# 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: 2080/04/06**
**(July-22)**

**Duration: 2 hours**
**Time: 8 AM – 10 AM**

# Section-A (1 marks)

1) Often a team of engineers _____ on one project.
a) works b) work c) are working d) have worked

2) I am chosen for the contest, _____?
a) aren't I b) do I c) am I d) don't I

3) He stopped _____ and doesn't do it anymore.
a) smoked b) smoking c) to smoke d) smokes

4) He congratulated me for what I _____.
a) did b) had done c) have done d) was doing

5) I would rather that he _____ the work next week.
a) completed b) completes c) must complete d) complete

6) He aimed the gun _____ me.
a) on b) in c) at d) by

7) The prices are going up by leaps and bounds.
a) irregularly b) gradually c) rapidly d) systematically

8) Audacious (Synonym):
a) Manifest b) Obvious c) Venture d) Daring

9) Replete (Antonym):
a) Stuffed b) Enumerate c) Concise d) Starved

10) He said to his servant, "Why are you so lazy today?"
a) He asked his servant why he was so lazy that day.
b) He asked his servant why he had been so lazy that day.
c) He asked his servant why he was being so lazy that day.
d) He asked his servant why was he so lazy that day.

11) /reIz/ is the phonetic transcription of:
a) rise b) rice c) raise d) risk

12) The compound sentence of "To his eternal disgrace, he betrayed his country." is:
a) He betrayed his country is an eternal disgrace.
b) For him betraying his country was an eternal disgrace.
c) He betrayed his country and this was to his eternal disgrace.
d) Eternal disgrace was his betraying the country.

13) The magnetic force acting on a current carrying conductor of length l carrying current i is given by: $F = Bil \sin\theta$, the dimensions of magnetic field induction B are:
a) $[MLT^{-2}A^{-1}]$ b) $[MT^{-2}A^{-1}]$ c) $[ML^2T^{-2}A^{-1}]$ d) $[LT^{-2}A^{-1}]$

14) Which of the following is a vector quantity?
a) electric current b) weight c) temperature d) pressure

15) At the top of the trajectory of a projectile, the direction of its velocity and acceleration are:
a) parallel to each other
b) perpendicular to each other
c) inclined to each other at an angle of 45°
d) inclined to each other at an angle of 60°

16) A stone, tied to the end of a 20 cm long string, is revolved in a horizontal circle. If the centripetal acceleration is 9.8 $m/s^2$, its angular speed is:
a) 22/7 rad/s b) 7 rad/s c) 14 rad/s d) 20 rad/s

17) Water rises in a capillary tube to a height H, when the capillary is vertical. If the same capillary is now inclined to the vertical, the length of water column in it will:
a) decrease
b) increase
c) will not change
d) may increase or decrease depending on the angle of inclination

18) The moderator in a nuclear reactor:
a) absorbs neutrons b) accelerate neutrons
c) slows downs neutrons d) absorbs thermal energy

19) Which of the following is not deflected by electric and magnetic field?
a) $\alpha$-particle b) $\beta$-particle c) photon d) proton

20) A horizontal straight conductor, placed along south-north direction falls under gravity, then there is:
a) an induced current from south to north direction
b) an induced current from north to south direction
c) no induce emf along the length of the conductor
d) an induced emf along the length of the conductor

21) The magnetic permeability is maximum for:
a) diamagnetic b) paramagnetic c) ferromagnetic d) equal for all

22) When a dielectric medium is inserted between the plates of a capacitor:
a) its capacitance increases b) its capacitance decreases
c) its capacitance remains unchanged d) p.d. between the plates increases

23) The wavelike properties shown by a column of soldiers marching obliquely from a hard road into soft muddy track is:
a) reflection b) refraction c) diffraction d) interference

24) Spherical aberration of a thin lens can be reduced by:
a) using a monochromatic light
b) using a doublet combination
c) using a circular annular mask over the lens
d) increasing the size of the lens

25) When the moon is near horizon, it appears bigger due to:
a) atmospheric refraction b) scattering of light
c) diffraction d) total internal reflection

26) The temperature of an ideal gas is increased from 27˚C to 927˚C. The root mean square speed of its molecules becomes:
a) twice b) halved c) four times d) one fourth

27) Hydrogen may be liquefied at -235˚C under a pressure of 20 atmospheres. What is this temperature on the Fahrenheit scale?
a) -91˚F b) -191˚F c) -291˚F d) -391˚F

28) The graph between length and time period of a simple pendulum is:
a) a straight-line b) a circle c) a parabola d) a hyperbola

