

MHT CET 2020 Mathematics Memory Based Question Paper PDF

SECTION 1: PHYSICS

1. A thin uniform rod of length 'L' and mass 'M' is bent at the middle point 'O' at an angle of 45° as shown in the figure. The moment of inertia of the system about an axis passing through 'O' and perpendicular to the plane of the bent rod, is:

- 1) $\frac{ML^2}{12}$
- 2) $\frac{ML^2}{24}$
- 3) $\frac{ML^2}{3}$
- 4) $\frac{ML^2}{6}$

2. The ratio of the specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom 'n' is given by:

- 1) $(1 + \frac{n}{2})$
- 2) $(1 + \frac{1}{n})$
- 3) $(1 + \frac{n}{3})$
- 4) $(1 + \frac{2}{n})$

3. When the observer moves towards a stationary source with velocity V_1 , the apparent frequency of emitted note is F_1 . When observer moves away from the source with velocity V_1 , the apparent frequency is F_2 . If V is the velocity of sound in air and $F_1/F_2 = 2$ then V/V_1 is equal to:

- 1) 5
- 2) 6
- 3) 4
- 4) **3**

4. Two parallel wires of equal lengths are separated by a distance of 3m from each other. The currents flowing through first and second wire is 3A and 4.5A respectively in opposite directions. The resultant magnetic field at mid-point of both the wires is:

- 1) $\frac{3\mu_0}{2\pi}$
- 2) $\frac{7\mu_0}{2\pi}$
- 3) $\frac{\mu_0}{2\pi}$
- 4) $\frac{5\mu_0}{2\pi}$

5. The angle made by a vector $\vec{B} = 3\hat{i} + 2\hat{j} + 4\hat{k}$ with y-axis is:

- 1) $\cos^{-1}(\frac{5}{\sqrt{23}})$
- 2) $\cos^{-1}(\frac{4}{\sqrt{11}})$
- 3) $\cos^{-1}(\frac{3}{\sqrt{17}})$

- 4) $\cos^{-1}\left(\frac{2}{\sqrt{29}}\right)$
6. An electron makes a transition from an excited state to the ground state of a hydrogen like atom. Out of the following statements which one is correct?
- 1) K.E., P.E. and T.E. decreases.
 - 2) K.E. decreases, P.E. increases but total energy remains the same.
 - 3) **K.E. increases but P.E. and T.E. decreases.**
 - 4) K.E. and T.E. decreases but P.E. increases.
7. In transistor amplifier, base-emitter junction is forward biased and collector emitter junction is reverse biased. The current gain is:
- 1) $\Delta I_E / \Delta I_B$
 - 2) $\Delta I_B / \Delta I_E$
 - 3) $\Delta I_B / \Delta I_C$
 - 4) $\Delta I_C / \Delta I_B$
8. The maximum error in the measurement of mass and length is 4% and 3% respectively. The error in the measurement of density of a cube will be:
- 1) 9%
 - 2) 15%
 - 3) 13%
 - 4) 6%
9. If two sources emit light waves of different amplitudes then in interference pattern:
- 1) fringes disappear after short time.
 - 2) brightness of fringes is less.
 - 3) **there is some intensity of light in the region of destructive interference.**
 - 4) fringe width will be less.
10. The radius of the orbit of a geostationary satellite is:
- 1) $(gR^2/\omega^2)^{1/3}$
 - 2) gR^2/ω^2
 - 3) $(gR^2/\omega^2)^{2/3}$
 - 4) $(gR^2/\omega^2)^{1/2}$
11. A thin circular ring (M, R) is rotating with ω . Two objects (m) are attached to opposite ends of a diameter. The new angular velocity is:
- 1) $M\omega/(M + 2m)$
 - 2) $M\omega/(M + m)$

- 3) $(M + 2m)\omega/M$
- 4) $(M - 2m)\omega/(M + 2m)$

12. For the fundamental forces, maximum and minimum range is for:

- 1) **gravitational force, weak nuclear force.**
- 2) gravitational force, electromagnetic force.
- 3) strong nuclear force, electromagnetic force.
- 4) electromagnetic force, gravitational force.

