Class XII Holiday Homework – BIOLOGY

1. Give an example of false fruit and true fruit.
2. What are the major components of seminal plasma?
3. Name any two autosomal linked recessive Mendelian disorders.
4. What are the number of base pairs in - a) Man b) E-coli
5. Draw a well labelled diagram of blastocyst.
6. What is Parturition? Name hormone which controls it.
7. Differentiate between the following :
   a) Gametogenesis and Embryogenesis
   b) Juvenile phase and Senescent phase
   c) Zoospore and Zygote
8. Draw a well labelled diagram of Anatropous ovule.
   a) Name the phase in the menstrual cycle that precedes ovulation.
   b) What is semen?
9. Differentiate between Graafian follicle and Corpus Luteum.
10. a) Differentiate between IUT and IUI.
11. b) Describe the 2 different type of IUDs, with an example of each.
12. Name any one plant and its feature that shows the phenomenon of incomplete dominance.
13. Comment on the cause and effect of chromosomal disorders where females are XO and males are XXY.
15. Name the negatively and positively charged components of nucleosome and comment on its structure and function.
16. What are bacteriophages?
   A village health worker was taking session with women. She tells the women that one has to be very careful while using oral pills as method of birth control. Wrong usage can actually promote conception.
17. a) Analyze the statement and compare the merits and demerits of using oral pills and surgical methods of birth control.
   b) Village women was confused as to how a thin metallic copper loop can provide protection against pregnancy. Justify the use explaining the mode of action of IUDS.
18. Describe oogenesis in human female with labelled diagrams.
19. Describe development of pollen grain with labelled diagrams.
20. Draw a schematic diagram of double stranded dinucleotide DNA chain having all the four nitrogenous bases and showing the correct polarity.
Holiday Home Work for Classes XII

Class XII – The students need to read the following chapters and summarise them in their English Literature note-books 100 words each)

Flamingo – Deep Water; The Rattrap

Vistas – The Enemy; Should Wizard Hit Mommy
Chapter 1 (Electric charges & Fields)

1. Using Gauss's law deduce the expression for the electric field due to an uniformly charged spherical conducting shell of radius \( R \) at a point (i) outside (ii) inside the shell. Plot a graph showing the variation of electric field as a function of \( r>R \) and \( r<R \). (\( r \) being the distance from the centre of the shell)

   \[2013, 2015, 2019\]

2. Define electric dipole moment. Is it a scalar or vector? Derive the expression for the electric field of a dipole at a point
   (i) on the equatorial plane of the dipole. (ii) on the axis of the dipole.

   \[2011, 2013\]

3. An electric dipole is held in a uniform electric field. (i) Show that net force acting on it is zero. (ii) Find the torque acting on a dipole and specify its direction (iii) If the dipole is aligned parallel to the field. Find the work done in rotating through the angle of 180°.

   \[2008, 2012\]

4. Two identical conducting balls A & B have charges \(-Q\) and \(+3Q\) respectively. They are brought in contact with each other and then separated by a distance \( d \) apart. Find the nature of the coulomb force between them.

   \[2019\]

5. Use Gauss's law to find the electric field due to a uniformly charged infinite plane sheet. What is the direction of field for positive and negative charge densities?

   \[2016, 2017\]

6. Two large parallel plane plates, each of area \( A \) having surface charge densities \(+\sigma\) and \(-\sigma\) are separated by a distance \( d \) in air. Find the expressions for
   (a) Field at point between the two plates and on outer side of the plates. Specify the direction of the field in each case.
   (b) The potential difference between the plates.
   (c) The capacitance of the capacitor so formed.

   \[2016, 2019\]

7. (a) Derive an expression for the electric field \( E \) due to a dipole of length ‘2a’ at a point distant \( r \) from the centre of the dipole on the axial line. (b) Draw a graph of \( E \) versus \( r \) for \( r >> a \). (c) If this dipole were kept in a uniform external field \( E_0 \) diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expression for torque acting on the dipole in both cases.

   \[2017\]

8. Four point charges \( Q, q, Q \) and \( q \) are placed at the corners of a square of side ‘a’ as shown in the figure. Find the (a) resultant electric force on a charge \( Q \) (b) potential energy of this system.

   \[2016\]

9. (a) Define electric flux. Is it a scalar or a vector quantity? (b) A point charge \( q \) is at a distance of \( d/2 \) directly above the centre of a square of side \( d \), as shown in the figure. Use Gauss’ law to obtain the expression for the electric flux through the square. If the point charge is now moved to a distance ‘d’
from the centre of the square and side of the square is doubled, explain how the electric flux will be affected.

10. (a) Use Gauss’ law to derive the expression for the electric field due to a straight uniformly charged infinite line of charge density \( \lambda \) C/m. (b) Draw a graph to show the variation of \( E \) with perpendicular distance \( r \) from the line of charge.

Chapter 2 (Electrostatic Potential & Capacitance)

1. A slab of material of dielectric constant \( K \) has the same area as that of the plates of a parallel plate capacitor but has the thickness \( d/3 \), where \( d \) is the separation between the plates. Find out the expression for its capacitance when the slab is inserted between the plates of the capacitor.

2. Describe schematically the equipotential surface corresponding to a constant electric field in \( z \) direction.

3. Derive an expression for the energy stored in a parallel plate capacitor \( C \), charged to a potential difference \( V \). Hence derive an expression for the energy density of a capacitor.

4. A parallel plate capacitor is charged by a battery, which is then disconnected. A dielectric slab is then inserted in the space between the plates. Explain what changes if any occur in the values of:
   (i) capacitance (ii) potential difference between the plates (iii) electric field between the plates and (iv) energy stored in the capacitor.

