Examination: **M.Tech Green Energy Technology**

SECTION 1 - SECTION 1

Question No.1

Molecular chaperons are associated with

- Protein transport
- Protein folding
- Protein secretion
- Protein degradation

Question No.2

The primary source of the sun's energy is a series of thermonuclear reactions in which the energy produced is c^2 times the mass difference between

- Four hydrogen atoms and one helium atom
- Two hydrogen atoms and one helium atom
- Three helium atoms and one carbon atom
- Six hydrogen atoms and two helium atoms

Question No.3

Beta diversity refers to

- Ecosystem diversity
- Diversity of regional species pool
- Diversity of local species pool
- Differences in species composition among sites

Question No.4

For a particle exceeding S.H.M, the phase difference between displacement and velocity is

- π
- $\frac{-\pi}{2}$
- $\frac{\pi}{2}$
- 0

Question No.5

Assume that energy released during the combustion of methane is 900 kJ/mol. Its carbon intensity is:

- 13.3 gc/MJ
- 19.7 gc/MJ
- 15.3 gc/MJ
- 24.2 gc/MJ

Question No.6

The concentration of $MgSO_4$ solution having the same ionic strength as that of a 0.1M Na_2SO_4 solution is :

- 0.075 M
- 0.067 M
- 0.05 M
- 0.133 M

Question No.7

An atom has filled n = 1 and n = 2 levels. How many electrons does the atom have?

- 6
- 8

- 4
- 10

Question No.8

A balloon will carry a total load of 175 Kg when the temperature and pressure are normal. What load will the balloon carry on rising to a height at which the barometric pressure is 50 cm of mercury and the temperature is -10^{o}C, assuming the envelope maintains a constant volume?

- 114.5 Kg
- 122.5 Kg
- 140 Kg
- 119.5Kg

Question No.9

Higher COP can be achieved with _____

- Lower evaporator temperature and lower condenser temperature
- Lower evaporator temperature and higher condenser temperature
- Higher evaporator temperature and lower condenser temperature
- Higher evaporator temperature and higher condenser temperature

Question No.10

Which of the following amino acid is likely to destabilise an alpha helix?

- Histidine
- Proline
- Glycine
- Leucine

Question No.11

The latent heat loaded in an auditorium is 25% of the sensible heat factor (SHF) is equal to

- 0.8
- 0.5
- 1.0
- 0.25

Question No.12

Among the following, the isoelectronic and isostructural pair is

- NO_2^+ and TeO_2
- SiO_4 and PO_4^{3-}
- CO_2 and SO_3
- SO_3 and SeO_3

Question No.13

Proteins specific to sugars are called

- Myoglobin
- Chitin
- Lectin
- Pectin

Question No.14

Which of the following has coulomb as the unit?

- $\iint \vec{D}.d\vec{s}$
- $\vec{E}.d\vec{l}$

- $\oint \vec{H}.d\vec{l}$
- $\iint \vec{E}.d\vec{s}$

Question No.15

Fin effectiveness will be increased more by

- Longer circumference
- Higher thermal conductivity
- Higher sectional area
- Having higher value of convection coefficient

Question No.16

A steam pipe is covered with two layers of insulating materials, with the better insulating material forming the outer part. If the two layers are interchanged the heat conducted

- Will decrease
- Will increase
- Will remain unaffected
- May increase or decrease depending upon the thickness of the each layer

Question No.17

A matrix $[1 \quad 2]\left(\begin{bmatrix}-2 & 5\\ 3 & 2\end{bmatrix}\begin{bmatrix}1\\ 2\end{bmatrix}\right)$ is equal to

- 31
- 23
- 22
- 122

Question No.18

Which of the following ion present in chlorophyll molecule?

- Ca^{+2}
- Fe^{+2}
- Mg^{+3}
- Mg^{+2}

Question No.19

How far from the earth must a body be along a line towards the sun so that the sun's gravitational pull balances the earth? The sun is about 9.3 x 10^7 km away and its mass is 3.24 x 10^5 M_e, where M_e is the mass of the earth.