13. If $|\hat{a}_1 - \hat{a}_2| = \sqrt{3}$ for unit vectors, then $(\hat{a}_1 - \hat{a}_2) \cdot (2\hat{a}_1 - \hat{a}_2)$ is:

- 1) $1/2$
- 2) 2
- 3) 1
- 4) $3/2$

14. Light (λ) on photosensitive surface, photons power 'P'. Photons (n) in 't' second is:

- 1) $hc/P\lambda t$
- 2) $P\lambda t/hc$
- 3) $P\lambda/hct$
- 4) $hP/\lambda tc$

15. Spring ($k=10\text{N/m}$, $m=10\text{kg}$). If velocity is 40cm/s , displacement is ($\text{Amp}=0.5\text{m}$):

- 1) **0.3 m**
- 2) 0.2 m
- 3) 0.4 m
- 4) 0.45 m

16. Potential difference across the $4.5\mu\text{F}$ capacitor in the given circuit:

- 1) $8/3$ volt
- 2) **8 volt**
- 3) 6 volt
- 4) 4 volt

17. Seconds pendulum length decreases by 0.3cm shifting A to B. If $g_A = 981$, then g_B is:

- 1) 975 cm/s^2
- 2) **978 cm/s^2**
- 3) 984 cm/s^2
- 4) 981 cm/s^2

18. Resistance required for a galvanometer (G , V_g) to read 'V' volt:

- 1) $G(V + V_g)/V$
- 2) $G(V/V_g - 1)$
- 3) $G(V - V_g)/V$
- 4) GV_g

19. Pipe time 't' for sound to reach closed end. Frequency of vibration is:

- 1) $1/3t$
- 2) $1/t$
- 3) $1/4t$
- 4) $1/2t$

20. Magnetic field (B), intensity (H), permeability (μ_0), susceptibility (χ) relation:

- 1) $B/H = \mu_0(1 + \chi)$
- 2) $H/B = \mu_0(1 - \chi)$
- 3) $B/H = \mu_0(1 - \chi)$
- 4) $H/B = \mu_0(1 + \chi)$

21. A solid sphere (M, R) is recast into a disc (thickness 't'). If I_{axis} remains 'I', radius is:

- 1) $R/\sqrt{19}$
- 2) $R/\sqrt{15}$
- 3) $2R/\sqrt{15}$
- 4) $2R/\sqrt{19}$

22. Reactance at frequency 'f' is X_c . At frequency $4f$, reactance is:

- 1) $X_c/2$
- 2) $X_c/4$
- 3) $X_c/8$
- 4) X_c

23. Organ pipe closed at one end vibrates with 2 nodes and antinodes. Mode is:

- 1) 3rd overtone
- 2) **1st overtone**
- 3) fundamental
- 4) 2nd overtone

24. Telescope focal length eyepiece doubled, magnifying power becomes:

- 1) $m/4$

- 2) $m/2$
- 3) $2m$
- 4) m

25. Electron revolving around nucleus. Magnetic field 'B' at centre is:

- 1) $\mu_0 e L / 4 \pi m r^2$
- 2) $\mu_0 e L / 4 \pi m r^3$
- 3) $\mu_0 e L / 2 \pi m r^2$
- 4) $\mu_0 e L / 2 \pi m r^3$

26. Height difference between centre and edge of rotating liquid in cylindrical vessel:

- 1) $R^2 \omega^2 / g$
- 2) $R \omega / g$
- 3) $R \omega / 2g$
- 4) $R^2 \omega^2 / 2g$

27. Potentiometer (4m, 5Ω) with 495Ω series and cell 2V. Potential gradient:

- 1) 0.03 V/m
- 2) 0.01 V/m
- 3) 0.02 V/m
- 4) 0.04 V/m

28. Two wires A and B (ratio diam 1:3). Ratio of energy density $u_A : u_B$:

- 1) 27 : 1
- 2) 9 : 1
- 3) 81 : 1
- 4) 3 : 1

29. Particle moves on circular path with decreasing speed. Correct statement:

- 1) Resultant acceleration is towards centre.
- 2) Angular momentum remains constant.
- 3) **Direction of angular momentum remains constant.**
- 4) It moves in spiral path.

30. Small angle prism 'A'. Ray emerges normally. Angle of incidence 'i' is:

- 1) A/μ
- 2) $\mu A/2$
- 3) μA

4) $A/2\mu$

31. Layer of atmosphere where water vapour is present:

- 1) **Troposphere**
- 2) Ionosphere
- 3) Mesosphere
- 4) Stratosphere

32. Galvanometer (100 divisions, Sens: 10 div/mA, 4 div/mV). Resistance:

- 1) 5 Ω
- 2) 2.5 Ω
- 3) 10 Ω
- 4) 7.5 Ω

33. Ideal diode current in arrangement (+2V $\rightarrow$ Diode $\rightarrow$ 400 Ω $\rightarrow$ -2V):

- 1) 10 A
- 2) **10 mA**
- 3) 20 mA
- 4) 1 mA

34. Mercury drops R_1, R_2 form big drop isothermally. Resultant radius R:

- 1) $\sqrt{R_1^2 - R_2^2}$
- 2) $(R_1 + R_2)/2$
- 3) $\sqrt{R_1^2 + R_2^2}$
- 4) $(R_1^3 + R_2^3)^{1/3}$