5. (a) When a parallel plate capacitor is connected across a dc battery, explain briefly how the capacitor gets charged. (b) A parallel plate capacitor of capacitance \( C \) is charged to \( V \) volt by a battery. After some time the battery is disconnected and distance between the plate is doubled. Now a slab of dielectric constant \( 1 < k < 2 \) is introduced to fill the space between the plates. How will the following be affected?
   The electric field between the plates of capacitor and energy stored in the capacitor. Justify your answer in each case.

6. Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable and unstable equilibrium. Is the electrostatic potential necessarily zero at a point where the electric field is zero? Give an example to support your answer.

Chapter-3 (Current Electricity)

1. Under what condition will the current in a wire be the same when connected in series and in parallel of \( n \) identical cells each having internal resistance ‘\( r \)’ and external resistance ‘\( R \)’?

2. State the underlying principle of metre bridge. Draw the circuit diagram and explain how the unknown resistance of a conductor can be determined by this method.

3. Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time.

4. (a) Draw a graph showing the variation of current versus voltage in an electrolyte when an external resistance is also connected.
(b) (i) The graph between resistance (R) and temperature (T) for Hg is shown in the figure (a) . Explain the behavior of Hg near 4K. (ii) In which region of the graph (b) is resistance negative and why?

5. Draw a neat labelled diagram of a simple potentiometer used to compare the e.m.f. of two cells and explain its principle. [2003, 2006, 2007]

6. For the circuit shown in the figure, how would the balancing length be affected, if (i) $R_1$ is decreased (ii) $R_2$ is increased, the other factors remaining the same in the circuit? Justify your answer in each case. Why is a potentiometer preferred over a voltmeter? Give reason. [2019]

7. Define the term mobility and give its SI unit. State the two Kirchhoff’s rules used in electric networks. How are these rules justified? [2015]

8. Two electric bulbs P and Q have their resistance in the ratio of 1:2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs. [2018]

9. In a potentiometer arrangement for determining the emf of a cell, the balance point of the cell in open circuit is 350 cm. When a resistance of 9 ohm is used in the external circuit of the cell, the balance point shifts to 300 cm. Determine the internal resistance of the cell. [2018]

10. Define the term ‘conductivity’ of a metallic wire. Write its SI unit. [2018]

11. Using the concept of free electrons in a conductor, derive the expression for conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and applied electric field E. [2018]

**Chapter 4 (Moving charges & Magnetism)**

1. (a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle. (b) Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction, how it is used to accelerate the charged particles. Write the limitations of cyclotron. [2014]

2. Discuss the motion of a charge particle entering in a uniform magnetic field $B$ with velocity ‘$v$’ inclined at an angle $\theta$ with the direction of magnetic field. [2014]

3. (a) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and working. (b)(i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer? (ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason. [2011, 2014, 2015]
4. Derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis.

5. What does a toroid consist of? Find out the expression for the magnetic field inside a toroid for N turns of the coil having the average radius r and carrying a current I. Show that the magnetic field in the open space inside and exterior to the toroid is zero.

6. Using Ampere’s circuital law find an expression for the magnetic field at a point on the axis of a long solenoid with closely wound turns.

7. Derive an expression for the force per unit length between two long straight parallel current carrying conductors. Write about the nature of force for the flow of current in (i) same direction (ii) opposite direction in parallel conductors. Hence define SI unit of current.

8. A proton, a deuteron and an alpha particle, are accelerated through the same potential difference and then subjected to a uniform magnetic field B, perpendicular to the direction of their motions. Compare (i) their kinetic energies, and (ii) if the radius of the circular path described by proton is 5 cm, determine the radii of the paths described by deuteron and alpha particle.

9. A proton and an electron travelling along parallel paths enter a region of uniform magnetic field, acting perpendicular to their paths. Which of them will move in a circular path with higher frequency?

10. (a) Briefly explain how a galvanometer is converted into (i) an ammeter (ii) a voltmeter. 
(b) A galvanometer coil has resistance of 15Ω and it shows full scale deflection for a current of 4mA. Convert it into an ammeter of range 0 to 6 A.
(c) A voltmeter of a certain range is constructed by connecting a resistance of 980 Ω in series with a galvanometer. When the resistance of 470 Ω is connected in series, the range gets halved. Find the resistance of the galvanometer.

Chapter 5 (Magnetism & Matter).

1. Distinguish the magnetic properties of diamagnetic, paramagnetic and ferromagnetic substances in terms of (i) susceptibility (ii) magnetic permeability (iii) coercivity. Give an example for each. Draw the field lines due to an external magnetic field near (i) diamagnetic(ii) paramagnetic substance.

2. Where on the surface of earth is the angle of dip 90°?

3. Define intensity of magnetisation of a magnetic material. How does it vary with temperature for a paramagnetic material?

4. Write two properties of a material suitable for making (a) a permanent magnet, and (b) an electromagnet.

5. A magnetised needle in a uniform magnetic field experiences a torque but no net force. An iron nail near a bar magnet, however, experience a force of attraction in addition to a torque. Why?

6. In what way is the behavior of a diamagnetic material different from that of a paramagnetic, when kept in an external magnetic field?

7. Verify the Gauss’s law for magnetic field of a point dipole of dipole moment m at the origin for the surface which is a sphere of radius R.

8. The susceptibility of a magnetic material is 0.9853. Identify the type of magnetic material. Draw the modification of the field pattern on keeping a piece of this material in a uniform magnetic field.

Chapter 6 (Electromagnetic Induction)

1. How does the mutual inductance of a pair of coils change when (i) distance between the coils is increased and (ii) number of turns in the coils is increased?

2. (a) Draw a labelled diagram of an ac generator. Obtain the expression for the emf induced in the rotating coil of N turns each of cross-sectional area A, in presence of magnetic field B. Show how an alternating emf is generated by a loop of wire rotating in a magnetic field. (b) A horizontal conducting rod 10m long
extending from east to west is falling with a speed 5 m/s at right angles to the horizontal component of
the earth’s magnetic field, 0.3 x 10^{-4} \text{Wb m}^{-2}. Find the instantaneous value of emf induced in the rod.

