GATE XE 2015

AI25BTECH11003 - Bhavesh Gaikwad

General Aptitude

1) Choose the most appropriate word from the options given below to complete the following sentence.
The principal presented the chief guest with a _____ as token of appreciation.
(GATE 2015 XE)

a) momento b) memento c) momentum d) moment

2) Choose the appropriate word/phrase to complete the following sentence: Frogs _____.
(GATE 2015 XE)

a) croak b) roar c) hiss d) patter

3) Choose the word most similar in meaning to the given word: **Educe**
(GATE 2015 XE)

a) Exert b) Educate c) Extract d) Extend

4) Operators, $\diamondsuit$ and $\square$, are defined by: $a\diamondsuit b = \frac{a-b}{a+b}$; $a\square b = \frac{a+b}{a-b} = ab$. Find the value of $(6\diamondsuit 6)\square(6\diamondsuit 6)$.

(GATE 2015 XE)

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

5) If $\log_x\left(\frac{5}{7}\right) = -\frac{1}{3}$, then the value of x is

(GATE 2015 XE)

a) $\frac{343}{125}$ b) $\frac{125}{343}$ c) $\frac{-25}{49}$ d) $\frac{-49}{25}$

6) The following sentence has a part underlined. Choose the most effective alternative:
Tuberculosis, together with its effects, ranks one of the leading causes of death in India.
(GATE 2015 XE)

a) ranks as one of the leading causes of death
b) rank as one of the leading causes of death
c) has the rank of one of the leading causes of death
d) are one of the leading causes of death

7) Read the paragraph and choose the correct statement.
Climate change has reduced human security and threatened human well-being. An ignored reality is that human security largely depends upon environmental security. But on the contrary, human progress seems contradictory to environmental security.
(GATE 2015 XE)

a) Human progress and security are positively associated with environmental security.
b) Human progress is contradictory to environmental security.
c) Human security is contradictory to environmental security.
d) Human progress depends upon environmental security.

8) Fill in the missing value:

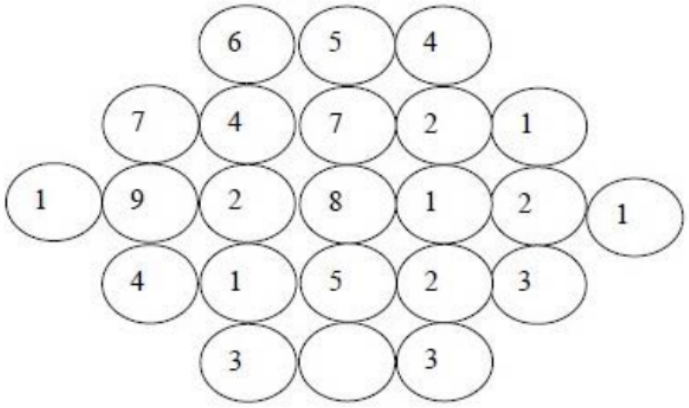

Fig. 8: Puzzle

(GATE 2015 XE)

9) A cube of side 3 units is formed using smaller cubes of side 1 unit. Find the proportion of faces visible to those NOT visible. (GATE 2015 XE)

a) $1:4$ b) $1:3$ c) $1:2$ d) $2:3$

10) Humpty Dumpty sits on a wall every day while having lunch. The wall sometimes breaks. If the wall breaks, the person falls.
Which statement is logically valid?
(GATE 2015 XE)

a) Humpty Dumpty always falls while having lunch
b) Humpty Dumpty does not fall sometimes while having lunch
c) Humpty Dumpty never falls during dinner
d) When Humpty Dumpty does not sit on the wall, the wall does not break

END OF SECTION- GA

ENGINEERING MATHEMATICS

1) Considering the matrix $\begin{pmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ -2 & -3 & 0 \end{pmatrix}$ which one of the following statements is INCORRECT?

(GATE 2015 XE)

a) One of its eigenvalues is zero.
b) It has two purely imaginary eigenvalues.
c) It has a non-zero real eigenvalue.
d) The sum of its eigenvalues is zero.

2) The value of x where $f(x) = \sin x + \cos x$ attains a minimum in $0 \leq x \leq 2\pi$ is _____

(GATE 2015 XE)

3) The radius of convergence of $\sum_{n=0}^{\infty} \frac{(x-3)^n}{3^n\, n!}$ (GATE 2015 XE)

a) zero
b) 1
c) 3
d) ∞

4) For complex k and z, $(z+k)^2$ is analytic (GATE 2015 XE)

a) for all k
b) only when the imaginary part of k is zero
c) only when the real part of k is zero
d) only when $k = 0$

5) The divergence of $\mathbf{v} = 2x\,\mathbf{i} + 2y\,\mathbf{j} + 2z\,\mathbf{k}$ at $(1, 1, 1)$ is _____ (GATE 2015 XE)

6) The type of the differential equation

$$(1-x)\frac{d^3y}{dx^3} + \sqrt{1 + \left(\frac{dy}{dx}\right)^2} + 5y = \cos x \tag{1}$$

(GATE 2015 XE)

a) linear and first order
b) non-linear and first order
c) linear and third order
d) non-linear and third order

7) A box has 10 bulbs, 2 defective, drawn without replacement. Probability both are NOT defective: (GATE 2015 XE)

a) $\frac{8}{45}$
b) $\frac{28}{45}$
c) $\frac{16}{25}$
d) $\frac{4}{5}$

8) The limit value: $\lim_{x\to\infty} \frac{x-\sin x}{x+\sin x} + \frac{\ln x}{x}$ (GATE 2015 XE)

a) zero
b) 1
c) 2
d) ∞

9) The A_0 of Fourier series of $f(x) = x^2$ over $0 \leq x \leq 2\pi$ is (GATE 2015 XE)

a) $\frac{4\pi^2}{3}$ b) $\frac{2\pi^2}{3}$ c) $\frac{\pi^2}{3}$ d) $\frac{\pi^2}{6}$