35. Bar magnet axial vs transverse field magnitude ratio at distance 'r':

- 1) 4 : 1
- 2) 2 : 1
- 3) 1 : 4
- 4) 1 : 2

36. Projectile vertically. K.E. is half of escape value. Max height is:

- 1) 4R
- 2) **R**
- 3) 2R
- 4) 3R

37. Black surface (A, 27°C) emits energy E. If sides reduced to 1/3 and 327°C:

- 1) $2E/9$
- 2) $E/9$
- 3) $16E/9$
- 4) $4E/9$

38. Graph for max K.E. (E) vs Intensity (I) of incident radiation:

- 1) (D)
- 2) (B)
- 3) (A)
- 4) **(C) (Horizontal line)**

39. Particle in conical funnel at height from vertex. Speed 'V' is:

- 1) $V^2/2g$
- 2) V/g
- 3) V^2/g
- 4) $V/2g$

40. Metal rod heating $T^\circ\text{C}$. Force required to prevent expansion:

- 1) $YA\alpha/T(1 + \alpha T)$
- 2) $YA\alpha T/(1 - \alpha T)$
- 3) $YA\alpha T/(1 + \alpha T)$
- 4) $YA\alpha/(1 - \alpha T)$

41. To have minimum resistance for a copper wire, we should:

- 1) increase L and decrease D.
- 2) **decrease L and increase D.**
- 3) decrease both L and D.
- 4) increase both L and D.

42. Ratio of centripetal acceleration electron in 3rd to 5th Bohr orbit:

- 1) $424/21$
- 2) $625/81$
- 3) $125/4$
- 4) $775/61$

43. SHM particle (Amp A, Energy E). At what displacement is $\text{K.E.} = 3E/4$?

- 1) A
- 2) $A / 8$

- 3) $A / 4$
- 4) **$A / 2$**

44. Ratio h_1/h_2 for capillary at surface vs depth 'd' in mine:

- 1) $(1 + 2d/R)$
- 2) $(1 - d/R)$
- 3) $(1 + d/R)$
- 4) $(1 - 2d/R)$

45. Transverse wave speed on string. If string extended by 50%, speed nearly:

- 1) $(0.7) V$
- 2) **$(1.22) V$**
- 3) $(1.1) V$
- 4) $(0.9) V$

46. K.E. acquired by mass 'M' in distance 'd' starting from rest under force F:

- 1) inversely proportional to $\sqrt{M}$.
- 2) directly proportional to M.
- 3) **independent of M.**
- 4) directly proportional to $\sqrt{M}$.

47. Coherent sources path difference 0 and $\lambda/2$. Intensity ratio:

- 1) two : one
- 2) one : two
- 3) one : one
- 4) **infinity : one**

48. Light passing through crossed polaroids. Statement correct:

- 1) also passes through second polaroid.
- 2) partially passes through second polaroid.
- 3) **is blocked by second polaroid.**
- 4) passes with greater intensity.

49. Series LCR circuit ($R = 18\Omega$, $Z = 33\Omega$, $V = 220V$). True power:

- 1) 400 W
- 2) 600 W
- 3) **800 W**
- 4) 200 W

50. Metal sphere radius 1m, charge 10^{-2}C . Bulk Modulus $10^{11}/4\pi^2$. Volume strain:

- 1) $10^{-1}/6\epsilon_0$
- 2) $10^{-14}/8\epsilon_0$
- 3) $10^{-15}/8\epsilon_0$
- 4) $10^{-12}/4\epsilon_0$

SECTION 2: CHEMISTRY

1. Role of tuyers used in blast furnace for iron extraction:

- 1) even distribution of charge.
- 2) **blow blast of preheated air.**
- 3) remove molten slag and iron.
- 4) prevents loss of hot gases.

