Examination: **M.Tech. Nanoscience and Technology**

Section 1 - Section 1

Question No.1 4.00

Bookmark

Based on the information given answer the following question.
1. In a family of six persons, there are people from three generations. Each has separate professions and they like different colours. There are two couples.
2. Shyam is an Engineer and his wife is not a doctor and she does not like Red colour.
3. Chartered Accountant likes green colour and his wife is a teacher.
4. Manisha is the mother-in-law of Sunita and she likes orange colour.
5. Vimal is the grand father of Tarun and tarun is the Principal and likes black colour.
6. Nyna is the grand daughter of Manisha and she likes blue colour. Nyna's Mother likes white colour.

What is the profession of Sunita?

- Cannot be determined
- Principal
- Teacher
- Chartered Accountant

Question No.2 4.00

Bookmark

The utilization of elemental carbon by microorganisms during bio-geochemical cycles is termed as

- Dissimilation
- Immobilization
- Diffusion
- Mineralization

Question No.3 4.00

Bookmark

Yeast Replicating plasmids (YRp) carry

- Centromere
- Telomere
- Mitochondrial DNA
- Autonomously replicating sequence

Question No.4 4.00

Bookmark

A fully formed infectious virus particle is called as

- Prions
- Virusoid
- Virion
- Capsid

Question No.5 4.00

Bookmark

Who is recognized as father of genetics?

- Louis Pasteur
- Gregor Mendel
- Darwin
- Alexander Fleming

Question No.6 4.00

Bookmark

DNA makes and RNA makes proteins this is termed as

- metabolism
- biosynthesis
- Central dogma
- protein expression

Question No.7 4.00

Bookmark

What value of the activation energy is predicted by the Arrhenius equation if $T \to \infty$?

- $E_a = \infty$
- $E_a = 0$

- $E_a = -1$
- $E_a = 1$

Question No.8 4.00

Bookmark

If $|f(Z)|$ is constant, then $f(Z)$is

- Variable
- Partially variable and constant
- Constant
- None of these

Question No.9 4.00

Bookmark

The burgers vector of a dislocation in NaCl (a = 5.58 Å) is

- 5.58 Å
- 4.83 Å
- 3.95 Å
- 2.79 Å

Question No.10 4.00

Bookmark

The basis for measuring thermodynamic property of temperature is given by

- first law thermodynamics
- Zeroth law thermodynamics
- third law thermodynamics
- second law thermodynamics

Question No.11 4.00

Bookmark

A certain op-amp has bias currents of 50 µA and 49.3 µA. The input offset current is

- 99 µA
- 49.7 µA
- 99.3 µA
- 700 nA

Question No.12 4.00

Bookmark

If A+B means A is daughter of B,
A-B means A is husband of B
A × B means A is brother of B

From the statement A × B × C × D, which of the following statement is not necessarily true?

- C is the brother of A
- A, B, C are male
- B is the brother of A
- D is brother of C

Question No.13 4.00

Bookmark

Let $A = i + 2j - k$, $B = 2i + j - 3k$, $C = 3i - 2j + k$

Find the value of Product $(A \; X \; B).C$

- -20
- 15
- 20
- -10

Question No.14 4.00

Bookmark

Correct the error in the italicized part of the sentence by choosing the most appropriate options
Job was a tiny man, barely five feet tall, with *a spright walk*

- a sprightly walk
- a sprightly walking
- spright walkingly
- spright walk

Question No.15 4.00

Bookmark

Appearance of thiophene is _____

- Colourless liquid
- Colourless soild
- Red colour liquid
- Red colour solid

Question No.16 4.00

Bookmark

The Laplace equation can be written as _____

- $\nabla^2 u = Constant$
- $\nabla^2 u = f(x)$
- $\nabla u = 0$
- $\nabla^2 u = 0$

Question No.17 4.00

Bookmark

According to Debye's theory of specific heat at low temperature specific heat is proportional to .....

- T^2
- Independent of T
- T^3
- T

Question No.18 4.00

Bookmark

Which among the following statement is wrong?

