

Q.1 If A and B are square matrices of size $n \times n$, then which of the following statement is not true

- (a) $\det(AB) = \det(A)\det(B)$
- (b) $\det(kA) = k^n \det(A)$
- (c) $\det(A+B) = \det(A) + \det(B)$
- (d) $\det(A^T) = 1/\det(A^{-1})$

Q. 2 If matrix A is $m \times n$ and B is $n \times p$, the number of multiplication operations and addition operations needed to calculate the matrix AB, respectively, are:

- (a) mn^2p, mpn
- (b) $mpn, (n-1)$
- (c) mpn, mpn
- (d) $mn^2p, (m+p)n$

Q.3 The solution(s) to the equations $2x+3y=1, x-y=4, 4x-y= \alpha$, will exist if α is equal to

- (a) -33
- (b) 0
- (c) 9
- (d) 59/5

Q. 4 $\lim_{x \rightarrow 0} x \sin\left(\frac{1}{x}\right)$ is

- (a) ∞
- (b) 0
- (c) 1
- (d) Non-existent

Q. 5 The inverse Laplace transform of $\frac{s+9}{s^3+6s+13}$ is

- (a) $\cos 2t + 9 \sin 2t$
- (b) $e^{-3t} \cos 2t = 3e^{-3t} \sin 2t$
- (c) $e^{-3t} \sin 2t + 3e^{-3t} \cos 2t$
- (d) $e^{-3t} \cos 2t + 3e^{-3t} \sin 2t$

Q.6 The differential equation $y'' + (s^3 \sin x)^5 y' + y = \cos x^3$ is

- (a) homogenous
- (b) nonlinear
- (c) second order linear
- (d) non-homogenous with constant coefficients

Q.7 The area bounded by the parabola $2y = x^2$ and the line $x = y - 4$ is equal to

- (a) 6
- (b) 18
- (c) ∞
- (d) None of the above

Q.8 The series $s = 1 - 1 + 1 - 1 \dots$ is

- (a) convergent
- (b) monotonous
- (c) uniformly convergent
- (d) divergent

Q.9 If a function is continuous at a point its first derivative

- (a) may or may not exist
- (b) exist always
- (c) will not exist
- (d) has a unique value

Q.10 If A and B are non zero square matrices, then $AB=0$ implies

- (a) A and B are orthogonal
- (b) A and B are singular
- (c) B is Singular
- (d) A is singular

Q. 11 The Eigen values of a square symmetric matrix are always

- (a) positive
- (b) real and imaginary
- (c) negative
- (d) real

Q.12 A box contains 10 screws, 3 of which are defective. Two screws are drawn at random with replacement. The probability that none of the two screws is defective will be

- (a) 100%
- (b) 50%
- (c) 49%
- (d) None of these

Q.13 If P,Q and R are three points having coordinates (3,-2,-1), (1,3,4), (2,1,-2) in XYZ space, then the distance from point P to plane OQR (O being the origin of the coordinate system) is given by

- (a) 3
- (b) 5
- (c) 7
- (d) 9

Q.14 The maximum value of the poisson's ratio for an elastic material is

- (a) 0.25
- (b) 0.5
- (c) 0.75
- (d) 1.0

Q.15 A cantilever beam of tubular section consists of 2 materials, copper as outer cylinder and steel as inner cylinder. It is subjected to a temperature rise of 20°C and $\alpha_{\text{copper}} > \alpha_{\text{Steel}}$. The stresses developed in the tube will be

- (a) compression in steel and tension in copper
- (b) tension in steel and compression in copper
- (c) no stress in both
- (d) tension in both the materials

Q. 16 In a linear elastic structural element

- (a) stiffness is directly proportional to flexibility
- (b) stiffness is inversely proportional to flexibility
- (c) stiffness is equal to flexibility
- (d) stiffness and flexibility are not related

Q.17 In reinforced concrete, pedestal is defined as compression member, whose effective length does not exceed its least dimension by

- (a) 12 times
- (b) 3 times
- (c) 16 times

(d) 8times

Q.18 The minimum area of tension reinforcement in a beam shall be greater than

(a) $0.85bd/f_y$

(b) $0.85f_y/bd$

(c) $0.04bd$

(d) $0.4 bd/f_y$

Q.19 A thin cylindrical vessel of mean diameter D and of length ' L ' closed at both ends is subjected to a water pressure ' p '. The value of hoop stress and longitudinal stress in the shell shall be respectively