2. Compound containing -CO-NH- linkage:

- 1) Vinylcyanide
- 2) Dimethylterephthalate
- 3) ϵ **caprolactam**
- 4) Hexamethylenediamine

3. Primary nitroalkanes hydrolysis with HCl forms:

- 1) Alcohol and nitrous acid
- 2) **Carboxylic acid and hydroxyl amine**
- 3) Aldehyde and hydroxyl amine
- 4) Ketone and nitrous acid

4. Moles of acetic acid from 1 mole glucose treated with excess acetic anhydride:

- 1) **5 moles**
- 2) 3 moles
- 3) 4 moles
- 4) 2 moles

5. Method NOT used to preserve food:

- 1) Removal of heat
- 2) Irradiation
- 3) **Addition of water**
- 4) Addition of heat

6. Molecular formula of 3-bromopropene:

- 1) C_3H_6Br
- 2) C_3H_7Br
- 3) **C_3H_5Br**
- 4) C_3H_3Br

7. Condition for spontaneous reaction:

- 1) $\Delta S < 0, \Delta H > 0, \Delta G > 0$ at all temp
- 2) $\Delta S < 0, \Delta H > 0, \Delta G > 0$ at low temp
- 3) **$\Delta S > 0, \Delta H < 0, \Delta G < 0$ at all temp**
- 4) $\Delta S < 0, \Delta H > 0, \Delta G > 0$ at high temp

8. Substance NOT a mineral of chlorine:

- 1) Horn silver
- 2) **Cryolite**
- 3) Carnalite
- 4) Sylvine

9. Allylic secondary alcohol:

- 1) But-2-en-1-ol
- 2) **But-3-en-2-ol**
- 3) 2-Methyl but-3-en-2-ol
- 4) Prop-2-en-1-ol

10. Reaction NOT involving replacement of diazonium group:

- 1) Potassium iodide
- 2) **Aniline**
- 3) Cuprous chloride in HCl
- 4) Hypophosphorus acid

11. If 's', 'p' and 'd' atomic orbitals take part, hybrid orbitals formed:

- 1) **5**
- 2) 3
- 3) 4
- 4) 2

12. IUPAC name of the cyclopentanol derivative shown:

- 1) 3 - chloro - 5 - methyl cyclopentanol

- 2) 4 - chloro - 2 - methyl cyclopentanol
- 3) 1 - chloro - 3 - methyl cyclopentan - 4 - ol
- 4) 4 - chloro - 2 - hydroxy - 1- methylcyclopentane

13. Mineral of Sulphur:

- 1) Fluorapatite
- 2) Carnalite
- 3) **Cinnabar**
- 4) Sylvine

14. FCC element density 2.8, edge length 4×10^{-8} cm. Molar mass:

- 1) 33.0 g mol⁻¹
- 2) 22.0 g mol⁻¹
- 3) **27.0 g mol⁻¹**
- 4) 36.0 g mol⁻¹

15. Vapour pressure A (0.90) drops to (0.60) with solute. Mole fraction of A:

- 1) 0.300
- 2) 0.333
- 3) 0.500
- 4) **0.667**

16. Alkane source ($M = 240, H = 15\%$):

- 1) Gasoline
- 2) Diesel
- 3) Petrol
- 4) **Coatings on green leaves**

17. P_4O_{10} reacts with water to produce:

- 1) $H_3P(OH)_3$
- 2) H_3PO_3
- 3) **H_3PO_4**
- 4) $H_4P(OH)_3$

18. Sum of oxidation states in $Cr_2O_7^{2-}$:

- 1) Zero
- 2) -2
- 3) +2

4) -1

19. Reaction converting methyl to aldehyde via chromyl chloride complex:

- 1) Stephen reaction
- 2) Wolff-Kishner reaction
- 3) **Etard reaction**
- 4) Rosenmund reaction

20. Artificial sweetener containing chlorine:

- 1) Saccharine
- 2) Alitame
- 3) Aspartame
- 4) **Sucralose**

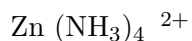
21. Conductivity of 0.08 M KCl is 2×10^{-2} . Molar conductivity:

- 1) 350
- 2) **250**
- 3) 25.0
- 4) 0.25

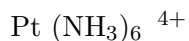
22. Alcohol NOT prepared by acid catalyzed hydration of alkenes:

- 1) Ethanol
- 2) Propan-2-ol
- 3) **Propan-1-ol**
- 4) 2-Methyl propan-2-ol

23. Complex where central metal does NOT obey EAN rule:



- 1) **$[\text{Cu}(\text{NH}_3)_4]^{2+}$**



24. First order reaction rate constant 0.02232. Time for 75% completion:

- 1) **62.12 min**
- 2) 38.31 min
- 3) 12.77 min
- 4) 48.12 min

25. IUPAC name of $[\text{CoCl}_2(\text{en})_2]^+$:

- 1) **Bis (ethylenediammine) dichloro cobalt (III) ion**
- 2) Dichloro ethylenediamine cobalt (I)
- 3) Ethylene diamine cobalt (I) dichloride
- 4) Ethylene diamine cobalt chloride