3. A wheel with 8 metallic spokes each 50 cm long is rotated with a speed of 120 rev/min in a plane normal
to the horizontal component of the earth’s magnetic field. The earth’s magnetic field at the plane is 0.4G
and the angle of dip is 60^0. Calculate the emf induced between the axle and the rim of the wheel. How
will the value of emf be affected if the number of spokes were increased?

4. What are eddy currents? How are they produced? How can they be minimized? Give two applications of
it.

5. Write expression for energy stored in an inductor when a steady current I is passed through it.Is this
energy electric or magnetic? Define the term self inductance and give its SI unit.

6. Define mutual inductance between a pair of coils. Derive an expression for the mutual inductance of two
long coaxial solenoids of same length wound one over the other.

Chapter 7 (Alternating Current)

1. A voltage $V = V_0 \sin \omega t$ is applied to a series LCR circuit. Derive the expression for the average power
dissipated over a cycle. Under what condition (i) no power dissipated even though the current flows
through the circuit, (ii) maximum power dissipated in the circuit?

2. (a) For a given a.c., $i = i_m \sin \omega t$, show that the average power dissipated in a resistor $R$ over a complete
cycle is $\frac{1}{2} i_m^2 R$. (b) A light bulb is rated at 100 W for a 220 V a.c. supply. Calculate the resistance of the
bulb.

3. (a)(i) Draw a labelled diagram of a step-down transformer. State the principle of its working. (ii) Express
the turn ratio in terms of voltages. (iii) Find the ratio of primary and secondary currents in terms of turn
ratio in an ideal transformer. (iv) How much current is drawn by the primary of a transformer
connected to 220V supply when it delivers power to a 110V-550W refrigerator? (b) Write any two
sources of energy loss in a transformer. Can a transformer be used to step up or step down a d.c.
voltage? Justify your answer.
(c) How is the large scale transmission of electric energy over long distances done with the use of
transformers?

4. (a)State the condition for resonance to occur in series LCR a.c. circuit and derive an expression for
resonant frequency. Mention the factors on which the resonant frequency of a series LCR circuit
depends. Plot a graph showing variation of impedance of series LCR with frequency of an ac source.(b)
Draw a plot showing the variation of the peak current with frequency of the a.c. source used. Define
quality factor $Q$ of the circuit.

5. (i) When an AC source is connected to an ideal inductor show that the average power supplied by the
source over a complete cycle is zero.(ii) A lamp is connected in series with an inductor and an AC source.
What happens to the brightness of the lamp when the key is plugged in and an iron rod is inserted inside
the inductor? Explain.

6. What do you understand by ‘sharpness of resonance’ for a series LCR resonant circuit ? How is it related
with the quality factor ‘$Q$’ of the circuit ? Using the graphs given in the diagram, explain the factors which
affect it. For which graph is the resistance minimum?

7. A 2\(\mu\)F capacitor, 100\(\Omega\) resistor and 8H inductor are connected in series with an ac source. Find the frequency of the ac source for which the current drawn in circuit is maximum. If the peak value of emf of the source is 200V, calculate the (i) maximum current, and (ii) inductive and capacitive reactance of the circuit at resonance.

Chapter-8 (Electromagnetic Waves)

1. Welders wear special goggles or face masks with glass window to protect their eyes from electromagnetic radiations. Name the radiations and write range of their frequency.

2. The small ozone layer on top of the stratosphere is crucial for human survival. Why?

3. Name the part of electromagnetic spectrum whose wavelength lies in the range of \(10^{-10}\)m. Give its one use.

4. A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere’s circuital law is generalized to incorporate the effect due to the displacement current.

5. Find wavelength of electromagnetic wave of frequency \(6 \times 10^{12}\)Hz. Give its two applications.

6. How you can show that electromagnetic waves carry both energy and momentum? Illustrate by giving suitable examples.

7. Name the electromagnetic radiations used for (a) water purification, and (b) eye surgery.

8. (a) Why are infra-red waves often called heat waves? Explain (b) what do you understand by the statement, “Electromagnetic waves transport momentum”?

Chapter-9 (Ray Optics)

1. Derive the mathematical relation between refractive indices \(n_1\) and \(n_2\) of two radii and radius of curvature \(R\) for refraction at a convex spherical surface. Consider the object to be a point since lying on the principal axis in rarer medium of refractive index \(n_1\) and a real image formed in the denser medium of refractive index \(n_2\). Hence derive the lens maker’s formula.

2. How does the angle of minimum deviation of a glass prism vary, if the incident violet light is replaced by red light? Give reason.

3. Explain the phenomenon of total internal reflection. What are the conditions for phenomenon? Explain the meaning of critical angle.

4. A convex lens of focal length 25 cm is placed coaxially in contact with a concave lens of focal length 20 cm. Determine the power of combination. Will the system be converging or diverging in nature?

5. Plot a graph for angle of deviation as a function of angle of incidence for a triangular prism. Derive the relation for refractive index of the prism in terms of the angle of minimum deviation and angle of prism.
6. Draw a ray diagram to show the image formation of distant object by a refracting telescope. Derive an expression for its magnifying power when final image is (i) at infinity (ii) at least distance of distant vision. State two important considerations required to achieve large resolution and their consequent limitations.  

7. Describe reflecting type telescope. What are its advantages over a refracting telescope?  

8. Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.  

9. A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is \( \frac{3}{4} \)th of the angle of prism. Calculate the speed of light in the prism.  

10. (a) Draw a ray diagram to show image formation when the concave mirror produces a real, inverted and magnified image of the object. (b) Obtain the mirror formula and write the expression for the linear magnification.  

11. An object is kept in front of a concave mirror of focal length 15 cm. The Image formed is real and three times the size of the object. Calculate the distance of the object from the mirror.  

12. A beam of light converges at a point P. Now a convex lens is placed in the path of the convergent beam at 15 cm from P. At what point does a beam converge if the convex lens has a focal length 10 cm?  