(a) $\frac{pD}{2t}, \frac{pD}{4t}$

(b) $\frac{pD}{4t}, \frac{pD}{8t}$

(c) $\frac{pD}{8t}, \frac{pD}{8t}$

(d) $\frac{pD}{t}, \frac{pD}{2t}$

Q.20 In a real beam at an end, the boundary condition of zero slope and zero vertical displacement exists. In the corresponding conjugate beam, the boundary conditions at this end will be

(a) shear force=0 and bending moment =0

(b) slope =0 and vertical displacement=0

(c) slope =0 and bending moment=0

(d) shear force=0 and vertical displacement=0

Q.21 The loss of prestress due to elastic shortening of concrete is least in

(a) one wire pre-tensioned beam

(b) one wire post-tensioned beam

(c) multiple wire pre-tensioned beam with sequential cutting of wires

(d) multiple wire post-tensioned beam subjected to sequential prestressing

Q.22 A floor slab of thickness, t , is cast monolithically transverse to a rectangular continuous beam of span, L , and width, B . If the distance between two consecutive points of contra-flexure is L_o , the effective width of compression flange at a continuous support is

(a) B

(b) $L/3$

(c) $B + 12t$

(d) $B + 6t + L_o/6$

Q.23 Which of the following joint type is not eccentric?

(a) Lap joint

(b) Single cover type butt joint

(c) Double cover type butt joint

(d) Both (b) and (c) above

Q.24 Area of splice plates shall exceed the area of flange element spliced by at least

(a) 10%

(b) 20%

(c) 5%

(d) 2.5 %

Q.25 The diameter (d) of a rivet connecting the plate of thickness (t) in mm is given unwin's formula is

(a) $d = 6.05\sqrt{t}$

(b) $d = 1.9\sqrt{t}$

(c) $d = 4.05\sqrt{t}$

(d) $d = 1.5\sqrt{t}$

Q.26 The span to depth ratio limit is specified in IS 456:2000 for the reinforced concrete beams, in order to ensure that the

- (a) tensile crack width is below a limit
- (b) shear failure is avoided
- (c) stress in the tension reinforcement is less than the allowable value
- (d) deflection of the beam is below a limiting value

Q.27 The modulus of rupture of concrete gives

- (a) the direct tensile strength of the concrete
- (b) the direct compressive strength of the concrete
- (c) the tensile strength of the concrete under bending
- (d) the characteristic strength of the concrete

Q.28 A soil having particles of nearly the same size is known as

- (a) well graded
- (b) uniformly graded
- (c) poorly graded
- (d) gap graded

Q.29 The consistency of a saturated cohesive soil is affected by

- (a) water content
- (b) particle size distribution
- (c) density index
- (d) coefficient of permeability

Q.30 The appropriate field test to determine the undrained shear of soft clay is

- (a) plate load test
- (b) static cone penetration test
- (c) standard penetration test
- (d) vane shear test

Q.31 The earth pressure for the design of bridge abutments is taken as

- (a) active thrust
- (b) passive thrust
- (c) thrust in at-rest condition
- (d) none of the above

Q.32 Along a phreatic line in an earth dam

- (a) the total head is constant but not zero
- (b) the total head is everywhere zero
- (c) the pressure head is everywhere zero
- (d) none of the above

Q.33 The coefficient of permeability of a soil is 5×10^{-5} cm/sec for a certain pore fluid. If the viscosity of the pore fluid is reduced to half, the coefficient of permeability will be

- (a) 5×10^{-5} cm/sec
- (b) 10×10^{-5} cm/sec
- (c) 2.5×10^{-5} cm/sec

(d) 1.25×10^{-5} cm/sec

Q.34 The ultimate bearing capacity of a surface strip footing on clay, according to Terzaghi's theory is

(a) $5.7c$

(b) $5.14c$

(c) $q_u B$

(d) $9c$

Where, c -unit cohesion, q_u -unconfined compressive strength, B -width of footing

Q.35 The zero air voids curve is non-linear owing to

(a) the standard proctor test data of dry density and corresponding water content plotting as a non linear curve

(b) the dry density at 100% saturation being a non-linear function of the void ratio

(c) the water content altering during compaction

(d) the soil being compacted with an odd number of blows

Q.36 The coefficient of consolidation is used for

(a) establishing the duration of primary consolidation

(b) estimate the amount of settlement for a load increment

(c) determining the depth to which the soil is stressed when loads are applied on the surface of a soil deposit

(d) determining the pre-consolidation pressure for soil deposits known to be over-consolidated

Q.37 Which of the following relations is not correct?