26. Electronic configuration of 3rd element of group-2:

Ne $3s^1$

Ne $3s^2$

Ar $4s^1$

- 1) **[Ar] $4s^2$**

27. Element FCC ($a = 250$ pm, $at.mass = 90.3$). Density:

- 1) 23.12 g cm^{-3}
- 2) 19.20 g cm^{-3}
- 3) 48.40 g cm^{-3}
- 4) **38.40 g cm^{-3}**

28. Heat evolved when 6g carbon forms CS_2 ($\Delta H = -92$ kJ):

- 1) 22 kJ
- 2) 32 kJ
- 3) **46 kJ**
- 4) 11 kJ

29. Volume of dihydrogen for hydrogenation of 0.5 dm^3 ethene at STP:

- 1) 1.0 dm^3
- 2) **0.5 dm^3**
- 3) 0.75 dm^3
- 4) 0.25 dm^3

30. Electrons flow for current of 5 amp passed for 200 sec:

- 1) 9.65×10^{21}
- 2) 1.60×10^{21}
- 3) 3.12×10^{21}
- 4) 6.24×10^{21}

31. Example of hydrophobic sol:

- 1) Rubber in benzene
- 2) Cellulose acetate in acetone

- 3) Metal sulphide
- 4) Starch in water

32. IUPAC name of acrolein:

- 1) **Prop-2-enal**
- 2) 2-methyl but-2-enal
- 3) 3-methyl but-2-enal
- 4) But-2-enal

33. Formula of pyrolusite ore:

- 1) PbCrO_4
- 2) Cu_2O
- 3) Cr_2O_3
- 4) **MnO_2**

34. Aluminum FCC ($\text{radius} = 125 \text{ pm}$). Edge length of unit cell:

- 1) 280 pm
- 2) **353.5 pm**
- 3) 335.5 pm
- 4) 288.6 pm

35. Element exhibiting oxidation states other than +3:

- 1) **Ce**
- 2) Gd
- 3) Lu
- 4) La

36. IUPAC name of isobutyl bromide:

- 1) 2-methyl-1-bromo propane
- 2) **1-bromo-2-methyl propane**
- 3) 2-bromo-2-methyl propane
- 4) 2-bromo-1-methyl propane

37. Molecular formula of allyl chloride:

- 1) $\text{C}_3\text{H}_3\text{Cl}$
- 2) **$\text{C}_3\text{H}_5\text{Cl}$**
- 3) $\text{C}_3\text{H}_7\text{Cl}$
- 4) $\text{C}_3\text{H}_6\text{Cl}$

38. Molecule NOT obeying octet rule:

- 1) N_2
- 2) $NaCl$
- 3) Cl_2
- 4) **SF_6**

39. Oxide amphoteric in nature:

- 1) Cl_2O_7
- 2) CaO
- 3) B_2O_3
- 4) **SnO**

40. Toluene ($Cl_2/h\nu \rightarrow A, H_2O/\Delta \rightarrow B$). A and B are:

- 1) Benzoyl chloride, benzoic acid
- 2) Benzoyl chloride, benzaldehyde
- 3) Benzyl chloride, benzoic acid
- 4) **Benzyl chloride, benzaldehyde**

41. Reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ rate constant 6.2×10^{-4} . Rate at 1.25 mol L^{-1} :

- 1) 7.75×10^{-4}
- 2) 8.15×10^{-4}
- 3) 4.96×10^{-4}
- 4) 2.01×10^{-4}

42. Property of thermoplastic polymer:

- 1) Can't be recycled.
- 2) **Linear or branched chain polymers.**
- 3) Can't be remoulded.
- 4) Don't become soft on heating.