29) A semiconductor device is connected in a series circuit with a battery and a resistance. A current is found to pass through the circuit. If the polarity of the battery is reversed, the current drops almost to zero. The device may be:
a) a p-type semiconductor b) a n-type semiconductor
c) a p-n junction d) an intrinsic semiconductor

30) $\lim_{x\to\infty} x\cos\left(\frac{\pi}{4x}\right).\sin\left(\frac{x}{4\pi}\right) =$
a) 1 b) $\pi/2$ c) $\pi/4$ d) 0

31) If $y = \tan^{-1}(\cot x)$, then $\frac{dy}{dx} =$
a) $-\operatorname{cosec}^2 x$ b) $\sin^2 x$ c) $-\cot x\,.\operatorname{cosec} x$ d) -1

32) The interval in which the function $f(x) = 2x^3 - 9x^2 + 12x - 20$ is decreasing in:
a) $[2,\infty)$ b) $(-\infty,2]$ c) $[1,\infty)$ d) $(1,2)$

33) $\int \frac{dx}{x(1+\log x)} =$
a) $\log(\log x) + c$ b) $\log x + c$ c) $(1+\log x) + c$ d) $\log(1+\log x) + c$

34) $\int_0^1 \left(\sin^{-1}\frac{2x}{1+x^2} + 2\cot^{-1} x\right) dx =$
a) $\pi/6$ b) $\pi$ c) $2\pi$ d) $3\pi$

35) If when $f(x) = 3x^2 - 2x + k$ is divided by (x-2), the remainder is 3. The value of k is:
a) -3 b) -5 c) 3 d) 5

36) If $y = 1 + \frac{x^2}{1!} + \frac{x^4}{2!} + \frac{x^6}{3!} + \cdots$, then $x =$
a) $e^{-y}$ b) $e^{y}$ c) $\sqrt{\log y}$ d) $\frac{e^y}{2}$

37) $(1+i)^6 + (1-i)^6 =$
a) 0 b) $2^7$ c) $2^6$ d) 1

38) If $A = \begin{bmatrix} 2 & -1 \\ -3 & 4 \end{bmatrix}$, then adj. A is equal to:
a) $\begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$ b) $\begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ c) $\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$ d) $\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$

39) If 4 parallel lines intersect another set of 3 parallel lines, then the number of parallelograms formed with these lines is:
a) 6 b) 9 c) 12 d) 18

40) If $f(x) = 2\sin x, g(x) = \cos^2 x$, then $(f+g)\frac{\pi}{3} =$
a) 1 b) $\frac{2\sqrt{3}+1}{4}$ c) $\sqrt{3} + \frac{1}{4}$ d) $\sqrt{3} + \frac{1}{2}$

41) If $A = \{3^{2n} - 1 : n \in N\}, B = \{8n : n \in N\}$, then:
a) $A = B$ b) $A \subset B$ c) $B \subset A$ d) $A \cap B = \phi$

42) The slope of the line joining two points on the curve $y = x^2 + 2x$ with abscissae 1 and 3 is:
a) 6 b) 5 c) 4 d) 3

43) Lines represented by $9x^2 + y^2 + 6xy - 4 = 0$ are:
a) coincident b) parallel but not coincident
c) not parallel d) parallel

44) The length of chord joining the points in which the straight line $4x + 3y = 5$ cuts the circle $x^2 + y^2 = 26$ is:
a) 5 units b) 10 units c) 20 units d) 25 units

45) If the line $2x + y + \lambda$ is a normal to the parabola $y^2 = -8x$, then $\lambda =$
a) 12 b) -12 c) 24 d) -24

46) The length of latus rectum of the hyperbola $9y^2 - 4x^2 = 36$ is:
a) 9 b) 8/9 c) 4/9 d) 9/2

47) The locus of a point P(x, y, z) which moves in such a way that $z = c$ is a:
a) line parallel to z-axis b) plane parallel to xy-plane
c) line parallel to y-axis d) line parallel to x-axis

48) The maximum value of $12\sin\theta - 9\sin^2\theta$ is:
a) 3 b) 4 c) 5 d) 6

49) The value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is:
a) $\frac{7\pi}{6}$ b) $\frac{\pi}{3}$ c) $\frac{2\pi}{3}$ d) $\frac{5\pi}{6}$

50) 1 litre of $O_2$ at NTP weighs:
a) 1.43 g b) 2.85 g c) 0.71 g d) 2.3 g

51) Magnetic quantum number gives:
a) Nuclear stability b) Orbital orientation
c) Shape of orbital d) Size of orbital