Chapter 10 (Wave Optics)  

1. Define Wavefront. Use Huygens' principle to verify the laws of reflection.  

2. What type of wavefront will emerge from (i) a point source (ii) distant light source.  

3. What is meant by interference of light? Describe briefly young's double slit experiment to demonstrate interference of light.  

4. How would resolving power of microscope change on (i) decreasing of wavelength of light (ii) decreasing diameter of objective lens. (iii) frequency of incident radiation (iv) focal length of objective lens.  

5. The figure shows a modified Young's double slit experimental set-up. Here \( SS_2 - SS_1 = \lambda / 4 \). (a) write the condition for constructive interference. (b) obtain an expression for the fringe width.  

6. Explain using a suitable diagram, how unpolarized light gets linearly polarized by scattering.  

7. Describe briefly the variation of the intensity of transmitted light when a polaroid sheet kept between two crossed polaroids is rotated. Draw the graph depicting the variation of intensity with the angle of rotation. How many maxima and minima would be observed when \( \theta \) varies from 0 to \( \pi \)?  

8. (a) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band? Explain.  

9. When a tiny circular obstacle is placed in the path of light from a distance source, a bright spot is seen at the centre of the obstacle. Explain why.  

10. Show using a proper diagram how unpolarised light can be linearly polarized by reflection from a transparent glass surface.
Chapter-11 (Dual nature of matter and radiation)

1. An electron and a proton are accelerated through the same potential. Which one of the two has (i) greater value of de-Broglie wavelength associated with it, and (ii) lesser momentum? Justify your answer in each case. How momentum of a particle related with its de-Broglie wavelength? Show the variation on graph.

2. Write three silent features observed in photoelectric effect which can be explained using Einstein’s photoelectric equation.

3. Using photon picture of light, show how Einstein’s photoelectric equation can be established. Write two features of photoelectric effect which cannot be explained by wave theory.

4. An electron, an α-particle and a proton have same kinetic energy. Which of these particles has the largest de Broglie wavelength?

5. State briefly, with what purpose was Davisson and Germer experiment performed and what inference was drawn from this. Obtain an expression for the ratio of the accelerating potentials required to accelerate a proton and an α-particle to have the same de-Broglie wavelength associated with them.

6. Define the terms threshold frequency and stopping potential in relation to the phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the (i) frequency (ii) intensity of incident radiations and why?

7. The figure shows the variation of stopping potential \( V_0 \) with the frequency of incident radiation ‘\( \nu \)’ for two photo sensitive metals P and Q. Which metal has smaller threshold wavelength? Justify your answer.

8. Draw graph showing variation of photoelectric current with intensity of incident radiation.

Chapter-12 (Atom)

1. Write an expression for Bohr’s radius in a hydrogen atom.

2. Define ionization energy. What is the value for a hydrogen atom?

3. Using Bohr’s postulate of the atomic model, derive an expression for radius and orbital period of \( n^{th} \) orbit of hydrogen atom. Write Rydberg’s formula for wavelengths of the spectral lines of hydrogen atom spectrum. Mention to which series in the emission spectrum of hydrogen, \( H_\alpha \) line belongs.

4. What is the ratio of radii of orbit corresponding to first excited state and ground state of a H atom?

5. The total energy of an electron in the ground state of Bohr model of hydrogen atom is 13.6 eV. Obtain the value of potential energy \( U \) and kinetic energy \( K \) in eV.

6. The ground state energy of hydrogen atom is -13.6 eV. If an electron makes a transition from an energy level -0.85 eV to -3.4 eV, calculate the wavelength of spectral line emitted. To which series of hydrogen spectrum does this wavelength belong?

7. A 12.5 eV electron beam is used to excite a gaseous hydrogen atom at room temperature. Determine the wavelengths and the corresponding series of the lines emitted.
8. A 12.9 eV beam of electrons is used to bombard gaseous hydrogen at room temperature. Up to which energy level the hydrogen atoms would be excited? Calculate the wavelength of the first member of Paschen series and first member of Balmer series. [2014]

9. State Bohr’s postulate to define stable orbits in hydrogen atom. How does de Broglie’s hypothesis explain the stability of these orbits? [2018]

Chapter-13 (Nuclei)
1. Define activity of a radioactive substance. Write its SI unit? [2013]
2. Derive an expression for average life of radioactive nuclei. Give its relationship with half life. [2010]
3. If the nucleons bound in a nucleus are separated apart from each other, the sum of their masses is greater than the mass of the nucleus. Where does this mass difference come from? Explain. [2007]
4. State with reason why light nuclei usually undergo nuclear fission. [2000]
5. Does the neutron to proton ratio in a nucleus increases, decreases or remain same. [2011]
6. Why is it found experimentally difficult to detect neutrinos in nucleus $\beta$ – decay? [2014]
7. State the law of radioactive decay. If $N_0$ is the number of radioactive nuclei in the sample at some initial time, $t_0$, find out the relation to determine the number $N$ present at a subsequent time. Draw a plot of ‘$N$’ as a function of time. [2008, 2019]
8. Two nuclei have mass numbers in the ratio 1:8. What is the ratio of their nuclear radii? [2009]
9. Deduce the expression $N=N_0 e^{-\lambda/t}$ for the law of radioactive decay. [2014]
10. Show that nuclear density is same for all the nuclei. [2013]
11. Explain the processes of nuclear fission and nuclear fusion by using the plot of binding energy per nucleon (BE/A) versus the mass number $A$. Write two salient features of the curve. [2018, 2019]