43. Organic monobasic acid ($M = 129, n = 2$). Empirical formula mass:

- 1) 158.0
- 2) 193.5
- 3) **64.5**
- 4) 258

44. K_f for 30g urea in 0.5 dm^3 water (Freezing point decreases 0.15°C):

- 1) **$0.15 \text{ K kg mol}^{-1}$**

- 2) $0.030 \text{ K kg mol}^{-1}$
- 3) $0.30 \text{ K kg mol}^{-1}$
- 4) $0.015 \text{ K kg mol}^{-1}$

45. Sodium nitrite + α -chlorosodium propionate boiling gives:

- 1) 1-Nitropropane
- 2) **Nitroethane**
- 3) 2-Nitropropane
- 4) Nitromethane

46. Molality 300mg urea in 30g water:

- 1) 0.133 m
- 2) 0.825 m
- 3) 0.498 m
- 4) **0.166 m**

47. Number of oxygen atoms in saccharic acid:

- 1) **8**
- 2) 12
- 3) 4
- 4) 6

48. Approximate ratio roasted ore:coke:limestone in blast furnace:

- 1) 5 : 12 : 3
- 2) 12 : 3 : 5
- 3) **12 : 5 : 3**
- 4) 5 : 3 : 12

49. Relation ΔH and ΔU for $2\text{SO}_{3(g)} \rightarrow 2\text{SO}_{2(g)} + \text{O}_{2(g)}$:

- 1) $\Delta H - \Delta U = 2RT$
- 2) $\Delta H - \Delta U = RT$
- 3) $\Delta H + \Delta U = -RT$
- 4) $\Delta H + \Delta U = RT$

50. New pressure if 100mL at 720mm occupies 84mL (const T):

- 1) **857.14 mm**
- 2) 712.14 mm
- 3) 816.60 mm

4) 604.82 mm

SECTION 3: MATHEMATICS

1. $\int [\log(1 + \cos x) - x \tan(x/2)] dx =$

- 1) $x \log |x| + c$
- 2) $x \log |1 + \sin x| + c$
- 3) $x \log |\tan(x/2)| + c$
- 4) $x \log |1 + \cos x| + c$

2. Population growth rate 5%. Time to double ($\log 2 = 0.6912$):

- 1) 13.8275 years
- 2) 13.624 years
- 3) 13.725 years
- 4) **13.8240 years**

3. Area bounded by circle $x^2 + y^2 = 16$ and lines $x = 0, x = 2$:

- 1) $[4\sqrt{3} + 8\pi/3]$
- 2) $1/2[4\sqrt{3} + 8\pi/3]$
- 3) $[4\sqrt{3} - 8\pi/3]$
- 4) $1/2[4\sqrt{3} - 8\pi/3]$

4. Integral from 0 to π ($x \cos x \sin x / (\cos^3 x + \cos x)$):

- 1) $\pi/4$
- 2) $\pi^2/4$
- 3) $\pi/8$
- 4) $\pi^2/8$

5. $A = \{1, 2, 3, 4, 5\}, B = \{1, 4, 5\}$. Relation $x > y$. Range of R:

- 1) **$\{1, 4\}$**
- 2) $\{4, 5\}$
- 3) $\{1, 4, 5\}$
- 4) $\{2, 4\}$

6. Plane intersection $x + 2y - 3z + 2 = 0, x + y + z + 1 = 0$ parallel to line:

- 1) $5x - y + 4z + 1 = 0$
- 2) $5x + y + 4z + 1 = 0$
- 3) $5x - y + 4z = 1$

4) $5x + y + 4z = 1$

7. Matrix not invertible if x is:

- 1) $-10/7$
- 2) $7/10$
- 3) $-7/10$
- 4) $10/7$

8. If matrix A has entries as shown, then:

- 1) A is not invertible
- 2) $A = A^{-1}$
- 3) $A^{-1} = 2A$
- 4) $A^{-1} = I$

9. Integral of $\sin x / \sin(x - \pi/4)$:

- 1) $1/\sqrt{2}[x + \log |\sin(x - \pi/4)|] + c$
- 2) $1/\sqrt{2}[x + \log |\sin(x + \pi/4)|] + c$
- 3) $x - \log |\sin(x - \pi/4)| + c$
- 4) $1/\sqrt{2}[x - \log |\sin(x - \pi/4)|] + c$

10. $(\sim p \wedge q) \rightarrow r$ is false. Values of p, q, r are:

- 1) **F, T, F**
- 2) F, T, T
- 3) T, T, F
- 4) F, F, T

11. $\tan A, \tan B, \tan C$ in H.P. for triangle ABC , then a^2, b^2, c^2 in:

- 1) **A. P.**
- 2) Not in A. P.
- 3) H. P
- 4) G. P.