- 1.631x10^5 km
- 2.242x10^5 km
- 0.2242x10^5 km
- 0.1631x10^5 km

Question No.20

The resonant frequency of an electric oscillator is given by

- $v = 2\pi\sqrt{LC}$
- $v = 2\pi/\sqrt{LC}$
- $v = 2\pi/LC$
- $v = 1/\ 2\pi\sqrt{LC}$

Question No.21

Which of the function is not continuous.

- sin z
- ln z
- tan z
- cos z

Question No.22

Which among the following is used to know the protein sequences?

- Sothern's chemistry
- Next generation sequencing
- Sanger's sequencing
- Edman's chemistry

Question No.23

The function $f(x) = x^3-3x+3$, the maximum value is

- -5
- 34
- 5
- 54

Question No.24

If $|Z_1| = |Z_2|$ and $\arg(Z_1) = \arg(Z_2)$ then

- $Z_1 < Z_2$
- $Z_1 > Z_2$
- $Z_1 = Z_2$
- $Z_1 \neq Z_2$

Question No.25

The net charge of an n-type semiconductor is

- Negative
- Dependent
- Zero
- Positive

Question No.26

Which of the following is an example of bottom-up approach for the preparation of nanomaterials

- Etching
- Dip pen nano-lithography
- Erosion
- lithography

Question No.27

An alkyl halide may be converted into an alcohol by

- Dehydrohalogenation.
- Elimination
- Substitution
- Addition

Question No.28

Energy intensity is a measure of

- Effectiveness of energy utilization
- Energy Produced Per unit area
- Energy Produced Per unit volume
- Energy Produced Per unit area Per unit time

Question No.29

The half- life period of $^{210}Po_{84}$ is 140 days. In how many days 1g of this isotope is reduced to 0.25g.

- 250 days
- 180 days
- 160 days
- 280 days

Question No.30

Which one dimensional number relates the thermal boundary layer and hydrodynamic boundary layer?

- Rayleigh number
- Peclet number
- Prandtl number
- Grashof number

Question No.31

A thermodynamic equation that relates the chemical potential to the composition of a mixture is known as

- Gibb's-Duhem equation
- Debye-Huckel equation
- Gibb's-Helmholtz equation
- Joule-Thomson equation

Question No.32

One side of rectangular field is 15 meter and one of its diagonals is 17 meter. Then find the area of the field.

- $150m^2$
- $140m^2$
- $130m^2$
- $120m^2$

Question No.33

Given the function $f(x) = x^2e^{-2x}, x > 0$. Then $f(x)$ has the maximum value equal to

- $(2e)^{-1}$
- e^{-1}
- e^{-2}
- 1

Question No.34

Arrange the following carbocations in the order of increasing stability.

- $1^0 > 2^0 > 3^0 >$ Benzyl
- Benzyl $> 1^0 > 2^0 > 3^0$
- Benzyl $> 3^0 > 2^0 > 1^0$

- $3^0 > 2^0 > 1^0 >$ Benzyl

Question No.35

The real part of $z = \frac{1}{1-cos\theta+i\ sin\theta}$ is

- $\frac{1}{2}$
- 2
- $\frac{1}{2}$
- $\frac{1}{1-cos\theta}$

Question No.36

A bicycle tube has a mean circumference of 200 cm and a circular cross section of diameter 6 cm. What is the approximate volume of water (in cc) required to completely fill the tube, assuming that is does not expand?

- 3600 π
- 1800π
- 600 π
- 1200 π

Question No.37

The angle of a complex number is called the _____of z

- argument
- angle
- modulus
- rational

Question No.38

A plate of metal 100 sq. cm in area rests on a layer of castor oil 2 mm thick whose coefficient of viscosity is 15.5 poise. Calculate the horizontal force required to move the plate with a speed of 0.03 ms^{-1}.

- 2.325 N
- 0.2325 N
- 4.65 N
- 0.465 N

Question No.39

Solar radiation which reaches the surface without scattering or absorbed is called

- Ultraviolet radiation
- Diffuse radiation
- Infrared radiation
- Beam Radiation

Question No.40

The following are the example for mobile elements

- Fe, Ca
- Mn, Mo
- Bo, S
- Cu, Mg

Question No.41

In an equilibrium reaction for which $\Delta G^{o}=0$, The equilibrium constant should be equal to

- 1
- 0
- 2
- 10

Question No.42

Essential trace element Selenium is an integral part of

- Glutathione peroxidase
- Tyrosine hydroxylase
- Nucleoside diphosphate kinase
- Phenylalanin hydroxylase

Question No.43

The middle most value of a frequency distribution table is known as

- Mode
- Range
- Mean
- Median

Question No.44

The value of $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\tan^3 x}$ is

- 0
- 1
- $\frac{\pi}{4}$
- $\frac{\pi}{2}$

Question No.45

In what form is solar energy is radiated from the sun?

