  
 a)  $-\frac{Gm}{R}$       b)  $-\frac{3Gm}{R}$   
 c)  $-\frac{4Gm}{R}$       d)  $-\frac{2Gm}{R}$
- 91) Eight drops of water, each of radius 2 mm are falling through air at a terminal velocity of 8 cm/s. If they coalesce to form a single drop, then the terminal velocity of the combined drop will be:  
 a) 32 cm/s      b) 30 cm/s      c) 28 cm/s      d) 24 cm/s
- 92) The volume of a metal sphere increases by 0.24% when its temperature is raised by  $40^\circ\text{C}$ . The coefficient of linear expansion of the metal is:  
 a)  $2 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$       b)  $6 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$   
 c)  $18 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$       d)  $1.2 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$

- 93) A mass of diatomic gas ( $\gamma = 1.4$ ) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from  $27^\circ\text{C}$  to  $927^\circ\text{C}$ . The pressure of the gas in the final state is:
- a) 8 atm                      b) 28 atm                      c) 68.7 atm                      d) 256 atm
- 94) Two tuning forks, A and B, produce notes of frequencies 258 Hz and 262 Hz. An unknown note sounded with A produces certain beats. When the same note is sounded with B, the beat frequency gets doubled. The unknown frequency is:
- a) 250 Hz                      b) 252 Hz                      c) 254 Hz                      d) 256 Hz
- 95) The total energy stored in the condenser system shown in the figure will be:



- a) 8  $\mu\text{J}$                       b) 16  $\mu\text{J}$                       c) 2  $\mu\text{J}$                       d) 4  $\mu\text{J}$
- 96) A ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. The magnetic field in the core for a magnetizing current of 1.2 A is:
- a) 2.48 T                      b) 3.48 T                      c) 4.48 T                      d) 5.48 T
- 97) A voltmeter which can measure 2 V is constructed by using a galvanometer of resistance 12  $\Omega$  and that produces maximum deflection for the current of 2 mA, then the resistance R is:



- a) 888  $\Omega$                       b) 988  $\Omega$                       c) 898  $\Omega$                       d) 999  $\Omega$
- 98) A circuit consists of a resistance of 10  $\Omega$  and a capacitance of 0.1  $\mu\text{F}$ . If an alternating emf of 100 V, 50 Hz is applied, the current in the circuit is:
- a) 3.14 mA                      b) 6.28 mA                      c) 1.51 mA                      d) 7.36 mA
- 99) For a glass prism ( $\mu = \sqrt{3}$ ), angle of minimum deviation is equal to angle of the prism. The angle of the prism is:
- a)  $45^\circ$                       b)  $30^\circ$                       c)  $90^\circ$                       d)  $60^\circ$
- 100) A triply ionized beryllium ( $\text{Be}^{3+}$ ) has the same orbital radius as the ground state of hydrogen. Then the quantum state 'n' of  $\text{Be}^{3+}$  is:
- a)  $n = 1$                       b)  $n = 2$                       c)  $n = 3$                       d)  $n = 4$

❖❖❖❖ Thank You!!! ❖❖❖❖