52) Hydrogen bonding is not present in:
a) $H_2O$ b) $H_2S$ c) Glycerol d) $HF$

53) The oxidation number of chromium in $Cr_2O_7{}^{2-}$ is:
a) +7 b) +3 c) +5 d) +6

54) Which of the following elements have least value for electronegativity?
a) Oxygen b) Boron
c) Carbon d) Nitrogen

55) If a salt bridge is removed between the two half cells, the voltage:
a) drops to zero b) does not change
c) increases gradually d) decreases rapidly

56) Catalyst used in the manufacture of sulphuric acid by contact process is:
a) Finely divided iron b) NO
c) $N_2O$ d) $V_2O_5$

57) The chemical composition of slag formed during smelting process in the extraction of copper is:
a) $Cu_2S + FeS$ b) $FeSiO_3$
c) $CuFeS_2$ d) $CuSiO_3$

58) White vitriol is:
a) $CuSO_4.5H_2O$ b) $FeSO_4.7H_2O$
c) $ZnSO_4.7H_2O$ d) $CaSO_4.2H_2O$

59) The reaction between ethylene and bromine is an example of:
a) electrophilic addition b) electrophilic substitution
c) nucleophilic addition d) nucleophilic substitution

60) What type of isomerism is shown by diethyl ether and methyl propyl ether?
a) chain b) functional c) metamerism d) position

## Section-B (2 marks)

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

One of the most hazardous conditions a firefighter will ever encounter is a backdraft (also known as a smoke explosion). A backdraft can occur in the hot-smoldering phase of a fire when burning is incomplete and there is not enough oxygen to sustain the fire. Unburned carbon particles and other flammable products, combined with the intense heat, may cause instantaneous combustion if more oxygen reaches the fire.

Firefighters should be aware of the conditions that indicate the possibility for a backdraft to occur. When there is a lack of oxygen during a fire, the smoke becomes filled with carbon dioxide or carbon monoxide and turns dense gray or black. Other warning signs of a potential backdraft are little or no visible flame, excessive heat, smoke leaving the building in puffs, muffled sounds, and smoke-stained windows.

Proper ventilation will make a backdraft less likely. Opening a room or building at the highest point allows heated gases and smoke to be released gradually. However, suddenly breaking a window or opening a door is a mistake, because it allows oxygen to rush in, causing an explosion.

61) A backdraft is a dangerous condition for firefighters mainly because
a) there is not enough oxygen for breathing.
b) the heat is extremely intense.
c) the smoke is dangerously thick.
d) an explosion occurs.

62) Which of the following is not mentioned as a potential backdraft warning sign?
a) windows stained with smoke b) flames shooting up from the building
c) puffs of smoke leaving the building d) more intense heat than usual

63) To prevent the possibility of a backdraft, a firefighter should
a) carry an oxygen tank.
b) open a door to allow gases to escape.
c) make an opening at the top of the building.
d) break a window to release carbon particles.

64) When compared with a hot, smoldering fire, a fire with visible, high-reaching flames
a) has more oxygen available for combustion.
b) has more carbon dioxide available for consumption.
c) produces more dense gray smoke.
d) is more likely to cause a backdraft.

65) A ball is released from the top of a tower of height h metres. If it takes T seconds to reach the ground, the position of the ball at time T/3 is:
a) $\frac{h}{9}$ m from the ground b) $\frac{7h}{9}$ m from the ground
c) $\frac{8h}{9}$ m from the ground d) $\frac{17h}{18}$ m from the ground

66) A block is lying on an inclined plane which makes an angle of 60˚ with the horizontal. If coefficient of friction between the block and the plane is 0.25 and $g = 10\ m/s^2$, the acceleration of block when it moves along the plane will be:'
a) 2.50 $m/s^2$ b) 5.00 $m/s^2$ c) 7.40 $m/s^2$ d) 8.66 $m/s^2$

67) A flywheel is a uniform disc of mass 72 kg and radius 50 cm. When it is rotating at the rate of 70 rpm, its kinetic energy is:
a) 142 J b) 242 J c) 342 J d) 400 J

68) The escape velocity from the earth is about 11 km/second. The escape velocity from a planet having double the radius and the same mean density as that of the earth is:
a) 22 km/second b) 11 km/second c) 5.5 km/second d) 15.5 km/second