10) The general solution $y(x)$ for $x\frac{d^2y}{dx^2} + \frac{dy}{dx} - 1 = 0$ is (GATE 2015 XE)

a) $\frac{C_1x^2}{2} + 2x + C_2$ b) $\frac{C_1x^2}{2} - x + C_2$ c) $\frac{C_1x^2}{2} + x + C_2$ d) $\frac{C_1x^2}{2} - 2x + C_2$

11) Minimum Newton–Raphson iterations to get $\sqrt{28}$ correct to 3 decimals starting at 5: ____ (GATE 2015 XE)

END OF SECTION- A

FLUID MECHANICS

1) The gap δ between two concentric cylinders, each of height h, is filled with an oil. The torque required to rotate the inner cylinder at angular velocity ω against the fixed outer cylinder is T. The diameter of the inner cylinder is d and $\delta \ll d$. The dynamic viscosity of the oil is
(GATE 2015 XE)

a) $\dfrac{4\pi\delta T}{d^3\omega h}$ b) $\dfrac{4\delta T}{\pi d^3\omega h}$ c) $\dfrac{4\pi\delta T}{d^2\omega h^2}$ d) $\dfrac{4\delta T}{\pi d\omega h^3}$

2) Water is retained against a sluice gate in the form of a circular segment as shown in the figure. If ρ and g are the density of water and gravitational acceleration, respectively, the upward force exerted by the gate on the water per unit depth perpendicular to the plane of the figure is

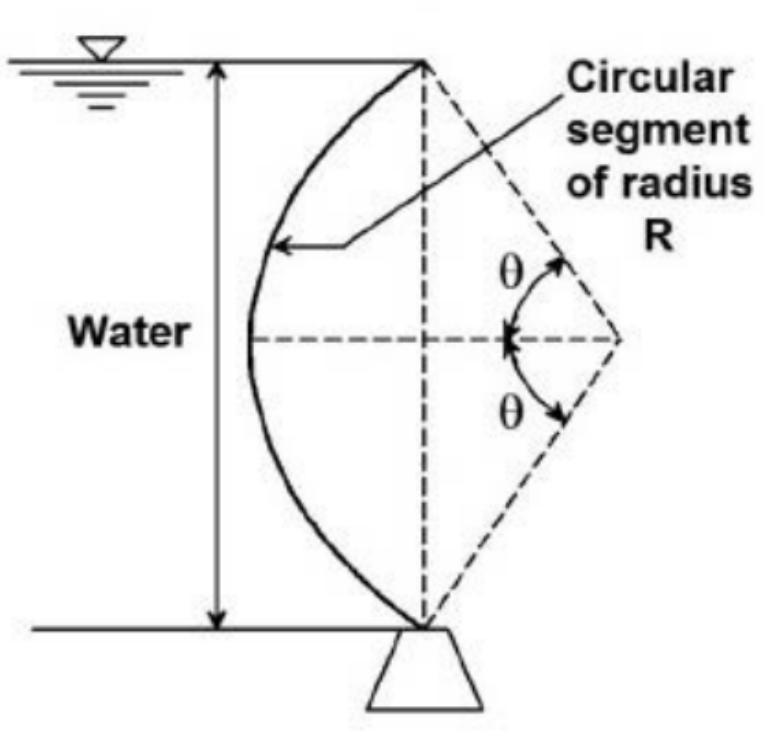

Fig. 2: Diagram

(GATE 2015 XE)

a) $\rho R^2\left(\theta - \frac{1}{2}\sin 2\theta\right) g$
b) $\rho R^2\left(\cos^2\theta - \frac{1}{2}\sin\theta\right) g$
c) $\rho R^2\left(\cos\theta - \frac{1}{2}\sin\theta\right) g$
d) $\rho R^2\left(\cos^2\theta - \frac{1}{2}\sin^2\theta\right) g$

3) A two-dimensional velocity field is given by $\vec{V} = 10(y^3 - x^2y)\,\mathbf{i} + 2Cxy^2\,\mathbf{j}$, where $\mathbf{i}$ and $\mathbf{j}$ are unit vectors in x and y directions, respectively. If the flow is incompressible, the constant C should be

(GATE 2015 XE)

a) -10 b) 0 c) 5 d) 10

4) Let $\vec{V}$ and T denote the velocity vector and temperature in a flow field. The rate of change of temperature experienced by a fluid particle at (x_1, y_1, z_1) at time t_1 is $2.5\ ^\circ\mathrm{C/s}$. The rate of change of temperature at the fixed point (x_1, y_1, z_1) at time t_1 is $4.8\ ^\circ\mathrm{C/s}$. The quantity $\vec{V}\cdot\nabla T$ at (x_1, y_1, z_1, t_1) in $^\circ\mathrm{C/s}$ is ____ (GATE 2015 XE)

5) In a simple Couette flow apparatus, the gap h between parallel plates is filled with a liquid of density ρ and dynamic viscosity μ. One plate is dragged at velocity U parallel to itself, the other plate is fixed. The magnitude of vorticity at any point is

(GATE 2015 XE)

a) $\frac{\mu}{\rho h^2}$ b) 0 c) $\frac{1}{h^2}\sqrt{\frac{\mu\nu h}{\rho}}$ d) $\frac{U}{h}$

6) An open glass capillary tube of $2\,\mathrm{mm}$ bore is lowered into a cistern of mercury ($\rho = 13600$ kg/m^3). Contact angle between mercury and glass is $140°$, surface tension coefficient $= 0.484$ N/m, $g = 9.81$ m/s^2. The depression of mercury in the tube, in mm, is ____

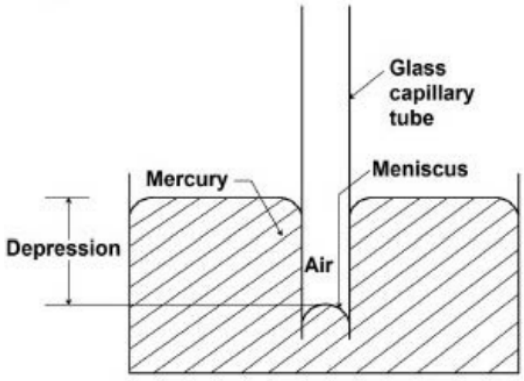

Fig. 6: Diagram

(GATE 2015 XE)