- Electromagnetic waves
- Transverse waves
- Infrared radiation
- Ultraviolet Radiation

Question No.46

Measurement of temperature is based on which law of thermodynamics?

- Third law of thermodynamics
- Zeroth law of thermodynamics
- First law of thermodynamics
- Second law of thermodynamics

Question No.47

A solar cell converts

- Heat energy into light energy
- Solar energy into electrical energy
- Heat energy into electrical energy
- Solar energy into light energy

Question No.48

A power plant which uses a gas turbine followed by a steam turbine for Power generation is called.

- Bottom cycle
- Generation cycle
- Combined cycle
- Topping cycle

Question No.49

Specific conductance of a decinormal solution of KCl is 0.0112 $ohm^{-1}cm^{-1}$. The resistance of cell containing the solution was found to be 56. What is the cell constant?

- $0.123cm^{-1}$
- $0.987cm^{-1}$
- $0.627cm^{-1}$
- $0.451cm^{-1}$

Question No.50

The radiations emitted by the sun and responsible for the cause of skin cancer are

- X-rays
- Infra-red
- Ultra-violet
- Micro-waves

Question No.51

A 10 kg object is whirled in a horizontal circle on the end of a wire. The wire is 0.3 m long and has a cross section $10^{-6}m^2$ and has the breaking stress 4.8×10^7 N/m^2. What is the maximum angular speed the object can have?

- 4 rad/s
- 3 rad/s
- 5 rad/s
- 2 rad/s

Question No.52

Quantum confinement results in

- Energy gap in semiconductor is proportional to the inverse of the square of size
- Energy gap in semiconductor is proportional to the inverse of the square root of size
- Energy gap in semiconductor is proportional to the inverse of the size
- Energy gap in semiconductor is proportional to the square of size

Question No.53

A flat plate has a thickness 5cm , thermal conductivity 1w/(mk) convective heat transfer coefficients on its two flat faces of 10 $w/(m^2k)$ and 20 $w/(m^2k)$. The overall heat transfer coefficient for such a flat plate is

- 30 $w/ (m^2k)$
- 5.00 $w/ (m^2k)$
- 20 $w/ (m^2k)$
- 6.33 $w/ (m^2k)$

Question No.54

The temperature of 5g of air is raised by 1^oC at constant volume. Calculate the increase in its internal energy. Given Cv = 0.172 cal g^{-10} C^{-1} and J = 4.18 cal^{-1}.

- 3.59 J
- 1.86 J
- 2.59 J
- 0.86 J

Question No.55

1 molecule of $NADH_2$ is equal to

- 52 Kcal
- 76 Kcal
- 67Kcal
- 25 Kcal

Question No.56

Hydrogen bomb is based on the principle of

- Artificial radioactivity
- Natural radioactivity
- Nuclear fission
- Nuclear fusion

Question No.57

Which radiation has major impact in heating up earth's atmosphere?

- Visible radiation
- Infra-Red radiation
- UV radiation
- Radio waves

Question No.58

A particle moves in the xy – plane according to the equations $x = a \sin\omega t$; $y = b \cos\omega t$. Determine the path of the particle.

- Hyperbola
- Ellipse
- Circle
- Parabola

Question No.59

Which of the following energy has the greatest potential among all the sources of renewable energy?

- Wind Energy
- Thermal energy
- Solar energy
- Hydro-electrical energy

Question No.60

Calculate the displacement to amplitude ratio for S.H.M when K.E is 90% of the total energy.

- 0.08
- 0.64
- 0.16
- 0.32

Question No.61

A weather balloon is loosely filled with 2 m^3 of helium at 1 atm and 27^oC. The balloon is then released and by the time it has reached an elevation of 7000 m, the pressure has dropped to 0.5 atm and the balloon has expanded. If the temperature at this elevation is -48^oC, what is the new volume of the balloon?