- Every thermodynamic system has its own equation of state independent of the others.
- An equation of state is a theoretical deduction from thermodynamics but is an experimental backing it.
- The equation of state is not applicable to systems which are not in thermodynamic equilibrium.
- An equation of state expresses the peculiar behaviour of one individual system which distinguishes it from the others

Question No.19 4.00

Bookmark

For the cylindrical coordinate system, the coordinate r-curves are

- horizontal straight lines.
- horizontal circles with centres on the z-axis.
- vertical straight lines
- horizontal straight half-lines radiating from the z-axis.

Question No.20 4.00

Bookmark

If A and B are non-zero square matrices, then AB = 0 implies

- A and B are singular
- A and B are orthogonal
- B is singular
- A is singular

Question No.21 4.00

Bookmark

Find the Eigen values of the matrix $B = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

- 6,1
- 1,5
- -6,1
- -5,1

Question No.22 4.00

Bookmark

A vector perpendicular to any vector that lies on the plane defined by $x + y + z = 6$

- $\hat{j} + \hat{k}$
- $\hat{2\imath} + 3\hat{\jmath} + 6\hat{k}$
- $\hat{\imath} + \hat{\jmath} - \hat{k}$
- $\hat{\imath} + \hat{\jmath} + \hat{k}$

Question No.23 4.00

Bookmark

Symmetrical molecules are

- Biological molecules
- Polar
- Organic molecules
- Non- Polar

Question No.24 4.00

Bookmark

Study the following information carefully and answer the question below it

Lakshman passes through seven lanes to reach his school. He finds that 'Truth lane' is between his house and 'Lie lane'. The third lane from his school is 'Karma lane'. 'Dharma lane' is immediately before the 'Yog lane'. He passes 'Salvation lane' at the end, 'Lie lane' is between 'Truth lane' and 'Dharma lane', the sixth lane from his house is 'Devotion lane'.

If Lakshman's house, each lane and his school are equidistant and he takes 2 minutes to pass one lane, then how long will he take to reach school from his house?

- 15 minutes
- 16 minutes
- 13 minutes
- 14 minutes

Question No.25 4.00

Bookmark

Which of the following are electromagnic in nature? 1) Alpha rays; 2) X – rays; 3) Gamma rays; 4) Cathode rays.

- 1 and 4
- 3 and 4
- 2 and 3
- 1 and 2

Question No.26 4.00

Bookmark

A function u is said to be harmonic if and only if

- $u_x^2 + u_y^2 = 0$
- $u_{xy} + u_{yx} = 0$
- $u_x + u_y = 0$
- $u_{xx} + u_{yy} = 0$

Question No.27 4.00

Bookmark

Genes are pieces of _____ that contain information for synthesis of ribonucleic acids (RNAs) or polypeptides

- Proteins
- pyrimidines
- Purines
- DNA

Question No.28 4.00

Bookmark

Which one of the following cannot be polarized?

- Sound waves
- Radio waves
- Microwaves
- X-rays

Question No.29 4.00

Bookmark

She studies very hard for the exams, _____?

- isn't it?
- is it?
- does she?
- doesn't she?

Question No.30 4.00

Bookmark

The first step in gene expression is

- Translation
- Transcription
- Transduction
- Replication

Question No.31 4.00

Bookmark

Crumb : Bread ::

- Flower : Vase
- Tea : Cup
- Splinter : Wood
- Water : Bucket

Question No.32 4.00

Bookmark

Biochips are made up of

- conducting molecules inserted into the protein frame work
- semi-conducting molecules inserted into the protein frame work
- functionalization
- non-conducting molecules inserted into the protein frame work

Question No.33 4.00

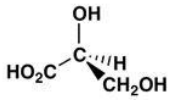
Bookmark

Study the following information carefully and answer the question below it

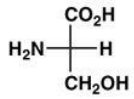
The Director of an MBA college has decided that six guest lectures on the topics of Motivation, Decision Making, Quality Circle, Assessment Centre, Leadership and Group Discussion are to be organised on each day from Monday to Sunday.
(i) One day there will be no lecture (Saturday is not that day), just before that day Group Discussion will be organised.
(ii) Motivation should be organised immediately after Assessment Centre.
(iii) Quality Circle should be organised on Wednesday and should not be followed by Group Discussion
(iv) Decision Making should be organised on Friday and there should be a gap of two days between Leadership and Group Discussion

Which of the following information is not required for the above lecture arrangements?