69) A vessel contains a liquid (density 1.2 g/cc) over mercury (density 13.5 g/cc). A homogenous sphere floats with one-third of its volume immersed in mercury and the other two-thirds in liquid. The density of the material of the sphere in g/cc is:
a) 7.3 b) 9.4 c) 5.3 d) 14.7

70) A steel rod and a copper rod have the same difference in length at all temperatures $(\alpha_{copper} = 18 \times 10^{-6}K^{-1}, \alpha_{steel} = 12 \times 10^{-6}K^{-1})$. If the length of copper rod is 16 cm, the length of steel rod is:
a) 20 cm b) 18 cm c) 24 cm d) 30 cm

71) If the pressure of an ideal gas contained in a vessel is increased by 0.5 %, the increase in temperature is 2˚C. The initial temperature of the gas is:
a) 27˚C b) 127˚C c) 300˚C d) 400˚C

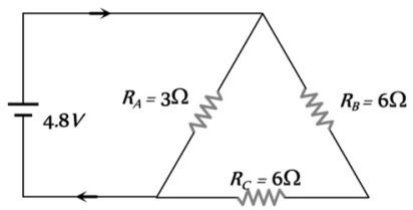
72) An organ pipe $P_1$ closed at one end and vibrating in its first overtone and another pipe $P_2$ open at both ends vibrating in its second overtone are in resonance. The ratio of lengths of $P_1$ to that of $P_2$ is:
a) 1 b) 1/2 c) 1/3 d) 3/4

73) A wave of light of wavelength 6000 Å falls on a plane surface $(\mu = \sqrt{3})$. If the reflected and refracted rays are perpendicular to each other, the angle of incidence is:
a) 30˚ b) 45˚ c) 60˚ d) 90˚

74) A screen is placed 50 cm from a single slit which is illuminated with light of wavelength 6000 Å. If the distance between first and third minima in the diffraction patterns is 3.0 mm, the width of slit is:
a) $1 \times 10^{-4}$ m b) $2 \times 10^{-4}$ m c) $0.5 \times 10^{-4}$ m d) $4 \times 10^{-4}$ m

75) A uniformly charged conducting sphere of 4.4 m diameter has a surface charge density of 60 $\mu C\ m^{-2}$. The charge on the sphere is:
a) $8.6 \times 10^{-3}$ C b) $4.7 \times 10^{-3}$ C c) $5.7 \times 10^{-3}$ C d) $3.7 \times 10^{-3}$ C

76) The current in the given circuit is:




a) 8.31 A b) 6.82 A c) 4.92 A d) 2 A

77) Through two parallel wires A and B, 10 and 2 amperes of currents are passed respectively in opposite direction. If the wire A is infinitely long and the length of the wire B is 2 m, the force on the conductor B, which is situated at 10 cm distance from A will be:
a) $8 \times 10^{-5}$ N b) $4 \times 10^{-7}$ N c) $4 \times 10^{-5}$ N d) $8 \times 10^{-7}$ N

78) If the wavelength of first line of the Balmer series of hydrogen is 6561 Å, the wavelength of the second line of series should be:
a) 13122 Å b) 3280 Å c) 4860 Å d) 2187 Å

79) The end product of the following sequence of operations is:
$CaC_2 \xrightarrow{H_2O} (A) \xrightarrow{H_2SO_4, HgSO_4} (B) \xrightarrow{LiAlH_4, [H]} (C)$
a) methyl alcohol b) ethyl alcohol c) acetaldehyde d) ethylene

80) The IUPAC name of $Cl - CH_2 - CH = \underset{\displaystyle CH_2CH_3}{\overset{\displaystyle |}{C}} - CH_2OH$ is:
a) 1-chloro-2-ethyl-4-hydroxybut-2-ene b) 4-hydroxy-1-chloro-2-ethylbut-2-ene
c) 4-choro-2-ethylbut-2-en-1-ol d) 2-ethyl-4-chlorobut-2-en-1-ol

81) The $p^H$ of a solution prepared by dissolving 2.0 gram of NaOH in water and diluting to 500 mL is:
a) 1 b) 12
c) 13 d) 2

82) A metal oxide contains 30% of oxygen. 100 cc of the metal chloride vapours at STP weighs 0.72 g. The formula for metal chloride is:
a) $MCl$ b) $MCl_2$
c) $MCl_3$ d) $MCl_4$

83) A cell is constructed by coupling a standard copper electrode and a standard magnesium electrode has emf of 2.7 V. If the standard reduction potential of copper electrode is +0.34 V, then that of magnesium electrode is:
a) +3.04 V b) -3.04 V c) +2.36 V d) -2.36 V