7) Consider a combined forced-free vortex. The central region radius R, angular velocity ω is a forced vortex, the rest is free vortex. Pressure at the edge is p_0. Fluid density is ρ. The pressure at the center is (GATE 2015 XE)

a) $p_0 - \rho\omega^2 R^2$
b) $p_0 - \frac{1}{2}\rho\omega^2 R^2$
c) $p_0 + \frac{1}{2}\rho\omega^2 R^2$
d) $p_0 + \rho\omega^2 R^2$

8) Which one is true at a point of separation of a boundary layer? (GATE 2015 XE)

a) Transition occurs from laminar to turbulent
b) The flow re-laminarizes from turbulent regime
c) The shear stress vanishes
d) The stress/strain relation ceases to be linear

9) A flow is described by Reynolds (Re), Weber (We) and Ohnesorge (Oh) numbers. $We = \rho U L/\sigma$, $Oh = \mu/\sqrt{\rho\sigma L}$. Which relation is correct?
(GATE 2015 XE)

a) $We = Oh\, Re^2$ b) $We = Oh^2\, Re^2$ c) $We = Oh^2\, Re$ d) $We = Oh\, Re$

10) A rectangular boat 6 m wide and 15 m long has a draught 2 m. The center of gravity is at the free surface level. The metacentric height (m) is

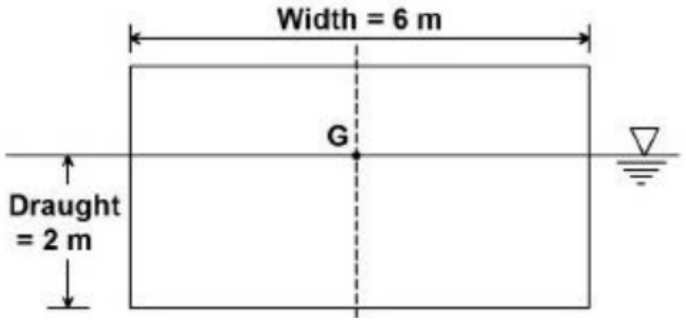

Fig. 10: Rectangular Boat

(GATE 2015 XE)

a) -1.0 b) 0.5 c) 1.5 d) 2.0

11) Water drains from a large tank through a small orifice at the bottom. If initial water column height is H, time to empty is proportional to
(GATE 2015 XE)

a) $H^{1/2}$ b) H c) $H^{3/2}$ d) H^2

12) 2D velocity field $\vec{V} = \pi y\, \mathbf{i} - \pi x\, \mathbf{j}$. A fluid particle initially at $(-1, 1)$ has position after unit time:

(GATE 2015 XE)

a) $(-2, -2)$ b) $(1, -1)$ c) $(1, 1)$ d) $(3, -1)$

13) The figure shows a reducing conduit carrying water. If total head loss due to friction equals loss of potential head between inlet and outlet, V_2 in m/s is ____.

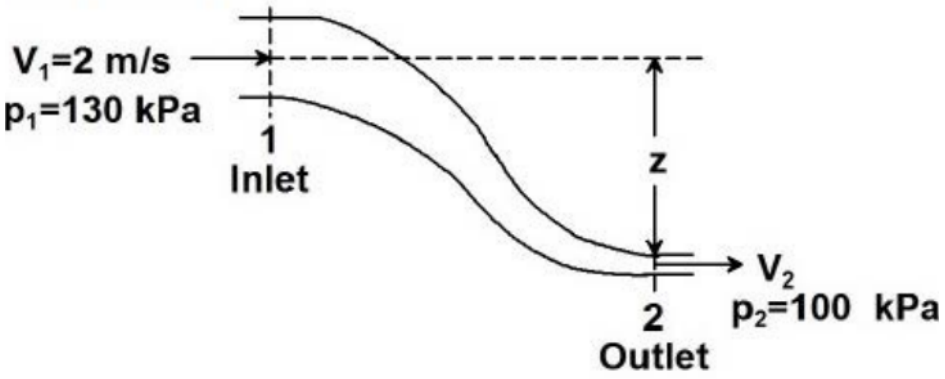

Fig. 13: Diagram

(GATE 2015 XE)

14) A control volume has inflow i and two outflows o_1 and o_2, with given ρ, V, A for each. The rate of change of mass in the CV (kg/s) is ____.

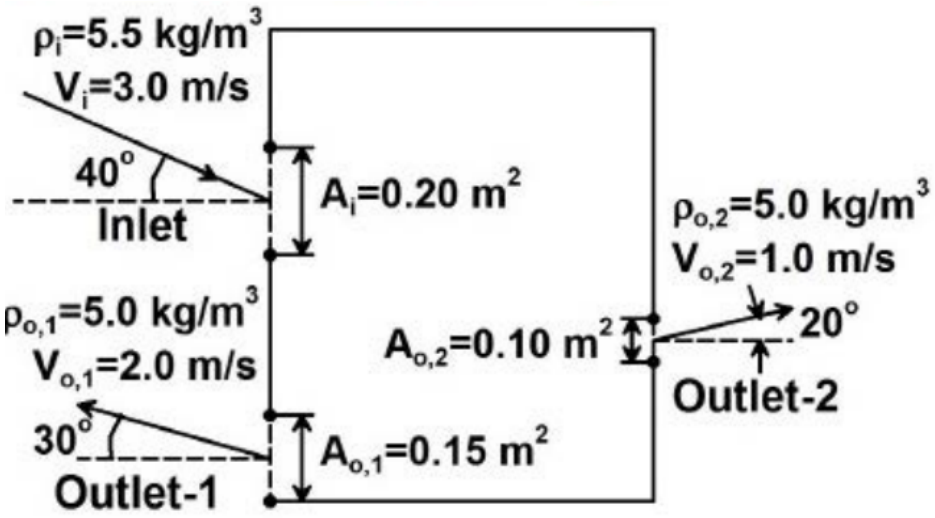

Fig. 14: Diagram

(GATE 2015 XE)

15) A lawn sprinkler discharges 1 liter/min total. Jet speed at each arm end relative to the arm is $2\pi/30$ m/s, arm length 0.1 m, frictional torque at pivot $\pi/36$ mN·m. Rotational speed (rpm) is ____.