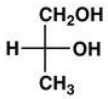
- Only (ii)



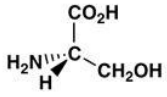
- All are required



- Only (i)



- Only (iii)



Question No.34 4.00

Bookmark

Figure out the odd statement about ceramics in the following.

- Contains both metallic and non-metallic elements
- usually less desire than metals
- Ductile in nature
- Good insulators of heat and electricity

Question No.35 4.00

Bookmark

The genetic information is stored in the form of _____ in most of the organisms.

- RNA
- DNA
- Proteins
- Histones

Question No.36 4.00

Bookmark

If the energy of a quantum harmonic oscillator is $E_n = n\hbar n$, n = 1, 2, 3,…..¥, the partition function of the system of oscillators is

- $e^{-\frac{h\nu}{kT}}$
- $\frac{1}{e^{\frac{h\nu}{kT}}-1}$
- $\frac{1}{1-e^{\frac{h\nu}{kT}}}$
- $e^{\frac{h\nu}{kT}}$

Question No.37 4.00

Bookmark

As per Faraday's laws of electromagnetic induction, an e.m.f. is induced in a conductor wheneverit

- Lies perpendicular to the magnetic flux
- Moves parallel to the direction of the magnetic field
- Lies in a magnetic field
- Cuts magnetic flux

Question No.38 4.00

Bookmark

When an ideal monatomic gas is expanded adiabatically from an initial volume V_0 to $3V_0$, its temperature changes from T_0 to T. Then the ratio T/T_0

- $(1/3)^{1/3}$
- 3
- 1/3
- $(1/3)^{2/3}$

Question No.39 4.00

Bookmark

Match the correct options

(i) paint	-	cellulose derivatives
(ii) varnishes	-	mixture of both paint and varnish
(iii) enamel	-	mixture of vehicle and pigment
(iv) lacquer	-	colloidal dispersion and contain no pigments

Select the correct answer using the code given below.

- ii, iii, iv & i
- ii, iii, i &iv
- iv, iii, ii &i
- iv, iii, i & ii

Question No.40 4.00

Bookmark

A dielectric material must be

- Semiconductor
- Insulator
- Good conductor
- Resistor

Question No.41 4.00

Bookmark

What is the value of the following series?

$$\left(1-\frac{1}{2!}+\frac{1}{4!}-\cdots\right)^2+\left(1-\frac{1}{3!}+\frac{1}{5!}-\cdots\right)^2$$

- e
- 1
- 0
- e^2

Question No.42 4.00

Bookmark

The electric field inside a spherical shell of uniform surface charge density is

- Inversely proportional to distance from centre
- Zero
- Non-Zero Constant
- Directly proportional to distance from centre

Question No.43 4.00

Bookmark

The actual rate equation for the reaction $CH_3COCH_3 + I_2 \rightarrow CH_3COCH_2I + HI$ is $\frac{d[CH_3COCH_3]}{dt} = k[CH_3COCH_3][H^+]$ .What is the order of the reaction with respect to acetone.

- Second order rate equation
- Third order rate equation
- Zero order rate equation
- First order rate equation

Question No.44 4.00

Bookmark

Let f(x,y)= e^{x^2}cosy. What is ∇f(x,y)?

- e^{x^2}cosyi−e^{x^2}sinyj
- $2xe^{x^2}$cosyi−e^{x^2}sinyj

- e^{x^2}i+cosyj
- $2xe^{x^2}$cosy−e^{x^2}siny

Question No.45 4.00

Bookmark

This is the school where I studied till class 5.
The underlined word is a

- preposition
- adjective
- pronoun
- adverb

Question No.46 4.00

Bookmark

What is the resolving power of a Transmission Electron Microscope?