(a) $e = \frac{n}{1-n}$

(b) $\gamma_{sat} = \frac{G+e}{1+e} \gamma_w$

(c) $n = \frac{e}{1-e}$

(d) $e = \frac{wG}{S}$

Where e =voids ratio, n =porosity, W =water content, S =degree of saturation, γ_{sat} =saturated unit weight of soil, γ_w =unit weight of water

Q.38 Seepage force per unit volume (j) can be expressed as

(a) $i\gamma_w L$

(b) iL

(c) $\gamma_w h$

(d) $i\gamma_w$

Where i =hydraulic gradient, L =length of soil sample, h =hydraulic head, γ_w =unit weight of water

Q.39 The soils most susceptible to liquefaction are

(a) saturated dense sands

(b) saturated fine and medium sands of uniform particle size

(c) saturated clays of uniform size

(d) saturated gravels and cobbles

Q.40 For the determination of earth pressure, coulombs wedge theory assumes that

(a) the back of wall is smooth and vertical

(b) the soil is non-homogenous and anisotropic

(c) the slip surface is circular

(d) the wall surface is rough

Q.41 The sequent depth ratio of a ratio of a hydraulic jump in a rectangular horizontal channel is 10.30. The Froude number at the beginning of the jump is

(a) 5.64

(b) 7.63

(c) 8.05

(d) 13.61

Q.42 In an iceberg, 15% of volume projects above sea surface. If the specific weight of sea water is 10.5 kN/m^3 , the specific weight of iceberg in kN/m^3 is

(a) 12.52

(b) 9.81

(c) 8.93

(d) 7.83

Q.43 The ordinate of the Instantaneous Unit Hydrograph (IUH) of a catchment at any time t , is

(a) the slope of the 1-hour unit hydrograph at that time

(b) the slope of the direct runoff unit hydrograph at that time

(c) difference in the slope of the S-curve and 1-hour unit hydrograph

(d) the slope of the S-curve with effective rainfall intensity 1 cm/hr

Q.44 An isochrone is a line on the basin map

(a) joining rain gauge stations having equal rainfall duration

(b) joining points having equal rainfall depth in a given time interval

(c) joining points having equal time of travel of surface runoff to the catchment outlet

(d) joining points which are at equal distance from the catchment outlet

Q.45 In a steady radial flow into an intake, the velocity is found to vary as $(1/r^2)$, where r is the radial distance. The acceleration of the flow is proportional to

(a) $1/r^5$

(b) $1/r^3$

(c) $1/r^4$

(d) $1/r$

Q.46 In a siphon aqueduct, the most severe condition of uplift on the floor occurs when

(a) the canal and drainage run full

(b) the canal run fulls; the drainage channel is dry; and the water table is at the stream base

(c) the canal is dry, the drainage floor is at HFL and the water table is at the HFL of the drainage flow

(d) the canal runs full; and the drainage is dry

Q.47 The standard project flood is

(a) the same as the probable maximum flood

- (b) the same as the design flood
- (c) smaller than the probable maximum flood
- (d) larger than the probable maximum flood by a factor implying safety factor

Q.48 The head loss due to sudden expansion is expressed by

- (a) $\frac{V_1^2 - V_2^2}{2g}$
- (b) $\left(\frac{V_1 - V_2}{2g}\right)^2$
- (c) $\frac{(V_1 - V_2)^2}{g}$
- (d) $\frac{(V_1 - V_2)^2}{2g}$

Q.49 A discharge of 1 cumec is flowing in a rectangular channel one metre wide at a depth of 20 cm. The bed slope of the channel is

- (a) mild
- (b) critical
- (c) steep
- (d) average

Q.50 The dimensions of a pressure gradient in a fluid flow are

- (a) $M L^{-1} T^2$
- (b) $M L^{-3} T^{-2}$
- (c) $M L^{-2} T^{-2}$
- (d) $M^{-1} L^{-3} T^{-2}$