12. Displacement $s = 3t^2 - 12t + 14$. Displacement when velocity is zero:

- 1) 14 units
- 2) 4 units
- 3) 0 units
- 4) **2 units**

13. Joint equation pair of lines through $(2, 3)$ parallel to $x^2 - y^2 = 0$:

- 1) $x^2 - y^2 - 4x + 6y - 5 = 0$
- 2) $x^2 - y^2 - 4x + 6y = 0$
- 3) $x^2 - y^2 - 4x + 6y + 17 = 0$
- 4) $x^2 - y^2 - 4x + 6y + 2 = 0$

14. $y = e^{\sin(\operatorname{cosec}^{-1}x)}$. Derivative dy/dx :

- 1) $1/ex^2$
- 2) $-1/ex^2$
- 3) 0
- 4) $e^{\cos(\operatorname{cosec}^{-1}x)}$

15. Approximate value of $\log_{10} 99$:

- 1) **1.9657**
- 2) 1.9857
- 3) 1.9957
- 4) 1.9757

16. Function $f(x)$ continuous at $x = 0$. Value of k :

- 1) 2
- 2) 10
- 3) **12**
- 4) 11

17. $y = mx + 2/m$ is general solution of:

- 1) $y(dy/dx)^2 = x(dy/dx) + 2$
- 2) $y = xdy/dx + 2$
- 3) $y(dy/dx) = x(dy/dx)^2 + 2$
- 4) $y(dy/dx) = x + 2$

18. For triangle ABC, $(\cos A - \cos C)/(a - c) + \cos B/b$ equals:

- 1) $1/b$
- 2) $2/b$
- 3) $-1/b$
- 4) $-2/b$

19. Max $Z = 10x + 25y$ subject to LPP constraints:

- 1) 110
- 2) 100

- 3) 120
- 4) **95**

20. Equation of line through intersection of $x + 2y + 8 = 0$ and $3x - y + 4 = 0$ with x,y intercept zero:

- 1) $4x - 5y = 0$
- 2) $5x - 4y = 0$
- 3) $5x + 4y = 0$
- 4) $4x + 5y = 0$

21. Equation of plane perpendicularly bisecting segment AB (3,2,-1) and (1,4,3):

- 1) $x + y + 2z + 3 = 0$
- 2) $x - y + 2z - 3 = 0$
- 3) $x + y - 2z - 3 = 0$
- 4) $x - y - 2z + 3 = 0$

22. Parallelogram ABCD. DP divides AC at R in ratio:

- 1) 3 : 1
- 2) 2 : 1
- 3) 1 : 2
- 4) 2 : 3

23. Two dice thrown. Prob sum divisible by 2 or 3:

- 1) $1/6$
- 2) $3/4$
- 3) $1/3$
- 4) $2/3$

24. Sequence sum upto 8 terms as shown:

- 1) 76
- 2) **74**
- 3) 78
- 4) 72

25. Integral 0 to $\pi/2$ ($1/(1 + \cos x)$):

- 1) -2
- 2) 2
- 3) **1**
- 4) -1

26. Which values have the same value ($\sin 120$, $\cos 930$, $\tan 840$, $\cot -1110$):

- 1) only (a) and (b)
- 2) All (a), (b), (c), (d)
- 3) only (a) and (c)
- 4) **only (c) and (d)**

27. Integral -1 to 1 ($\sqrt{1+x+x^2} - \sqrt{1-x+x^2}$):

- 1) 2
- 2) 5
- 3) 1
- 4) **0**

28. Integral $(1 - \log x)^2 / [1 + (\log x)^2]$ is:

- 1) $1/(1 + (\log x)^2) + c$
- 2) $x/(1 + (\log x)^2) + c$
- 3) $1/(1 + \log x) + c$
- 4) $x/(1 + \log x) + c$

29. $f(x) = e^x g(x)$, $g(0) = 4$, $g'(0) = 2$. Value of $f'(0)$:

- 1) 4
- 2) **6**
- 3) 1
- 4) 2

30. Circle through origin, x-int 3, y-int -5:

- 1) $x^2 + y^2 + 3x + 5y = 0$
- 2) $x^2 + y^2 + 3x - 5y = 0$
- 3) $x^2 + y^2 - 3x + 5y = 0$
- 4) $x^2 + y^2 - 3x - 5y = 0$

31. Foot of perpendicular from (0, 2, 3) on line:

- 1) $(-2, -3, 1)$
- 2) $(2, 3, -1)$
- 3) $(2, 3, 1)$
- 4) $(-2, -3, -1)$

32. Rate of decay mass. Time original m_0 becomes m_1 :

- 1) $1/k \log(m_1/m_0)$

- 2) $k \log(m_0/m_1)$
- 3) $k \log(m_1/m_0)$
- 4) $1/k \log(m_0/m_1)$

33. Cont. random variable pdf. Probability $P[-1 < X < 1]$:

- 1) 13/16
- 2) 1/2
- 3) 1/3
- 4) 11/16

34. Line passing through points (3,4,-7) and (6,-1,1):

- 1) $(x-3)/3 = (y-4)/-5 = (z+7)/8$
- 2) $(x-3)/3 = (y-4)/5 = (z+7)/8$
- 3) $(x-3)/-3 = (y-4)/-5 = (z+7)/8$
- 4) $(x-3)/3 = (y-4)/-5 = (z-7)/8$