- 0.05 nm
- 0.02 nm
- 0.2 nm
- 0.1 nm

Question No.47 4.00

Bookmark

The eigen functions of hydrogen atom contain which of the following?

(i) Legendre Polynomials

(ii) Laguerre Polynomials

(iii) Hermite Polynomials

- i and ii
- ii only
- i only
- i, ii and iii

Question No.48 4.00

Bookmark

In thermodynamics a quantity of energy that flows across the boundary between the system and the surrounding that can be used to change the height of the mass in the surroundings is defined as _____

- Work
- Force
- Heat
- Mass

Question No.49 4.00

Bookmark

A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, what part of the same work they can finish in a day?

- 0 1/8
- 0 1/4
- 0 1/2
- 0 1/6

Question No.50 4.00

Bookmark

Final product in aerobic glycolysis is

- Lactic acid
- Glucose
- Pyruvate
- Lactate

Question No.51 4.00

Bookmark

Microorganisms are in a rapidly growing and dividing state in

- Stationary phase
- Log phase
- Declining phase
- Lag phase

Question No.52 4.00

Bookmark

Calculate the degrees of freedom in an aqueous solution of sodium chloride.

- 4
- 3
- 1
- 2

Question No.53 4.00

Bookmark

Statement: Ten Candidates, who were on the waiting list could finally be admitted to the course.
Assumptions:
I. A large of number of candidates were on the waiting list.
II. Wait listed candidates do not ordinarily get admission.

- If both I and II are implicit
- If neither I nor II is implicit
- If only assumption II is implicit
- If only assumption I is implicit

Question No.54 4.00

Bookmark

The difference between the magnitudes of the magnetic fields at which free nuclei and molecular nuclei resonate is called _____

- Multiple splitting
- Chemical shift
- Hyperfine splitting
- Isomer shift

Question No.55 4.00

Bookmark

Statement: Apart from it's entertainment value of Television, it's educational value cannot be ignored
Assumptions:
I. People take Television to be the means of entertainment only.
II. The educational value of Television is not realized properly

- If both I and II are implicit
- If neither I nor II is implicit
- If only assumption II is implicit
- If only assumption I is implicit

Question No.56 4.00

Bookmark

Five membered hetro cyclic compounds are

- Imidazole, oxazole and Purine

- Imidazole, Oxazole and Purine
- Furan, quinoline and purine
- Pyridazine, pyrimidine and pyrazine
- Furan, Pyrrole and Thiophene

Question No.57 4.00

Bookmark

de-Broglie wavelength for charged particle of charge q and accelerated through a potential difference of V volts expressed as

- $\frac{h}{2mqv}$
- $\frac{h}{\sqrt{2mqv}}$
- $\frac{h}{2E_k qV}$
- $\frac{h}{\sqrt{2E_k qV}}$

Question No.58 4.00

Bookmark

What is the degree of polymerization of polyethylene? Assume the Molecular mass of polyethylene is 140000.

- 5384
- 5833
- 8750
- 5000

Question No.59 4.00

Bookmark

Heat is transferred to a heat engine from a furnace at a rate of 70 MW. If the rate of waste heat rejection to a nearby river is 40 MW, the thermal efficiency of this heat engine is

- 49.20%
- 42.80%
- 40.40%
- 44.60%

Question No.60 4.00

Bookmark

In a transistor, emitter current is

- slightly less than collector
- equal to collector
- equal to base current
- slightly more than collector