Chapter-14 (Semiconductor electronics, materials, devices and simple circuits)
1. Draw the energy band diagram of n-type and p-type semiconductor at temperature $T > 0$ K. In case of n-type Si-semiconductor, the donor energy level is slightly below the bottom of conduction band whereas in p-type semiconductor, the acceptor energy level is slightly above the top of valence band. Explain, giving examples, what role do these energy level play in conduction and valence bands. [2019]
2. With what considerations in view is a photodiode fabricated? Explain its working with the help of a suitable diagram. With the help of V-I characteristics, state how photodiode is used to detect optical signals. [2019]
3. In a half wave rectification what is the output frequency if input frequency is 50Hz. What is the output frequency of a full wave rectifier for the same input frequency? [2005]
4. Explain the formation of potential barrier and depletion region in a p-n junction. [2010]
5. What is a p-n junction diode? Explain with help of diagram, how p-n junction is used as full wave rectifier. Draw the input and output waveforms. [2007, 2017, 2018]
General Instruction:
(i) All questions are compulsory.
(ii) This question paper contains 29 questions.
(iii) Question 1-4 in Section A are very short-answer type questions carrying 1 mark each.
(iv) Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
(v) Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
(vi) Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

SECTION – A
Questions 1 to 4 carry 1 mark each.

1. Let \( f : \mathbb{R} \rightarrow \mathbb{R} \) be defined by \( f(x) = 3x^2 - 5 \) and \( g : \mathbb{R} \rightarrow \mathbb{R} \) be defined by \( g(x) = \frac{x}{x^2 + 1} \). Find \( g \circ f \).

2. What is the principal value of \( \cos^{-1}\left(\frac{\cos 2\pi}{3}\right) \)?

3. A and B are square matrices of order 3 each, \(|A| = 2\) and \(|B| = 3\). Find \(|3AB|\).

4. If \(|\vec{a}| = \vec{a}\), then find the value of \(|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2\).

SECTION – B
Questions 5 to 12 carry 2 marks each.

5. Show that if \( f : A \rightarrow B \) and \( g : B \rightarrow C \) are one-one, then \( g \circ f : A \rightarrow C \) is also one-one.

6. If \( A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix} \), the verify that \( A'A = I \).

7. Form the differential equation of the family of circles having centre on x-axis and radius 3 units.

8. Differentiate \( \sin x \) with respect to \( e^{\cos x} \).

9. A stone is dropped into a quiet lake and waves move in circles at a speed of 5cm/s. At the instant, when the radius of the circular wave is 15 cm, how fast is the enclosed area increasing?

10. Find the Cartesian and Vector equations of the line which passes through the point \((2, 4, 5)\) and parallel to the line given by \( \frac{x+3}{3} = \frac{y-4}{5} = \frac{8-z}{-6} \).

11. A black and a red dice are rolled. Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5.

12. Solve the following Linear Programming Problem graphically:
Maximize \( Z = 3x + 4y \); subject to \( x + y \leq 4, x \geq 0 \) and \( y \geq 0 \).

SECTION – C
Questions 13 to 23 carry 4 marks each.

13. Evaluate \( \int_{0}^{2} (x^2 + 3)dx \) as limit of sums.
14. Using properties of determinant, prove that
\[
\begin{vmatrix}
\cos A \cos B & \cos A \sin B & -\sin A \\
-\sin B & \cos B & 0 \\
\sin A \cos B & \sin A \sin B & \cos A
\end{vmatrix} = 1
\]

OR

Using properties of determinant, prove that
\[
\begin{vmatrix}
a^2 + 1 & ab & ac \\
ab & b^2 + 1 & bc \\
ca & cb & c^2 + 1
\end{vmatrix} = 1 + a^2 + b^2 + c^2
\]

15. It is given that for the function \( f(x) = x^3 - 6x^2 + ax + b \) Rolle’s theorem holds in \([1, 3]\) with \( c = 2 + \frac{1}{\sqrt{3}} \). Find the values of ‘a’ and ‘b’.

16. Determine for what values of \( x \), the function \( f(x) = x^3 + \frac{1}{x} \) \((x \neq 0)\) is strictly increasing or strictly decreasing

Find the points on the curve \( y = x^3 \) at which the slope of the tangent is equal to the \( y \)-coordinate of the point.

17. Find the area of the region bounded by the \( y \)-axis, \( y = \cos x \) and \( y = \sin x \), \( 0 \leq x \leq \frac{\pi}{2} \)

18. Show the following differential equation is homogeneous: \( x^2 \frac{dy}{dx} - xy = 1 + \cos \left( \frac{y}{x} \right), x \neq 0 \)

Find the general solution of the differential equation using substitution \( y = vx \).

OR

Find the general solution of the differential equation \( x \log x \cdot \frac{dy}{dx} + y = \frac{2}{x} \log x \)

19. If a 20 year old girl drives her car at 25 km/h, she has to spend Rs 4/km on petrol. If she drives her car at 40 km/h, the petrol cost increases to Rs 5/km. She has Rs 200 to spend on petrol and wishes to find the maximum distance she can travel within one hour. Express the above problem as a Linear Programming Problem. Write any one value reflected in the problem.

20. An experiment succeeds twice as often as it fails. Find the probability that in the next six trials there will be at least 4 successes.

21. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let \( \frac{3}{5} \) be the probability that he knows the answer and \( \frac{2}{5} \) be the probability that he guesses.

Assuming that a student who guesses at the answer will be correct with probability \( \frac{1}{3} \), what is the probability that the student knows the answer, given that he answered it correctly?

22. If the vectors \( \vec{p} = ai + j + k, \vec{q} = i + bj + k \) and \( \vec{p} = i + j + ck \) are coplanar, then for \( a, b, c \neq 1 \) show that \( \frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1 \)

23. A plane meets the coordinate axes in A, B and C such that the centroid of \( \Delta ABC \) is the point \((\alpha, \beta, \gamma)\). Show that the equation of the plane is \( \frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 3 \)
SECTION – D
Questions 24 to 29 carry 6 marks each.