Q.51 Shear stress develops on a fluid element, if

- (a) the fluid is at rest

(b) the fluid container is subject to uniform linear acceleration

(c) the fluid is inviscid

(d) the fluid is viscous and the flow is non uniform

Q.52 A lysimeter is used to measure

- (a) infiltration
- (b) evaporation
- (c) evapotranspiration
- (d) radiation

Q.53 At a rated capacity of 44 cumecs, a centrifugal pump develops 36 m of head when operating at 1450 rpm. Its specific speed is

- (a) 654
- (b) 509
- (c) 700
- (d) 90

Q.54 a combined sewer is one which transports

- (a) domestic sewage and storm water
- (b) domestic sewage and industrial waste
- (c) domestic sewage and overhead flow
- (d) domestic sewage, industrial wastes and storm water

Q.55 In an atmosphere under super adiabatic lapse rate conditions, the emissions from a chimney produces a flame described as

- (a) coning
- (b) loffing
- (c) looping
- (d) fumigation

Q.56 Methemoglobinemia, the 'blue baby' syndrome is caused by consuming water containing excess of

- (a) fluoride
- (b) phosphate
- (c) nitrate
- (d) nitrite

Q.57 Hardness of water is caused by the presence of which of the following in water?

- (a) chlorides and sulphates
- (b) calcium and magnesium
- (c) nitrites and nitrates
- (d) sodium and potassium

Q.58 The clariflocculator is the unit in which of the following things will occur

- (a) floc formation and its subsequent removal by filtration
- (b) floc formation and its subsequent removal by sedimentation
- (c) floc formation and its subsequent removal by decantation
- (d) removal of bacteria by filtration and chlorination

Q.59 A rapid test to indicate the intensity of pollution in river water is

- (a) Biochemical Oxygen Demand
- (b) Dissolved Oxygen
- (c) MPN
- (d) Total Dissolved Solids

Q.60 Trickling filters are used to remove

- (a) suspended solids
- (b) colloidal solids

(c) organic matter

(d) pathogenic bacteria

Q.61 Symbiosis, the beneficial association between algae and bacteria is used for treatment of waste water in the following unit?

- (a) Activated sludge
- (b) Rotating Biological Disc
- (c) Anaerobic Digester
- (d) Oxidation Pond

Q.62 The ultimate BOD of the waste water whose 5 day BOD $(BOD)_5$ and rate constant (base e) are respectively 150mg/L and 0.23 is

- (a) 80 mg/L
- (b) 150 mg/L
- (c) 180 mg/L
- (d) 220 mg/L

Q.63 A small filter of 0.05 m depth removes 90% of particles present in water. If the particle removal required is 99%, what should be the depth of filter?

- (a) 0.10 m
- (b) 0.50 m
- (c) 0.75 m
- (d) 1.00 m

Q.64 During temperature inversion in atmosphere, air pollutants tends to

- (a) accumulate above inversion layer
- (b) accumulate below inversion layer
- (c) disperse laterally
- (d) disperse vertically

Q.65 Alkalinity of water can be defined correctly in one of the following ways

(a) it is the measure of ability of water to neutralize oxygen

(b) it is the measure of ability of water to neutralize carbonates

(c) it is the presence of ions in water that will neutralize hydrogen ions

(d) it is the measure of ability of water to neutralize hydroxides

Q.66 Among the following disinfectants of waste water, the one that is most commonly used is

(a) Chlorine dioxide

(b) Chlorine

(c) Ozone

(d) UV radiation

Q.67 Transition curve is provided in horizontal alignment

(a) to increase radius of curvature

(b) to facilitate the application of super elevation

(c) to counteract the centrifugal forces developed

(d) to prevent vehicles from skidding laterally

Q.68 The result of ring and ball softening point test on asphalts is given in terms of

(a) viscosity

(b) time

(c) flow

(d) temperature

Q.69 Moving car observer method is a procedure

(a) to find the traffic flow of traffic stream

(b) to estimate the traffic capacity of a road section

(c) to carry out origin destination studies

(d) to identify accident prone locations on highways

Q.70 California Bearing Ratio

(a) is a measure of soil strength

(b) is a procedure for designing flexible pavements

(c) is a method of soil identification

(d) is a measure to indicate the relative strength of paving materials

Q.71 A contraction joint is provided in concrete pavement to

(a) prevent contraction of the pavement

(b) permit cracking at the joint

(c) lower the bending moment in the pavement in order to reduce pavement thickness