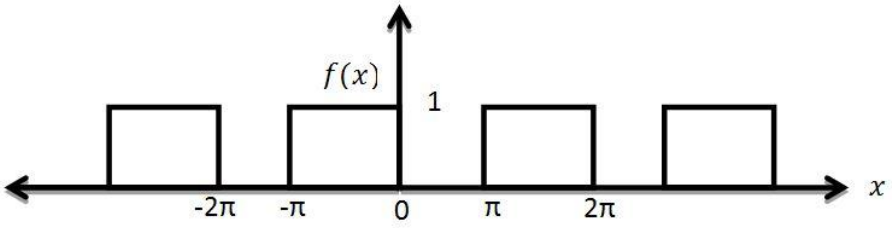
Question No.61 4.00

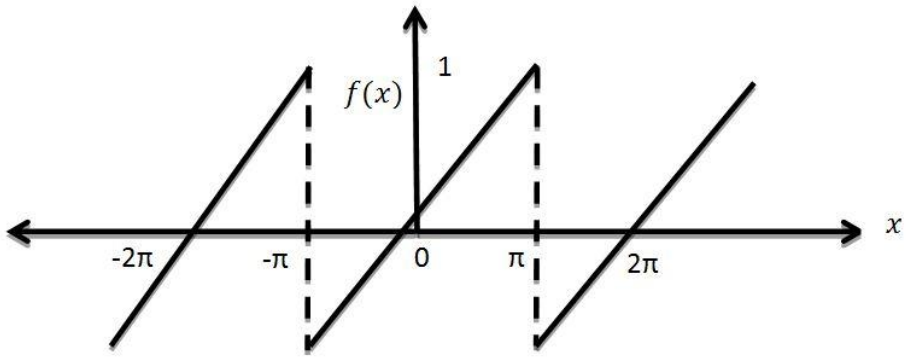
Bookmark

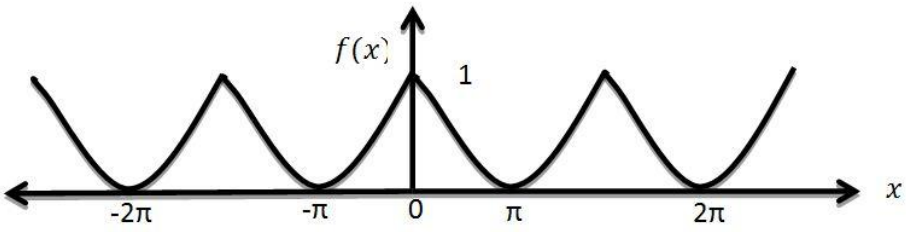
Find the characteristic Equation of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$

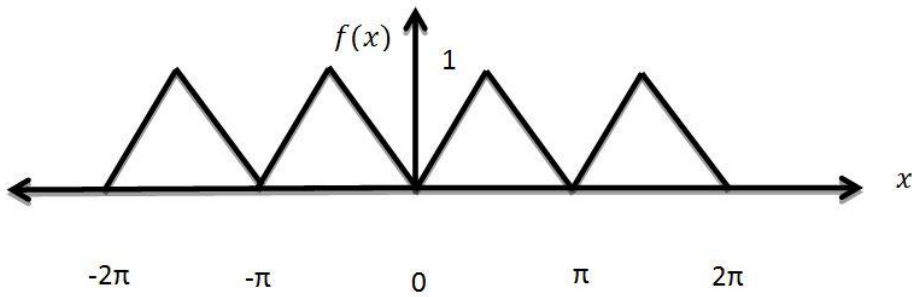
- $\lambda^3 + 7\lambda^2 + 2\lambda + 38 = 0$
- $\lambda^3 + 7\lambda^2 + 38 = 0$
- $\lambda^3 - 7\lambda^2 + 2\lambda + 36 = 0$
- $\lambda^3 - 7\lambda^2 + 36 = 0$

$f(x) = \begin{Bmatrix} 1, -\pi < x < 0 \\ 0, \ 0 < x < \pi \end{Bmatrix}$, In this case the sketch is









Question No.63 4.00

Bookmark

In a magnetic material, the field strength is found to be 10^6 A m^{-1}. If the magnetic susceptibility of the material is $0.5X10^{-5}$, calculate the intensity of magnetization and the flux density of the material?