(GATE 2015 XE)

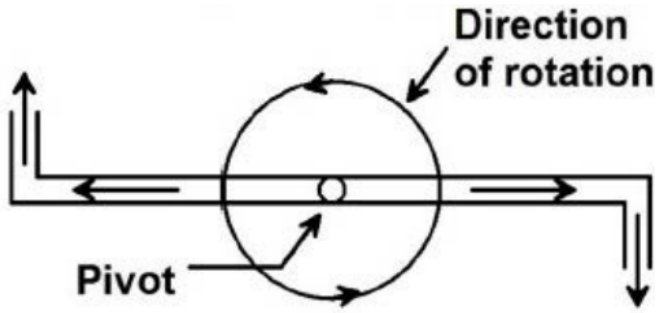

Fig. 15: Lawn Sprinkler

16) 2D potential flow field: $V_r = \dfrac{m}{2\pi r}$, $V_\theta = \dfrac{k}{r}$. The stream function ψ with $\psi = 0$ at $r = a$, $\theta = 0$, is (GATE 2015 XE)

a) $\frac{m\theta}{2\pi} + k \ln \dfrac{r}{a}$ b) $\frac{m\theta}{\pi} + k \ln \dfrac{r}{a}$ c) $\frac{m\theta}{2\pi} + \frac{k}{2\pi} \ln \dfrac{r}{a}$ d) $\frac{m\theta}{\pi} + \frac{k}{2\pi} \ln \dfrac{r}{a}$

17) A steady, inviscid, incompressible 2D flow: $u = ax$, $v = -ay$, gravity along $-y$. Pressure distribution with $p = 0$ at origin is (GATE 2015 XE)

a) $-\frac{\rho a^2}{2}(x^2 + xy + y^2) - \rho g y$
b) $-\frac{\rho a^2}{2}(x^2 - xy + y^2) - \rho g y$
c) $-\frac{\rho a^2}{2}(x^2 + y^2) - \rho g y$
d) $-\frac{\rho a^2}{2}(x^2 - y^2) - \rho g y$

18) A cylinder radius 0.1 m rotates clockwise at angular velocity $100/\pi$ rad/s in a cross-flow 10 m/s, air density 1.2 kg/m^3. The lift force per unit length (N/m) is ____ (GATE 2015 XE)

19) Turbulent pipe flow velocity profile:

$$\frac{u}{u_{max}} = \left(\frac{y}{R}\right)^{1/7} .Ratio \frac{U_{av}}{U_{max}} is \tag{2}$$

(GATE 2015 XE)

a) $\frac{15}{16}$ b) $\frac{49}{60}$ c) $\frac{3}{4}$ d) $\frac{2}{3}$

20) A steel sphere ($\rho = 7900$ kg/m^3) diameter 0.1 m drops in water ($\rho = 1000$ kg/m^3), $g = 9.81$ m/s^2, drag coefficient 1.33. Terminal velocity (m/s) is ____ (GATE 2015 XE)

21) An inclined venturimeter with inverted manometer: inlet and throat areas 2×10^{-3} m^2 and 2×10^{-4} m^2; water ($\rho = 1000$) and oil ($\rho = 800$). Flow rate $Q = 5 \times 10^{-3}$ m^3/s. Neglect viscosity. Manometer reading h (m) is ____

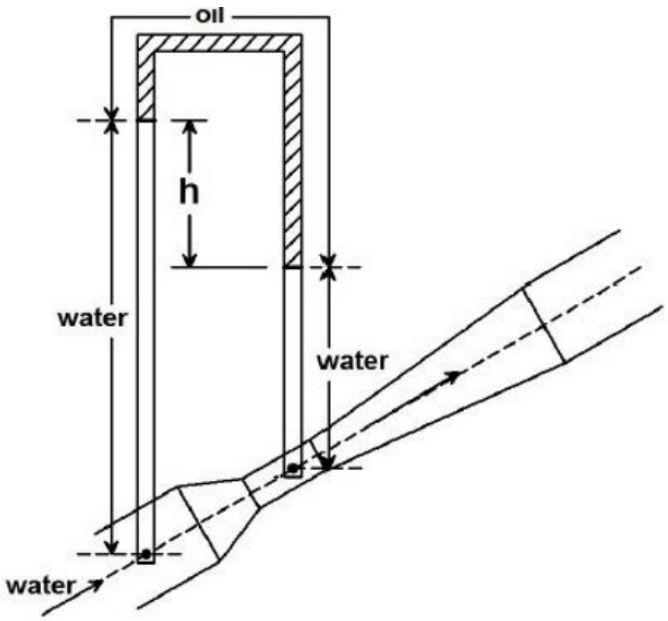

Fig. 21: Venturimeter with Inverted Manometer

(GATE 2015 XE)

22) A plane jet $Q = 0.012$ m^3/s, area 6×10^{-4} m^2, strikes a stationary plate inclined at θ, splits into two streams in $3:1$ discharge ratio. Uniform velocities, ignore friction, $\rho = 1000$ kg/m^3. Magnitude of normal force (N) is ____

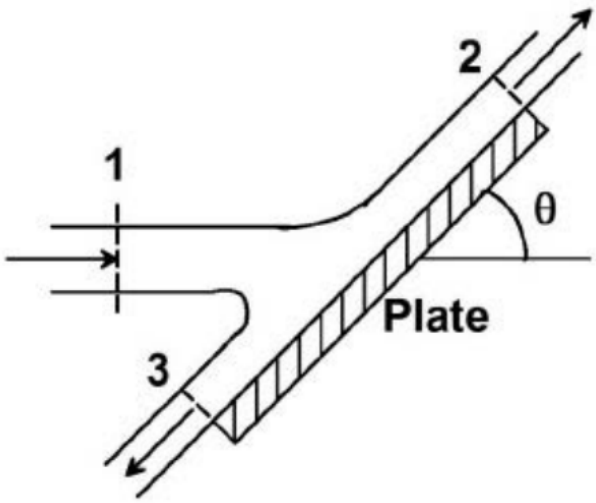

Fig. 22: Plate

(GATE 2015 XE)