35. Volume of parallelepiped with edges $2\vec{a} + \vec{b}$, $2\vec{b} + \vec{c}$, $2\vec{c} + \vec{a}$ (if $[\vec{a}\vec{b}\vec{c}] = 3$):

- 1) 22 cubic units
- 2) 15 cubic units
- 3) **27 cubic units**
- 4) 25 cubic units

36. Value of $(g \circ f)(3)$ for given $f(x)$ and $g(x)$:

- 1) -3
- 2) -1/3
- 3) **3**
- 4) 1/3

37. If $x/(x-y) = \log(a/(x-y))$, then dy/dx is:

- 1) $2 + 1/y$
- 2) $(2y-x)/y$
- 3) $(2x-y)/x$
- 4) $(x-2y)/y$

38. If $kx^2 + xy - y^2 = 0$ bisects angle between coordinate axes, k is:

- 1) 1, 2
- 2) 1, 3
- 3) **0, 2**

4) $-2, 2$

39. Solution of diff eq $(y + xdy/dx) \sin xy = \cos x$ at $x = 0$ is:

1) $\sin x + \cos xy = 1$

2) $\cos x - \sin xy = 1$

3) $\sin x - \cos xy = 1$

4) $\cos x + \sin xy = 1$

40. Incentre of triangle vertices A(0,4,0), B(0,0,3), C(0,4,3):

1) $(2, 0, 3)$

2) $(3, 0, 2)$

3) $(0, 3, 2)$

4) $(0, 2, 3)$

41. Angle between lines direction ratios $(4, -3, 5)$ and $(3, 4, k)$ is $\pi/3$, k:

1) ± 7

2) ± 10

3) ± 5

4) ± 6

42. Current in switching circuit $[\sim p \vee (p \wedge \sim q)] \vee q$ flows:

1) **irrespective of status of switches**

2) one open, one closed

3) both closed

4) both open

43. Probability distribution discrete. Value of $P(X \leq 2)$:

1) $1/10$

2) $7/10$

3) $3/10$

4) $9/10$

44. Value of p for binomial $X \sim B(4, p)$ if $2P(X = 3) = 3P(X = 2)$:

1) $9/13$

2) $4/13$

3) $1/13$

4) $12/13$

45. If $\tan \theta + \sin \theta = a$, $\tan \theta - \sin \theta = b$, values of $\cot \theta$, $\operatorname{cosec} \theta$ are:

- 1) $1/(a+b), 1/(a-b)$
- 2) $2/(a+b), 2/(a-b)$
- 3) $2/(a-b), 2/(a+b)$
- 4) $1/(a-b), 1/(a+b)$

46. Hyperbola focal distance $SP \cdot S'P$:

- 1) $a^2 \tan^2 \theta - b^2 \sec^2 \theta$
- 2) $a^2 \tan^2 \theta + b^2 \sec^2 \theta$
- 3) $a^2 \sec^2 \theta + b^2 \tan^2 \theta$
- 4) $a^2 \sec^2 \theta - b^2 \tan^2 \theta$

47. Trig sum $(\cos 12^\circ - \sin 12^\circ)/(\cos 12^\circ + \sin 12^\circ) + \sin 147^\circ/\cos 147^\circ$ is:

- 1) -2
- 2) 0
- 3) -1
- 4) 1

48. If $\cos A/a = \cos B/b = \cos C/c$, triangle is:

- 1) isosceles
- 2) **equilateral**
- 3) right angled scalene
- 4) scalene

49. Solution of diff eq $dy/dx + 2y = e^{-x}$ is:

- 1) $ye^x = x + c$
- 2) $ye^{2x} = x + c$
- 3) $ye^x = e^{2x} + c$
- 4) $ye^{2x} = e^x + c$

50. Function $f(x) = \log x - 2x/(x+2)$ increasing for:

- 1) $x \in (-\infty, 1)$
- 2) $x \in (-1, \infty)$
- 3) $x \in (-\infty, 0)$
- 4) $x \in (0, \infty)$