- 6 A m^{-1}
- 5 A m^{-1}
- 3 A m^{-1}
- 4 A m^{-1}

Question No.64 4.00

Bookmark

Differential calculus involves an operator called

- Laplace operator
- differential operator
- athematic operator
- integral operator

Question No.65 4.00

Bookmark

Find the Sum and Product of the Eigen values of matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$

- -5,4
- 6,-5
- 4,-5
- 6,5

Question No.66 4.00

Bookmark

In UV-visible spectroscopy ,if a spectrum is expressed as absorbance (A) as a function of wavelength (λ), the Second order derivative spectra is _____

- $\frac{dA}{d\lambda} = f''(\lambda)$
- $\frac{d^2A}{d\lambda^2} = f''(\lambda)$
- $dA = f''(\lambda)$
- $\frac{d^2A}{d\lambda} = f''(\lambda)$

Question No.67 4.00

Bookmark

The function $f(x) = x^3 - 6x^2 + 3x + 25$ has

- a maxima at x = 3 and a minima at x = 1
- no maxima, but a _minima at x = 1
- a maxima at x = 1, but no minima
- a maxima at x = 1 and a minima at x = 3

Question No.68 4.00

Bookmark

Thermoplast have high degree of plasticity because

(i) Plastical deformation increases with increasing temperature

(ii) Secondary bonds are broken more readily and ultimately melting it

(iii) Plastical deformation decreases with increasing temperature

Select the correct option using the code given below.

- (i) only
- (ii) & (iii)
- (i) & (ii)
- (ii) only

Question No.69 4.00

Bookmark

The first antibody that invading microorganism is

- IgM
- IgA
- IgG
- IgJ

Question No.70 4.00

Bookmark

The change of a single nitrogen base in a DNA sequence is

- Lethal mutation
- Point mutation
- Site directed mutagenesis
- Deletion mutation

Question No.71 4.00

Bookmark

Select the Pair that best respresents the relationship that is given in the question:
Explore : Discover

- Books : Knowledge
- Research : Learn
- Think : Relate
- Tree : Wood

Question No.72 4.00

Bookmark

Find the odd one out?

- Deposit
- Withdrawal
- Deduction
- Debit

Question No.73 4.00

Bookmark

In a cylindrical crystal of radius r = 10 mm, calculate the ratio of cross-sectional area available for diffusion through the surface layers to the area available for mass transport through the cylinder. (Assuming the effective thickness of the surface to be 4 Å)

- 8×10^{-8}
- 7.8814×10^{-5}
- 2.51×10^{-5}
- 3.14

Question No.74 4.00

Bookmark

Poisson's distribution is

- $P(r) = \frac{m^r e^{-m}}{r!}$
- $P(r) = \frac{m^r e^{m}}{r+1!}$
- $P(r) = \frac{m^r e^{m}}{r!}$
- $P(r) = \frac{m^r e^{-m}}{r+1!}$

Question No.75 4.00

Bookmark

The Calculate the degrees of freedom in an aqueous solution of acetic acid.

- 2
- 1
- 4
- 3

Question No.76 4.00

Bookmark

Which of the following is an analytic function of z everywhere in the complex plane?

- $(Z^*)^2$
- Z^2
- $|Z|^2$
- $\sqrt{Z}$

Question No.77 4.00

Bookmark

What is the curve made up of the points in the (x,y) plane satisfying the equation $|z| = 3$?

- Parabola
- Line
- Circle
- Hyperbola

Question No.78 4.00

Bookmark

_____ is one of a pair of genes that appear at a particular location on a particular chromosome and control the same characteristic

- DNA
- Allele
- Chromosome
- RNA

Question No.79 4.00

Bookmark

Polar form of a complex number is

- r(cosθ + isinθ)
- r(tanθ + icotθ)
- r(sinθ + icosθ)
- r(secθ + icosecθ)

Question No.80 4.00

Bookmark

Which of the following is even function?

- tan x
- sin x
- x^3
- cos x

Question No.81 4.00

Bookmark

Choose the best antonym of the italicized word.
The deliberate *suavity* of Olaf's behavior made the emotions of the audience volatile.