END OF SECTION- B

MATERIALS SCIENCE

1) Arrange the following in order of increasing melting point: (P) Gallium, (Q) Tungsten, (R) Aluminium, (S) Gold
(GATE 2015 XE)

a) P < R < Q < S b) S < P < R < Q c) P < R < S < Q d) R < S < Q < P

2) Coordination number of carbon atoms in diamond structure is
(GATE 2015 XE)

a) 2 b) 4 c) 6 d) 8

3) For an edge dislocation, the Burgers vector is
(GATE 2015 XE)

a) parallel to the dislocation line
b) perpendicular to the slip plane
c) perpendicular to the dislocation line
d) parallel to the slip plane

4) Hall–Petch relation correlates
(GATE 2015 XE)

a) grain size and ductility
b) grain size and strength
c) strength and ductility
d) strength and modulus

5) Fatigue failure primarily occurs
(GATE 2015 XE)

a) under static loading
b) under cyclic loading
c) under creep conditions
d) above recrystallization temperature

6) The eutectoid composition of steel (wt% C) is
(GATE 2015 XE)

a) 0.02 b) 0.8 c) 1.2 d) 2.0

7) Which one is NOT a ceramic?
(GATE 2015 XE)

a) Alumina b) Silicon carbide c) Polyethylene d) Zirconia

8) The electrical conductivity of a pure metal decreases with temperature because
(GATE 2015 XE)

a) carrier concentration decreases
b) carrier mobility decreases
c) band gap increases
d) lattice constant changes

9) The ratio $\rho_{\text{ceramic}}/\rho_{\text{metal}}$ is generally
(GATE 2015 XE)

a) < 1 b) ≈ 1 c) > 1 d) ≈ 0.5

10) Compressive strength of ceramics is typically
(GATE 2015 XE)

a) higher than tensile strength
b) equal to tensile strength
c) lower than tensile strength
d) unrelated to tensile strength

11) The process of heating and slow cooling to remove internal stresses is
(GATE 2015 XE)

a) hardening b) tempering c) annealing d) quenching

12) A polymer with amorphous arrangement is generally
(GATE 2015 XE)

a) transparent b) opaque c) brittle d) crystalline

13) In polymers, increasing crosslinking generally
(GATE 2015 XE)

a) increases ductility
b) increases brittleness
c) decreases stiffness
d) decreases glass transition temperature

14) The energy gap in a conductor is
(GATE 2015 XE)

a) large b) zero c) small d) infinite

15) Maximum solid solubility of carbon in γ-iron at eutectic temperature (wt% C) is
(GATE 2015 XE)

a) 0.02 b) 0.76 c) 2.14 d) 6.67

16) Which is a non-ferrous metal?
(GATE 2015 XE)

a) Aluminium b) Steel c) Cast iron d) Wrought iron

17) Creep in metals occurs predominantly at
(GATE 2015 XE)

a) low temperature
b) high temperature
c) room temperature
d) cryogenic tempera-
ture

18) The Brinell hardness test uses a
(GATE 2015 XE)

a) steel ball indenter
b) diamond pyramid
c) cylindrical punch
d) knife edge

19) The main constituent of glass is
(GATE 2015 XE)

a) SiO_2 b) Al_2O_3 c) CaO d) MgO

20) The coordination number in the FCC crystal structure is
(GATE 2015 XE)

a) 6 b) 8 c) 12 d) 14

21) Polymers with high crystallinity generally have
(GATE 2015 XE)

a) higher density
b) lower density
c) same density as amorphous polymers
d) no correlation with density

22) The primary strengthening mechanism in precipitation-hardened alloys is
(GATE 2015 XE)

a) grain boundary strengthening
b) solid solution strengthening
c) dispersion of coherent precipitates
d) work hardening

END OF SECTION- C

THERMODYNAMICS

1) A gas expands following PV^n = constant from (P_1, V_1) to $V_2 = 2V_1$. For the values of n given below, maximum displacement work is obtained for (GATE 2015 XE)

a) $n = -1$ b) $n = 0$ c) $n = 1$ d) $n = 1.4$

2) A $100\ \Omega$ resistor is heated steadily by passing a current of 20 A. Heating is in surroundings at $30°$C. The rate of increase in entropy of the universe (kW/K) is ____ (GATE 2015 XE)

3) As per Clausius inequality, a system operating on an irreversible cycle transfers (GATE 2015 XE)

a) more entropy to the sink than it receives from the source
b) as much entropy to the sink as it receives from the source
c) less entropy to the sink than it receives from the source
d) less entropy to the sink than that in a reversible cycle

4) The critical point of a substance is the state (GATE 2015 XE)

a) at which the solid, liquid, and vapour phases are in equilibrium
b) beyond which liquid requires very large amount of heat to become vapour
c) beyond which solid sublimates directly to vapour
d) beyond which the distinction between liquid and vapour disappears

5) Sensible cooling of 60% RH air at constant pressure: (GATE 2015 XE)

a) Humidity ratio and relative humidity increase
b) Humidity ratio decreases continuously due to condensation
c) Dry bulb temperature decreases but wet bulb temperature increases
d) Humidity ratio remains constant

6) The COP of a reversible refrigerator operating between two reservoirs is 4.0. The efficiency (%) of a reversible heat engine operating between the same limits is ____. (GATE 2015 XE)

7) For a real superheated vapour (non-ideal gas), the differential change in specific enthalpy is given by (GATE 2015 XE)

a) $dh = C_p\, dT$
b) $dh = C_p\, dT + \frac{\partial h}{\partial v} dv$
c) $dh = C_p\, dT + \frac{\partial h}{\partial p} dp$
d) $dh = C_p\, dT + \frac{\partial p}{\partial T} dp$