24. Define skew lines. Using only vector approach, find the shortest distance between the following two skew lines: \( \vec{r} = (8 + 3\lambda)\hat{i} - (9 + 16\lambda)\hat{j} + (10 + 7\lambda)\hat{k} \) and \( \vec{r} = 15\hat{i} + 29\hat{j} + 5\hat{k} + \mu(3\hat{i} + 8\hat{j} - 5\hat{k}) \).

25. Solve the trigonometric equation: \( \tan^{-1}\left(\frac{x+1}{x-1}\right) + \tan^{-1}\left(\frac{x-1}{x}\right) = -\tan^{-1} 7 \)

OR

Determine whether the operation, defined below on \( Q \) is binary operation or not.
\( a * b = ab+1 \)

If yes, check the commutative and the associative properties. Also check the existence of identity element and the inverse of all elements in \( Q \).

26. Find the value of \( x, y \) and \( z \), if \( A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix} \) satisfies \( A' = A^{-1} \)

OR

Verify: \( A(adj A) = (adj A)A = | A | I \) for matrix \( A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & -2 \\ 1 & 0 & 3 \end{bmatrix} \)

27. Using properties of integral, evaluate \( \int_{0}^{\pi/2} (2 \log \sin x - \log \sin 2x)dx \).

OR

Find: \( \int \frac{x}{x^3 + \cos x} \) \( dx \)

28. Find \( \frac{dy}{dx} \), if \( y = (\sin x)^{\tan x} + (\cos x)^{\sec x} \).

29. Show that the right circular cylinder, open at the top, and of given surface area and maximum volume is such that its height is equal to the radius of the base.
SUBJECT: MATHEMATICS
MAX. MARKS : 100
CLASS : XII
DURATION : 3 HRS

General Instruction:
(i) All questions are compulsory.
(ii) This question paper contains 29 questions.
(iii) Question 1- 4 in Section A are very short-answer type questions carrying 1 mark each.
(iv) Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
(v) Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
(vi) Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

SECTION – A
Questions 1 to 4 carry 1 mark each.

1. If \( f: \mathbb{R} \to \mathbb{R} \) be given by \( f(x) = (3 - x^3)^{1/3} \), then find \( f \circ f(x) \).

2. What is the principal value of \( \cot^{-1}\left(\frac{-1}{\sqrt{3}}\right) \)?

3. A is a square matrices of order 3 such that \( |A| = 4 \). Find \( |3A| \)

4. Find the value of \( \vec{a} \cdot \vec{b} \), if \( |\vec{a}| = 10, |\vec{b}| = 10 \) and \( |\vec{a} \times \vec{b}| = 16 \)

SECTION – B
Questions 5 to 12 carry 2 marks each.

5. Let \( A = \{1, 2, 3\}, B = \{4, 5, 6, 7\} \) and let \( f = \{(1, 4), (2, 5), (3, 6)\} \) be a function from \( A \) to \( B \). Show that \( f \) is one-one.

6. If \( A = \begin{bmatrix} 2 & 4 \\ 3 & 2 \end{bmatrix} \) and \( B = \begin{bmatrix} -2 & 5 \\ 3 & 4 \end{bmatrix} \), then find \( 3A - B \).

7. Find the differential equation representing the curve \( y = e^{-x} + ax + b \), where \( a \) and \( b \) are arbitrary constants.

8. If \( y = \sqrt{e^{\sqrt{x}}} \), then find \( \frac{dy}{dx} \)

9. The length \( x \) of a rectangle is decreasing at the rate of 3 cm/minute and the width \( y \) is increasing at the rate of 2cm/minute. When \( x = 10 \) cm and \( y = 6 \) cm, find the rates of change of (a) the perimeter and (b) the area of the rectangle.

10. Find the value of \( a + b \), if the points \((2, a, 3), (3, -5, b)\) and \((-1, 11, 9)\) are collinear.

11. In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10% of the girls study in class XII. What is the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl?

12. Solve the following Linear Programming Problem graphically:
Maximize \( Z = 250x + 75y \); subject to \( x + y \leq 60, x \geq 0 \) and \( y \geq 0 \)
SECTION – C
Questions 13 to 23 carry 4 marks each.

13. Evaluate: \[ \int \frac{dx}{x^3 (x^5 + 1)^{\frac{3}{5}}} \]

14. Using properties of determinant, prove that
\[
\begin{vmatrix}
1 + a^2 - b^2 & 2ab & -2b \\
2ab & 1 - a^2 + b^2 & 2a \\
2b & -2a & 1 - a^2 - b^2
\end{vmatrix} = (1 + a^2 + b^2)^3
\]

15. Verify Mean Value Theorem, if \( f(x) = x^3 - 5x^2 - 3x \) in the interval \([a, b]\), where \( a = 1 \) and \( b = 3 \). Find all \( c \in (1, 3) \) for which \( f'(c) = 0 \).

16. Find the equations of the tangent and the normal to the curve \( y = \frac{x-7}{(x-2)(x-3)} \) at the point where it cuts the x-axis.

OR
Find the absolute maximum and absolute minimum values of the function \( f \) given by \( f(x) = \cos^2 x + \sin x \), \( x \in [0, \pi] \).

17. Evaluate: \[ \int_{0}^{\pi/4} \frac{\sec x}{1 + 2\sin^2 x} \, dx \]

18. Find the particular solution of the differential equation \( (y - \sin x) \, dx + (\tan x) \, dy = 0 \) satisfying the condition that \( y = 0 \) when \( x = 0 \).

OR
Solve the following differential equation: \( \frac{dy}{dx} + y \cot x = 4x \cos ecx \), given that \( y = 0 \) when \( x = \frac{\pi}{2} \).

19. A cooperative society of farmers has 50 hectare of land to grow two crops X and Y. The profit from crops X and Y per hectare are estimated as Rs 10,500 and Rs 9,000 respectively. To control weeds, a liquid herbicide has to be used for crops X and Y at rates of 20 litres and 10 litres per hectare. Further, no more than 800 litres of herbicide should be used in order to protect fish and wildlife using a pond which collects drainage from this land. How much land should be allocated to each crop so as to maximize the total profit of the society? Write any one value reflected in the problem.