- 3.1m^3
- 2.4m^3
- 4.2m^3
- 1.3m^3

Question No.62

The value of the determinants $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix}$ is

- $a^2b^2c^2$
- $bc + ca + ab$
- abc
- zero

Question No.63

For an adiabatic process which of the following relation is correct

- ΔE=0
- q=0
- q = w
- PΔV=0

Question No.64

Affinity of haemoglobin for oxygen molecules increases due to binding of another oxygen molecule by

- Saturation effect
- Allosteric effect
- Catalytic effect
- Inhibitory effect

Question No.65

Thickness of ozone is measured in

- ppm
- meter
- grams/cubic meter
- Dobson units

Question No.66

Calculate the period of revolution of Neptune round the sun given that the diameter of the orbit is 30 times the diameter of the earth's orbit round the sun, both orbits being assumed to be circular.

- 154.3 years
- 174.3 years
- 164.3 years
- 144.3 years

Question No.67

Iodin evalue of lipids is a measure of

- Degree of saturation of lipids
- Degree of monosaturation of lipids
- Degree of polysaturation of lipids
- Degree of unsaturation of lipids

Question No.68

$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 0$,has the solution

- $y = ce^x$
- $y = c_1e^{-2x} + c_2e^{-x} + c_3$
- $y = c_1e^{-2x} + c_2e^x$
- $y = ce^{-2x}$

Question No.69

Down syndrome is caused due to non-disjunction of chromosomes at

- Anaphase of mitosis
- Anaphase I of meiosis
- Anaphase II of meiosis
- None of these

Question No.70

Ketogenic amino acids are

- Tryptophan and Tyrosine
- Valine and Threonine
- Leucine and Lysine
- Asparagine and Alanine

Question No.71

The resources which are unlimited and where quality is not degraded are termed as

- Renewable
- Immutable
- Reusable
- Exhaustible

Question No.72

The real part of $e(e^{i\theta})$ is

- $e^{cos\theta}\sin(sin\theta)$
- $e^{cos\theta}\cos(sin\theta)$
- $e^{cos\theta}\cos(cos\theta)$
- $e^{cos\theta}$

Question No.73

Degree of ODE $\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 = x^2\log\left(\frac{d^2y}{dx^2}\right)$

- one
- four
- undefined

- two

Question No.74

The number of closed neighbours in BCC lattice of identical spheres

- 4
- 6
- 12
- 8

Question No.75

In the molecules H_2O, NH_3 and CH_4

- The bond angles are same
- The shapes are same
- The bond distances are same
- The hybridizations are same

Question No.76

A particle which is similar to electron is

- Meson
- Positron
- Beta particle
- Photon

Question No.77

“Silent spring” written by Rachel Carson deals with

- Air pollution
- Deforestation
- Excessive use of pesticides
- Water pollution

Question No.78

Given $y = 5e^{3x} + sinx, \frac{dy}{dx}$ is

- $15e^{3x} - cosx$
- $5e^{3x} - cosx$
- $5e^{3x} + cosx$
- $15e^{3x} + cosx$

Question No.79

A finned tube hot water radiator with a fan blowing air over it is kept in rooms during winter. The major portion of the heat transfer from the radiator to air is due to

- Conduction
- Convection
- Radiation
- Combined conduction and radiation

Question No.80

Which of the given electrostatic fields is conservative?

$\vec{E} = \hat{\imath}x + \hat{\jmath}y + \hat{k}z$

$\vec{E} = xy^2\hat{\imath} + x^3y\hat{\jmath}$

$\vec{E} = xy\hat{\imath} + y^3\hat{\jmath}$

$\vec{E} = axy^2(y\hat{\imath} + x\hat{\jmath})$

Question No.81

Correct sequence flow of reaction in bioethanol production

- Enzyme hydrolysis- distillation- Fermentation- bioethanol
- Fermentation- Enzyme hydrolysis- distillation- bioethanol
- Distillation- Enzyme hydrolysis- Fermentation- - bioethanol
- Enzyme hydrolysis- Fermentation-distillation- bioethanol

Question No.82

The activation energy of a reaction can be lowered by

- Increasing temperature
- Using a positive catalyst
- Increasing concentration of the reactant.
- Decreasing temperature

Question No.83

The 260/280 ratio of genomic DNA preparation shows 2.0, what could be the possible reason?