8) An ideal gas mixture O_2 (MW=32) and CO_2 (MW=44) has 40% and 60% mass composition respectively. Total pressure is 200 kPa. The partial pressure of O_2 (kPa) is ____ (GATE 2015 XE)

9) For an ideal Rankine cycle, increasing the superheat of steam at boiler exit will (GATE 2015 XE)

a) decrease net work output
b) increase cycle efficiency
c) decrease cycle efficiency
d) decrease quality of steam at turbine exit

10) Two moles of air at 1 atm, 21.1°C pass into an adiabatic device and separate into a hot stream (0.4 mol, 176.3°C) and a cold stream (1.6 mol, -17.7°C), all at 1 atm. Which statement is correct? (GATE 2015 XE)

a) Total entropy change is zero
b) Total entropy change is positive
c) Device violates Second Law
d) Device violates First Law

11) For a real gas through a porous plug with coefficient α, Joule–Thomson cooling is observed when (GATE 2015 XE)

a) $0 < \alpha T < 1$ b) $\alpha T = 1$ c) $\alpha T > 1$ d) $\alpha T = 0$

12) A lead bullet at 100°C, moving at 500 m/s strikes a target and stops adiabatically. $c_p = 92$ J/kg°C, melt point 327.5°C, $L = 108$ kJ/kg. The percentage of mass melted is ____ (GATE 2015 XE)

13) Air–water vapour mixture, 100 m^3 at $p = 100$ kPa, $T = 35$°C, RH=75%, p_{sat}=5.63 kPa. Mass of water vapour (kg) = ____ (GATE 2015 XE)

14) 1 kg ideal gas at $T = 1200$ K, $C_v = 718$ J/kgK in rigid vessel, ambient 300 K. Maximum work (kJ) obtainable =
(GATE 2015 XE)

a) 646.2 b) 484.7 c) 387.7 d) 347.6

15) Boiling point of water changes from 99.62°C at 1 bar to 105.99°C at 1.25 bar. Boiling point at 1.5 bar is ____ (GATE 2015 XE)

16) Ideal gas expands adiabatically in a frictionless nozzle from 31 bar, 800 K to 1 bar. $C_p = 1$ kJ/kgK, $\gamma = 1.4$, neglect inlet kinetic energy. Exit velocity (m/s) = (GATE 2015 XE)

a) 32 b) 500 c) 707 d) 1000

17) One kmol H_2 ($\gamma = 1.4$) mixes with one kmol N_2 ($\gamma = 1.4$), both at 1 bar, 300 K, in an adiabatic vessel. Final mixture at 1 bar, 300 K. Entropy change (kJ/K) =
(GATE 2015 XE)

a) -5.76 b) 0 c) 5.76 d) 11.53

18) A cycle 1–2 constant pressure expansion, 2–3 reversible adiabatic expansion, 3–1 irreversible adiabatic compression. Which is true?
(GATE 2015 XE)

a) Net work = 0 (no heat transfer)
b) Feasible and net positive work
c) Impossible by Kelvin–Planck statement
d) Impossible by First Law

19) 1 kg saturated liquid–vapour water at 150 kPa ($u_f = 467$ kJ/kg, $v_f = 0.001053$ m^3/kg; $u_g = 2520$ kJ/kg, $v_g = 1.159$ m^3/kg), quality $x = 0.7$, is heated at constant pressure with paddle wheel work input =50 kJ, final state = saturated vapour. Heat added (kJ) = ____ (GATE 2015 XE)

20) A 2 kg metal block at 500 K is brought into contact with a 5 kg metal block at 300 K in an insulated environment until equilibrium is reached. Both metals have $C_p = 0.4$ kJ/kgK. Entropy change of the universe (kJ/K) = ____. (GATE 2015 XE)

21) A rigid insulated tank is divided into two equal parts by a partition. One side contains air at 800 kPa, 350 K, the other side is a vacuum. The partition is removed. Final temperature (K) = ____ (GATE 2015 XE)

END OF SECTION- D

POLYMER SCIENCE

1) The biodegradable polymer among the following polymers is (GATE 2015 XE)

a) poly(lactic acid)
b) poly(butylene terephthalate)
c) polystyrene
d) polypropylene

2) Notched impact strength of a plastic decreases with (GATE 2015 XE)

a) increase in notch tip radius
b) increase in notch depth
c) increase in temperature
d) decrease in notch depth

3) The compound used as a reactive diluent in unsaturated polyester resins is (GATE 2015 XE)

a) benzene b) cresol c) styrene d) adipic acid

4) The diameter of a die of an extruder producing extrudate of diameter 2.4 mm with a die-swell ratio of 2 is ____ mm. (GATE 2015 XE)

5) The degree of polymerization of Nylon 6 (ignore end-groups) with molar mass of 1,00,000 g mol^{-1} is ____ (GATE 2015 XE)

6) Ring opening polymerization is used for the synthesis of (GATE 2015 XE)

a) Nylon 6
b) poly(acrylic acid)
c) Nylon 66
d) poly(ethylene terephthalate)

7) Which among the following are used as initiators for free radical polymerization?
P. K_2SO_4 Q. $K_2S_2O_8$
R. AlBN S.t-butyl Hydroperoxide + Fe^{2+}
(GATE 2015 XE)

a) P, Q & S only b) Q, R & S only c) P, R & S only d) P, Q & R only

8) Weight average molecular weight can be determined by (GATE 2015 XE)

a) Osmometry b) Ebullimetry c) End group analysis d) Light scattering

9) Butyl rubber is a copolymer of (GATE 2015 XE)

a) isobutylene and butadiene
b) butadiene and 1-butene
c) isobutylene and isoprene
d) isoprene and 1-butene

10) Match the characterization technique with the polymer property it is used to determine.