20. An unbiased coin is tossed ‘n’ times. Let the random variable \( X \) denote the number of times the head occurs. If \( P(X = 1) \), \( P(X = 2) \) and \( P(X = 3) \) are in AP, find the value of \( n \).

21. Bag I contains 4 red and 5 black balls and bag II contains 3 red and 4 black balls. One ball is transferred from bag I to bag II and then two balls are drawn at random (without replacement) from bag II. The balls so drawn are both found to be black. Find the probability that the transferred ball is black.

22. Show that the four points with position vectors \( 4\hat{i} + 8\hat{j} + 12\hat{k} \), \( 2\hat{i} + 4\hat{j} + 6\hat{k} \), \( 3\hat{i} + 5\hat{j} + 4\hat{k} \) and \( 5\hat{i} + 8\hat{j} + 5\hat{k} \) are coplanar.
23. Find the vector and cartesian equations of a line through the point \((1, -1, 1)\) and perpendicular to the lines joining the points \((4, 3, 2)\), \((1, -1, 0)\) and \((1, 2, -1)\), \((2, 1, 1)\).

SECTION – D
Questions 24 to 29 carry 6 marks each.

24. If \(\tan^{-1}\left(\frac{x-5}{x-6}\right) + \tan^{-1}\left(\frac{x+5}{x+6}\right) = \frac{\pi}{4}\), then find the value of \(x\).

OR
Check whether the operation \(*\) defined on the set \(A = \mathbb{R} \times \mathbb{R}\) as \((a, b) * (c, d) = (a + c, b + d)\) is a binary operation or not, where \(\mathbb{R}\) is the set of all real numbers. If it is a binary operation, is it commutative and associative too? Also find the identity element of \(*\).

25. Using elementary transformations, find the inverse of the following matrix:

\[
\begin{bmatrix}
0 & 1 & 2 \\
1 & 2 & 3 \\
3 & 1 & 0
\end{bmatrix}
\]

OR
For the matrix

\[
\begin{bmatrix}
2 & -1 & 1 \\
-1 & 2 & -1 \\
1 & -1 & 2
\end{bmatrix}
\]

show that \(A^2 - 5A + 4I = O\). Hence find \(A^{-1}\).

26. Find the value of \(k\) for which the following lines are perpendicular to each other:

\[
\frac{x + 3}{k - 5} = \frac{y - 1}{1} = \frac{5 - z}{-2k - 1} ; \frac{x + 2}{-1} = \frac{2 - y}{-k} = \frac{z}{5}
\]

Hence find the equation of the plane containing the above lines.

27. Using integration, find the area of the region bounded by the line \(y - 1 = x\), the \(x\)-axis and the ordinates \(x = -2\) and \(x = 3\).

OR
Evaluate \(\int_{1}^{4} (x^2 - x)dx\) as a limit of sums.

28. Find \(\frac{dy}{dx}\), if \(y = (\sin x)^{\cos x} + (\cos x)^{\sin x}\).

29. A window is in the form of a rectangle surmounted by a semi-circular opening. The total perimeter of the window is 10 metres. Find the dimensions of the rectangle so as to admit maximum light through the whole opening.
General Instruction:
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(ii) This question paper contains 29 questions.
(iii) Question 1-4 in Section A are very short-answer type questions carrying 1 mark each.
(iv) Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
(v) Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
(vi) Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

SECTION – A
Questions 1 to 4 carry 1 mark each.

1. Let \( f : \{1, 3, 4\} \rightarrow \{1, 2, 5\} \) and \( g : \{1, 2, 5\} \rightarrow \{1, 3\} \) be given by \( f = \{(1, 2), (3, 5), (4, 1)\} \) and \( g = \{(1, 3), (2, 3), (5, 1)\} \). Write down \( gof \).

2. Find the value of \( \sin^{-1}\left(\frac{3\pi}{5}\right) \)

3. Write the value of \( \Delta = \begin{vmatrix} x + y & y + z & z + x \\ z & x & y \\ -3 & -3 & -3 \end{vmatrix} \).

4. Write a unit vector perpendicular to both the vectors \( \vec{a} = \hat{i} + \hat{j} + \hat{k} \) and \( \vec{b} = \hat{i} + \hat{j} \).

SECTION – B
Questions 5 to 12 carry 2 marks each.

5. Simplify: \( \tan^{-1}\left(\frac{a \cos x - b \sin x}{b \cos x + a \sin x}\right) \), if \( \frac{a}{b} \tan x > -1 \)

6. If \( A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix} \) and \( B = \begin{bmatrix} 3 & -1 & 3 \\ -1 & 0 & 2 \end{bmatrix} \), then find \( 2A - B \).

7. If \( y = \cos^{-1}\left(2x \sqrt{1 - x^2}\right) \), find \( \frac{dy}{dx} \).

8. If \( \frac{d}{dx} f(x) = 4x^3 - \frac{3}{x^4} \) such that \( f(2) = 0 \), then find \( f(x) \).

9. Use differential to approximate \( 25^{1/3} \).

10. Find the unit vector in the direction of vector \( \overrightarrow{PQ} \), where \( P \) and \( Q \) are the points (1, 2, 3) and (4, 5, 6), respectively.

11. In a school, there are 1000 students, out of which 430 are girls. It is known that out of 430, 10% of the girls study in class XII. What is the probability that a student chosen randomly studies in Class XII given that the chosen student is a girl?

12. Form a differential equation representing the given family of curves \( y = a e^{3x} + b e^{-2x} \) by eliminating arbitrary constants \( a \) and \( b \).
13. Evaluate: \[
\int (3 - 2x) \sqrt{2 + x - x^2} \, dx
\]

OR

Evaluate: \[
\int \frac{x^2 + x + 1}{(x^2 + 1)(x + 2)} \, dx
\]

14. Show that the function \( f(x) = |x - 1| + |x + 1| \), for all \( x \in \mathbb{R} \), is not differentiable at the points \( x = -1 \) and \( x = 1 \).