(d) lower the temperature gradient across the depth of the pavement

Q.72 At highway stretches where the required overtaking sight distance cannot be provided, it is necessary to incorporate

(a) at least twice the stopping sight distance

(b) half the required overtaking sight distance

(c) one third the required overtaking sight distance

(d) three times the stopping sight distance

Q.73 The ideal form of curve for the summit curve is

(a) spiral

(b) parabola

(c) circle

(d) lemniscates

Q.74 In using the data from a plate bearing test for determining the modulus of subgrade reaction, the value of settlement to be used is

- (a) 1.25 mm
- (b) 2.50 mm
- (c) 3.75 mm
- (d) 1.75 mm

Q.75 The function of ballast in the railway track is to

- (a) facilitate drainage
- (b) serve as an elastic support for the track structure
- (c) provide necessary resilience against the dynamic effects of the loads
- (d) all the above

Q.76 Flexible pavements derive stability primarily from

- (a) aggregate interlock, particle friction and cohesion
- (b) cohesion alone
- (c) the binding power of bituminous materials
- (d) the flexural strength of the surface course

Q.77 On a sag (or valley) curves the available sight distance is determined based on

- (a) design speed
- (b) height of obstacle
- (c) height of driver eye
- (d) night time driving conditions

Q.78 Sliding considerations for stopped vehicles on super elevated horizontal curves provide the following bound on the amount of super elevation, e ,

- (a) $e \geq$ coefficient of rolling friction
- (b) $e \geq$ coefficient of side friction
- (c) $e \leq$ coefficient of rolling friction
- (d) $e \leq$ coefficient of side friction

Q.79 It is required to produce a small scale map of an area in magnetic zone by directly plotting and checking the work in the field itself. Which of the following surveys will be the most appropriate for purpose?

- (a) Chain
- (b) Theodolite
- (c) Plane table
- (d) Compass

Q.80 A 30 m metric chain is found to be 0.1 m too short throughout the measurement. If the distance measured is recorded as 300 m, then the actual distance measured will be

- (a) 300.1 m
- (b) 301.0 m
- (c) 299.0 m
- (d) 310.0 m

Q.81 For locating an inaccessible point with the help of only a plane table, one should use

- (a) traversing
- (b) resection
- (c) radiation
- (d) intersection

Q.82 In a closed traverse, the sum of south latitudes exceeds the sum of north latitudes and the sum of east departures exceeds the sum of west departures. The closing line will lie in the

- (a) N-W quadrant
- (b) N-E quadrant
- (c) S-E quadrant
- (d) S-W quadrant

Q.83 Which of the following methods would give accurate results in determining the directions

- (a) observation of circumpolar stars at same vertical
- (b) observations of circumpolar stars at culmination
- (c) extra meridian observation of circumpolar star
- (d) observation of the sun at equal altitudes

Q.84 Which of the following methods estimates best area of an irregular and curved boundary

- (a) Trapezoidal method
- (b) Simson's method
- (c) Average ordinate method
- (d) Mid-ordinate method

Q. 85 A light house is visible just above the horizon at a certain station at the sea level. The distance between the station and the light house is 40 km. The height of the light house is approximately

- (a) 187 m
- (b) 137.7 m
- (c) 107.7 m
- (d) 87.3 m

Q.86 Which of the following surveys is required in observation of stars?

- (a) Astronomical survey

- (b) Cadastral survey
- (c) Aerial Survey
- (d) Photogrammetric survey

Q. 87 Triangulation station selected close to the main station for avoiding intervening obstruction is called

- (a) eccentric station
- (b) pivot station
- (c) satellite station
- (d) tie station

Q.88 The method of orienting a plane table with two inaccessible point is known as

- (a) intersection
- (b) resection
- (c) back sighting
- (d) two-point problem

Q.89 Theory of errors and adjustment deals with minimizing the effects of

- (a) instrumental errors
- (b) mistakes
- (c) systematic errors
- (d) personal and accidental errors

Q.90 The magnetic needle in prismatic compass is placed

- (a) at the bottom of the graduated aluminium ring
- (b) above the graduated aluminium ring
- (c) below the brass box
- (d) below the needle lifter, but above the bottom inside the compass