TABLE 10: Table-1

Technique	Property
P. X-ray diffraction	1. Melting temperature
Q. Differrential scanning calorimetry	2. Crystallinity & crystal size
R. Thermogravimetric analysis	3. Glass transition temperature
S. Dynamic mechanical analysis	4. Ash content

(GATE 2015 XE)

a) P–3, Q–1, R–4, S–2 b) P–3, Q–4, R–2, S–1 c) P–2, Q–4, R–1, S–3 d) P–2, Q–1, R–4, S–3

11) Match the following plastic additives with their function.

TABLE 11: Table-2

Additive	Fuction
P. Di-isotyl phthalate	1. Antioxidant
Q. 4-Methyyl-2,6-t-butylphenol	2. Plasticizer
R. Dicumyl peroxide	3. Antistatic agent
S. Quaterrnary ammonium compound	4. Cross-linking agent

(GATE 2015 XE)

a) P–2; Q–4; R–1; S–3
b) P–4; Q–1; R–3; S–2
c) P–2; Q–1; R–4; S–3
d) P–3; Q–1; R–4; S–2

12) The correct statement with respect to electrical property of polymeric materials is (GATE 2015 XE)

a) For non polar materials, dielectric constant is independent of frequency & temperature
b) For polar materials, dielectric constant depends on frequency but not on temperature
c) For non polar materials, power losses are high and depend on temperature & frequency
d) For polar materials, power losses are low and independent of frequency

13) The order of melting point for the given polymers is (GATE 2015 XE)

a) Nylon 66 $>$ PTFE $>$ Nylon 6 $>$ PP
b) Nylon 66 $>$ Nylon 6 $>$ PTFE $>$ PP
c) PTFE $>$ Nylon 66 $>$ Nylon 6 $>$ PP
d) PTFE $>$ Nylon 6 $>$ Nylon 66 $>$ PP

14) Match the processing technique used to manufacture the appropriate product.

TABLE 14: Table-3

Processing Technique	**Producct**
P. Calendering	1. Pipes
Q. Extrusion	2. Disposable cups
R. Injection moulding	3. Sheets
S. Thermoforming	4. Nylon gears

(GATE 2015 XE)

a) P–3; Q–2; R–1; S–4
b) P–3; Q–1; R–2; S–4
c) P–3; Q–1; R–4; S–2
d) P–3; Q–2; R–4; S–1

15) Match the thermosetting resins to the raw materials they are synthesized from.

TABLE 15: Table-4

Resin	**Raw Material**
P. Epoxy	1. Cresol + furfural
Q. Phenolic	2. Diethylene glycol + diallyl phthalate
R. Unsaturated polyester	3. Bisphenol A + epichlorohydrin
S. Allyl	4. Maleic acid + 1,2-propylene glycol

(GATE 2015 XE)

a) P–4; Q–2; R–3; S–1
b) P–3; Q–1; R–2; S–4
c) P–3; Q–2; R–1; S–4
d) P–3; Q–1; R–4; S–2

16) The damping factor of a solid polymer under sinusoidal loading in single cantilever mode showing 80 percent recovery in modulus is ____ (GATE 2015 XE)

17) A styrene–butadiene random copolymer with equal weight fraction of polystyrene ($T_g = 100°$C) and polybutadiene ($T_g = -100°$C) shows a single glass transition peak. The T_g of the copolymer is ____ °C. (GATE 2015 XE)

18) In a unidirectional carbon fibre reinforced epoxy composite, the ratio of fibre-to-matrix moduli is 30 and the fibres take up 50% of the cross-section. The percentage of applied force taken up by the fibres is ____ (GATE 2015 XE)

19) The viscoelastic behavior of a plastic is represented by spring and dashpot elements having constants of 2 GN m^{-2} and 90 GN s m^{-2}, respectively. If a constant stress of 12 MN m^{-2} is applied, the strain predicted by Maxwell model after 50 s is ____ % (GATE 2015 XE)

20) Match the elastomers given below to their suitable application.

TABLE 20: Table-5

Elastomer	Application
P. EPDM	1. Golf balls
Q. Polyurethane	2. Fuel transfer hose
R. Nitrile rubber	3. Cable insulation
S. Polybutadiene	4. Footwear

(GATE 2015 XE)

a) P–3; Q–4; R–2; S–1
b) P–4; Q–3; R–2; S–1
c) P–3; Q–2; R–4; S–1
d) P–1; Q–4; R–2; S–3

21) Match the following reagents to their function in natural rubber latex technology.

TABLE 21: Table-6

Reagent	Function
P.Ammonia	1. Prevent storage hardening
Q. Hydroxylamine	2. Delay plugging mechanism
R. Formic acid	3. Stabilizer
S. Ethephone	4. Coagulating agent

(GATE 2015 XE)

a) P–3; Q–1; R–2; S–4
b) P–3; Q–2; R–4; S–1
c) P–3; Q–1; R–4; S–2
d) P–3; Q–4; R–1; S–2

22) 1.0 g of a polybutadiene sample with carboxylic acid groups at both the ends requires 2.5 mL of 0.1 M KOH for complete neutralization. The molecular weight of the polymer in g mol^{-1} is ____ (GATE 2015 XE)

END OF SECTION- E

FOOD TECHNOLOGY

1) Standard pasteurization protocol for milk is adequate for destroying (GATE 2015 XE)

a) *Clostridium sporogenes*
b) *Bacillus cereus*
c) *Clostridium botulinum*
d) *Listeria monocytogenes*

2) Which one of the following is NOT a component of an evaporator? (GATE 2015 XE)

a) Heat exchanger
b) Vacuum separator
c) Condenser
d) Cyclone separator

3) Among the following animal foods, the fat content is least in (GATE 2015 XE)

a) Beef
b) Chicken meat
c) Pork
d) Lamb flesh

4) The enzyme that hydrolyzes starch to maltose is (GATE 2015 XE)

a) α-amylase
b) β-amylase
c) glucoamylase
d) cyclodextrin glucanotransferase

5) Which one of the following is NOT enriched in endosperm during parboiling of paddy? (GATE 2015 XE)

a) Thiamine
b) Niacin
c) Iron
d) Fat

6) Heat-treated legume seed proteins are more digestible than those of untreated legume seed proteins due to (GATE 2015 XE)

a) reaction of reducing sugars with ε-amino group of lysine
b) increased binding of lectins to intestinal mucosal cells
c) thermolabile nature of lectins and Kunitz-type protease inhibitors
d) thermolabile nature of Bowman–Birk type of inhibitor