- impetuosity
- pleasantness
- stupidity
- politeness

Question No.82 4.00

Bookmark

The first Brillouin zone for a FCC structure is

- Rhombic dodecahedron
- Hexagon
- Cube
- Truncated octahedron

Question No.83 4.00

Bookmark

Being awarded the Best Singer in 2010 marked a _____ in her life.

- yardstick
- sign-post
- memorial
- milestone

Question No.84 4.00

Bookmark

The magnitude of the critical cooling rate depends on the stability of the_____

- austenite
- martensite
- twinning
- detwinning

Question No.85 4.00

Bookmark

Choose the best synonym of the italicized word.
Dr. Elango is in the habit of using *obsolete* words.

- wrong
- simple
- outdated
- difficult

Question No.86 4.00

Bookmark

_____ is a specialized type of cell division that reduces the chromosome number by half

- Dialysis
- Meiosis
- Mitosis
- zygote

Question No.87 4.00

Bookmark

Viruses largely lack metabolic machinery of their own to generate energy or to synthesize

- Fat
- Alcohol
- Protein
- Glucose

Question No.88 4.00

Bookmark

When their father died, their elder brother sold the old house and _____ in a small flat in a far-off suburb

- set them up
- put them down
- set them down
- put them up

Question No.89 4.00

Bookmark

If A and B are square matrices of size n x n, then which of the following statement is not true?

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

Question No.90 4.00

Bookmark

Satellite contains _____

- Ni, Cu and Al
- Co, V and Ni
- Ni, Sc and Zn
- Co, Cr, and W

Question No.91 4.00

Bookmark

The integral

$$\lim_{a \to \infty} \int x^{-4}\, dx$$

- converges to 1/3
- converges to 0
- diverges
- converges to $-1/a^3$

Question No.92 4.00

Bookmark

A Laplace Transform exists when _____ A) The function is piece-wise continuous
B)The function is of exponential order
C) The function is piecewise discrete
D) The function is of differential order.

- A & D
- C & D
- A & B

- B & C

Question No.93 4.00

Bookmark

(A) Statement: Fused silica glass is used in the application requiring low thermal expansion

(B) Reason: It is highly viscous even in the molten state because of the Si-O bond

- Both (A) & (B) are True
- (A)False & (B) True
- Both (A) & (B) are False
- (A)True & (B) False

Question No.94 4.00

Bookmark

Choose the best synonym of the italicized word.
Children of excessively indulgent parents often become very *recalcitrant.*

- disobedient
- indolent
- insolent
- dependent

Question No.95 4.00

Bookmark

Which one of the following is not basic component of Materials Science?

- Properties
- Performance
- Structure
- Cost

Question No.96 4.00

Bookmark

Which of the following is the correct statement

(i) Hermitian operators have real eigen values

(ii) Orthonormal functions satisfy the condition $\int \Psi_m^*(x)\Psi_n(x)dx = \delta_{mn}$

(iii) Linear momentum $P = \frac{ih}{2\pi}(\frac{\partial}{\partial t})$

(iv) $E_n = (2n+1)\frac{h\omega}{2\pi}$

- (i) & (ii)
- (ii) & (iv)
- (i), (ii) & (iii)
- (i), (ii) & (iv)

Question No.97 4.00

Bookmark

If $u = x^2 + y^2$, then $\frac{\partial^2 y}{\partial x \partial y}$ is equal to

- 2
- 2y
- 2x + 2y
- 0

Question No.98 4.00

Bookmark

- 4
- 2

- 3
- 1

Question No.99 4.00

Bookmark

Solution of equation on an open interval is a pair of linearly independent solution on that interval is called

- basis
- code
- base
- core

Question No.100 4.00

Bookmark

Nidhi walks 10 metres in front and 10 metres to the right. Then every time turning to her left, she walks 5, 15 and 15 metres respectively. How far is Nidhi now from her starting point?

- 10 metres
- 5 metres
- 15 metres
- None of the above