- Mechanical shearing of genomic DNA
- Phenol contamination
- Protein contamination
- RNA contamination

Question No.84

If $x^2 + 2xy = y^2$, then $\frac{dy}{dx}$ is

- $\frac{x+1}{y}$
- $-x$
- $\frac{x+y}{y-x}$
- $2x + 2y$

Question No.85

A one ton capacity water cooler cools water steadily from 35^{o}C to 20^{o}C. The specific heat of water is 4.18kJ/kgK. The water flow rate will be nearly

- 200 l/hr
- 13.33 l/hr
- 250 l/hr
- 33.3 l/hr

Question No.86

In electrophilic aromatic substitution reactions, nitro group is meta-directing, because the nitro group

- decreasing electron density at meta-position

- increasing electron density at ortho and para-positions
- decreasing electron density at ortho and para-positions
- increasing electron density at meta-position

Question No.87

General solution of the equation $\frac{dy}{dx} = -\frac{x}{y}$ is

- $a^2b^2c^{2/sup>}$
- Zero
- abc
- bc + ca + ab

Question No.88

Strongest nucleophile is

- RNH_2
- CH_3O^-
- $C_6H_5O^-$
- ROH

Question No.89

Which among the following amino acid residue is most likely getting phosphorylated in prokaryotes?

- Tyrosine
- Serine
- Histidine
- Threonine

Question No.90

Mullerian mimicry is an example of

- Divergent evolution
- Convergent evolution
- Adaptive radiation
- Adaptive divergence

Question No.91

Cars A and B are travelling in adjacent lanes along a straight line. At time t = 0, cars A and B are travelling with velocities 13 m/s and 20 m/s respectively and they are separated by a distance of 30 m. If car A has a constant acceleration of 0.6 m/s^2 and car B has a constant deceleration of 0.46 m/s^2, determine when A will overtake B?

- 0.9s
- 9s
- 8s
- 0.8s

Question No.92

The equation $x^4 - 7x + 2 = 0$ has

- all the four roots lie between 0 and 2
- no real roots
- exactly two real roots and distinct solutions
- has four real roots

Question No.93

Under Jawaharlal Nehru Solar Mission of Government of India, a total of 20,000 MW of utility Grid Power (including roof to solar Power) is sought to be installed by the year:

- 2022
- 2025
- 2020
- 2030

Question No.94

The reaction of ammonium chloride with BCl_3 at 140 ^oC followed by $NaBH_4$ gives Product X. The formula of X is

- $B_3N_3H_6$
- $B_3N_3H_3$
- [BH…NH]n
- $B_3N_3H_{12}$

Question No.95

The first ionization potential of K is 4.34 eV, the electron affinity of Cl is 3.82 eV and the equilibrium separation of KCl is 0.3 nm. Then energy required to dissociate a KCl molecule into a K and a Cl atom is

- 8.16 eV
- 4.28 eV
- 8.62 eV
- 4.14 eV

Question No.96

The geometry of reaction intermediate in SN^1 reaction is

- tetrahedral
- Triangular bipyramidal
- planar
- None of these

Question No.97

Calculate the work done in blowing a soap bubble of radius 10 cm and surface tension 30 dynes per cm.

- 7.54×10^4 J
- 3.77×10^{-3} J
- 3.77×10^4 J
- 7.54×10^{-3} J

Question No.98

Let $X \sim N(3,2^2)$. What does this tell us about the distribution of X?

- X is binomial with mean 2 and variance 9
- X is normal with mean 3 and variance 2
- X is binomial with n=3 and p = 2
- X is normal with mean 3 and variance 4

Question No.99

Ice kept in a well-insulated thermo flask is an example of which system?

- Open system
- Isolated system
- Closed system
- Non-flow adiabatic system

Question No.100

An object is cooled from 85 to 75^{o}C in 2 min in a room at 30^{o}C. What time will be taken for the object to cool from 55 to 45^{o}C

- 7 min
- 4 min
- 6 min
- 5 min