7) What is the percent relative humidity at which both the dry bulb and wet bulb thermometers would record equal temperatures? (GATE 2015 XE)

a) 0
b) 10
c) 50
d) 100

8) How many fold would the g-number of a centrifuge increase by doubling both the spinning speed and bowl diameter? (GATE 2015 XE)

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

9) The gradual decrease in viscosity of tomato paste during storage can be prevented by quickly heating it to 82°C, because
(GATE 2015 XE)

a) water soluble pectin interacts with calcium
b) hemicellulose prevents decrease in viscosity
c) lignin prevents decrease in viscosity
d) pectin methyl esterase is inactivated

10) Match the enzyme in Group I with its corresponding application in Group II.

TABLE 10: Table-7

Group-I	**Group-II**
P. Chymosin	1. Removal of cooked flavor from milk
Q. Sulfhydryl oxidase	2. Soyabean milk coagulation
R. β-Galactosidase	3. For rennet puddings
S. Microbial proteases	4. Lactose removal

(GATE 2015 XE)

a) P–2, Q–1, R–4, S–3
b) P–3, Q–1, R–4, S–2
c) P–1, Q–2, R–3, S–4
d) P–4, Q–3, R–2, S–1

11) Milk is flowing at $0.12\ \mathrm{m}^3, \mathrm{min}^{-1}$ in a 2.5 cm diameter pipe. The temperature of the milk is 21°C and the corresponding viscosity and density are $2.1 \times 10^{-3}\ \mathrm{Pa, s}$ and $1029\ \mathrm{kg, m}^{-3}$, respectively. If the flow is found to be turbulent under the given conditions, the Reynolds number is ____.
(GATE 2015 XE)

12) Whole milk (34,950 kg) containing 4% fat is to be separated in 6 h period into skim milk with 0.45% fat and cream with 45% fat. The flow rate of cream stream (kg/h) from the separator is ____
(GATE 2015 XE)

13) Match the edible plant tissue in Group I with the type of carotenoid given in Group II.

TABLE 13: Table-8

Group-I	**Group-II**
P. Corn	1. Lycopene
Q. Red pepper	2. β-Carotene
R. Pumpkin	3. Capsanthin
S. Tomato	4. Lutein

(GATE 2015 XE)

a) P–4, Q–3, R–2, S–1
b) P–2, Q–4, R–3, S–1
c) P–3, Q–4, R–2, S–1
d) P–4, Q–1, R–2, S–3

14) Undesirable bitterness frequently encountered in cured cheese is due to the
(GATE 2015 XE)

a) presence of naringen
b) formation of limonin
c) overall hydrophobicity of amino acid side-chains in peptide
d) conversion of humulone to isohumulone

15) Green tea is considered to be a more healthy option than black tea because it (GATE 2015 XE)

a) has high content of polyphenols
b) is richer in thearubigin
c) does not require any sweetener during tea preparation
d) has no microbial load

16) Multiple effect evaporation leads to (GATE 2015 XE)

a) reduction in operating cost and reduction in capital cost
b) increase in operating cost and increase in capital cost
c) increase in operating cost and reduction in capital cost
d) reduction in operating cost and increase in capital cost

17) A dilute pineapple juice is heated in a double pipe heat exchanger from $28°$C to $75°$C by heat exchanging with hot water flowing in shell in counter current direction. Hot water is entering the shell at $95°$C and leaving at $85°$C. The log mean temperature difference ($°$C) is ____ (GATE 2015 XE)

18) Heat is transferred by radiation to a loaf of bread in an oven at a uniform temperature of $177°$C. The total surface area and temperature of the loaf are $0.0645\ \mathrm{m}^2$ and $100°$C, respectively. The surface emissivity of the loaf is 0.85 and the value of Stefan–Boltzmann constant is $5.67\times10^{-8}\ \mathrm{W,m^{-2},K^{-4}}$. The net heat transfer (W) is ____.
(GATE 2015 XE)

19) Granulated sugar, having an average particle size of $500\ \mu$m, is milled to produce icing sugar having an average particle size of $25\ \mu$m. The power requirement was 10 kW as obtained by Rittinger's law. If the same mill were to be used to produce fondant sugar having an average particle size of $20\ \mu$m at the same capacity, the power requirement (kW) would be ____.
(GATE 2015 XE)

20) One ton of soybean containing 18% oil, 35% protein, 27.1% carbohydrates, 9.4% of fibre and ash, and 10.5% moisture is crushed and pressed. The residual oil content in the pressed cake is 6%. Assuming that there is no loss of protein and water with oil, the amount of oil (kg) obtained from the crusher is ____..
(GATE 2015 XE)

21) Match the processing method in Group I with the operation carried out in Group II.

TABLE 21: Table-9

Group-I	**Group-II**
P. Degumming	1. Crystallization of triacylglycerol by cooling to remove fat crystals
Q. Deacidifying	2. Passing heated oil over charcoal
R. Bleaching	3. Using alkaline solution to remove fatty acids
S. Winterizing	4. Wetting with water to remove lecithin

(GATE 2015 XE)

a) P–3, Q–1, R–4, S–2
b) P–4, Q–3, R–1, S–2
c) P–4, Q–3, R–2, S–1
d) P–3, Q–1, R–2, S–4

22) The order of succession of microbes in the spoilage of milk, involving (P) *Lactobacillus*, (Q) protein digesting bacteria, (R) *Lactococcus lactis*, (S) yeasts and molds, is
(GATE 2015 XE)

a) S > R > Q > P b) S > Q > R > P c) R > P > S > Q d) Q > S > P > R

END OF SECTION- F