84) Which of the following order is correct regarding their dipole moments?
a) $BF_3 > NF_3 > NH_3$ b) $NF_3 > BF_3 > NH_3$
c) $NH_3 > BF_3 > NF_3$ d) $NH_3 > NF_3 > BF_3$

85) A solid compound 'X' on heating gives $CO_2$ gas and a residue. The residue mixed with water forms 'Y'; on passing an excess of $CO_2$ through 'Y' in water, a clear solution 'Z' is obtained. On boiling 'Z' compound 'X' is reformed. The compound 'X' is:
a) $Ca(HCO_3)_2$ b) $CaCO_3$ c) $Na_2CO_3$ d) $K_2CO_3$

86) If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitude a, then $|\vec{a} + \vec{b} + \vec{c}|$ is equal to:
a) a b) $\sqrt{2}$a c) $\sqrt{3}$a d) 2a

87) In a ΔPQR, $\angle R = \frac{\pi}{2}$. If $\tan\frac{P}{2}$ and $\tan\frac{Q}{2}$ are the roots of the equation $ax^2 + bx + c = 0$ $(a \neq 0)$, then:
a) $a + b = c$ b) $b + c = a$ c) $c + a = b$ d) $b = c$

88) The value of $\lim_{x\to 0} \frac{\tan x - \sin x}{x^3}$ is:
a) 1/2 b) 1/3 c) 1/4 d) 1/5

89) If $y = \log\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx} =$
a) $\frac{-4x^3}{1-x^4}$ b) $\frac{4}{1-x^4}$ c) $\frac{-4x}{1-x^4}$ d) $\frac{4x^3}{1-x^4}$

90) The point on the curve $y^2 = x$ where tangent makes 45° angle with x-axis is:
a) $\left(\frac{1}{2}, \frac{1}{4}\right)$ b) $\left(\frac{1}{4}, \frac{1}{2}\right)$ c) (4,2) d) (1, 1)

91) $\int \frac{\cot\sqrt{x}}{2\sqrt{x}} dx =$
a) $2\log|\sin\sqrt{x}| + c$ b) $\log|\sin\sqrt{x}| + c$
c) $\frac{1}{2}\log|\sin\sqrt{x}| + c$ d) $\frac{1}{2}\log|\cos\sqrt{x}| + c$

92) The area bounded by the parabola $y^2 = 4ax$, x-axis and its latus rectum is:
a) $\frac{2}{3}a^2$ b) $\frac{4}{3}a^2$ c) $\frac{8}{3}a^2$ d) $\frac{16}{3}a^2$

93) If the term independent of x in the expansion of $\left(\sqrt{x}-\frac{k}{x^2}\right)^{10}$ is 405, then $k=$

a) -3 b) 3 c) $\pm 3$ d) $\pm 5$

94) Three consecutive terms of HP are 30, 24, 20. The next term of the progression is:

a) 7/120 b) 120/7 c) 18 d) 7/18

95) If $A=\begin{bmatrix}2 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 2\end{bmatrix}$, then $A^5=$

a) 2A b) 4A c) 8A d) 16A

96) If $f: R \to R$ is defined by $f(x)=\frac{1}{2-3\cos x}$ for each $x \in R$, then the range of f is:

a) $\left[\frac{1}{3}, 1\right]$ b) $\left(\frac{1}{3}, 1\right)$ c) $(1, 2)$ d) $[1, 2]$

97) The equation of the bisector of the angle between the lines $3x-4y+10=0$ and $5x-12y-10=0$ in which the origin does not lie is:

a) $7x+4y+90=0$ b) $4x-7y+5=0$

c) $4x+7y+5=0$ d) $7x-4y+90=0$

98) If the circles $x^2+y^2+2x-8y+8=0$ and $x^2+y^2+10x-2y+22=0$ touch externally, then the equation of their common tangent at the point of contact is:

a) $4x+3y-7=0$ b) $4x+3y+7=0$

c) $3x+4y-7=0$ d) $3x+4y+7=0$

99) If $(\pm 1, 0)$ and $(\pm 2, 0)$ are respectively the foci and vertices of an ellipse, then the length of its minor axis is:

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

100) If co-ordinates of A, B, C, D are (2, 3, -1), (3, 5, -3), (1, 2, 3) and (3, 5, 7) respectively, then projection of AB on CD is:

a) 0 b) $\sqrt{3}$ c) 2 d) 4

Thank You!!!!!!