15. To promote the making of toilets for women, an organisation tried to generate awareness through (i) house calls (ii) letters, and (iii) announcements. The cost for each mode per attempt is given below:

(i) `50
(ii) `20
(iii) `40

The number of attempts made in three villages X, Y, and Z are given below:

<table>
<thead>
<tr>
<th></th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>400</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Y</td>
<td>300</td>
<td>250</td>
<td>75</td>
</tr>
<tr>
<td>Z</td>
<td>500</td>
<td>400</td>
<td>150</td>
</tr>
</tbody>
</table>

Find the total cost incurred by the organisation for the three villages separately, using matrices. Write one value generated by the organisation in the society.

16. Three cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of spades. Hence find the mean of the distribution.

OR

For 6 trials of an experiment, let \( X \) be a binomial variate which satisfies the relation \( 9P(X = 4) = P(X = 2) \). Find the probability of success.

17. Show that the differential equation \( \frac{dy}{dx} = \frac{y^2}{xy - x^2} \) is homogeneous and also solve it.

Find the particular solution of the differential equation \( (\tan^{-1} y - x)dy = (1 + y^2)dx \), given that \( x = 1 \) when \( y = 0 \).

18. In a factory which manufactures bolts, machines A, B and C manufacture respectively 30%, 50% and 20% of the bolts. Of their outputs 3, 4 and 1 percent respectively are defective bolts. A bolt is drawn at random from the product and is found to be defective. Find the probability that this is not manufactured by machine B.

19. If \( y = e^{\sin^{-1} x} \), then prove that \( (1 - x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} - m^2 y = 0 \).

20. The side of an equilateral triangle is increasing at the rate of 2 cm/s. At what rate is its area increasing, when the side of the triangle is 20 cm?

21. Find the equation of a line passing through the point \((1, 2, -4)\) and perpendicular to two lines \( \vec{r} = (8\hat{i} - 19\hat{j} + 10\hat{k}) + \lambda(3\hat{i} - 16\hat{j} + 7\hat{k}) \) and \( \vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k}) \).
22. If \( \vec{a} = \hat{i} + 2\hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} \) and \( \vec{c} = 3\hat{i} - 4\hat{j} - 5\hat{k} \), then find a unit vector perpendicular to both of the vectors \((\vec{a} - \vec{b})\) and \((\vec{c} - \vec{b})\).

23. Find the value of \( p \) for when the curves \( x^2 = 9p(9 - y) \) and \( x^2 = p(y + 1) \) cut each other at right angles.

SECTION – D
Questions 24 to 29 carry 6 marks each.

24. Consider \( f : R \to [-9, \infty] \) given by \( f(x) = 5x^2 + 6x - 9 \). Prove that \( f \) is invertible with 
\[
f^{-1}(y) = \left( \frac{\sqrt{54 + 5y - 3}}{5} \right)
\]

OR

A binary operation \( * \) is defined on the set \( x = R - \{ -1 \} \) by 
\( x * y = x + y + xy, \forall x, y \in X. \)

Check whether \( * \) is commutative and associative. Find its identity element and also find the inverse of each element of \( X. \)

25. Using properties of determinants, prove that 
\[
\begin{vmatrix} a^2 & bc & ac + c^2 \\ a^2 + ab & b^2 & ac \\ ab & b^2 + bc & c^2 \end{vmatrix} = 4a^2b^2c^2
\]

26. Using integration, prove that the curves \( y^2 = 4x \) and \( x^2 = 4y \) divide the area of the square bounded by \( x = 0, x = 4, y = 4, \) and \( y = 0 \) into three equal parts.

OR

Using integration, find the area of the region \( \left\{ (x, y) : x^2 + y^2 \leq 1 \leq x + \frac{y}{2}, x, y \in R \right\} \)

27. Evaluate: 
\[
\int_{0}^{1} x(\tan^{-1} x)^2 dx
\]

OR

Evaluate 
\[
\int_{1}^{3} (e^{2-3x} + x^2 + 1) dx
\]
as a limit of a sum.

28. Find the distance of the point \( P(3, 4, 4) \) from the point, where the line joining the points \( A(3, -4, -5) \) and \( B(2, -3, 1) \) intersects the plane \( 2x + y + z = 7. \)

29. A company manufactures three kinds of calculators: A, B and C in its two factories I and II. The company has got an order for manufacturing at least 6400 calculators of kind A, 4000 of kind B and 4800 of kind C. The daily output of factory I is of 50 calculators of kind A, 50 calculators of kind B, and 30 calculators of kind C. The daily output of factory II is of 40 calculators of kind A, 20 of kind B and 40 of kind C. The cost per day to run factory I is `12,000 and of factory II is `15,000. How many days do the two factories have to be in operation to produce the order with the minimum cost? Formulate this problem as an LPP and solve it graphically.
General Instruction:
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(iv) Question 5-12 in Section B are short-answer type questions carrying 2 marks each.
(v) Question 13-23 in Section C are long-answer-I type questions carrying 4 marks each.
(vi) Question 24-29 in Section D are long-answer-II type questions carrying 6 marks each.

SECTION – A
Questions 1 to 4 carry 1 mark each.

1. Find the number of all one-one functions from set A = \{1, 2, 3\} to itself.

2. If \( f : \mathbb{R} \rightarrow \mathbb{R} \) is defined by \( f(x) = x^2 - 3x + 2 \), find \( f(f(x)) \).

3. Find values of \( x \) for which
\[
\begin{vmatrix}
3 & x \\
1 & 2
\end{vmatrix} = \begin{vmatrix}
3 & 2 \\
4 & 1
\end{vmatrix}
\]

4. The vectors \( \vec{a} = 3\hat{i} + x\hat{j} \) and \( \vec{b} = 2\hat{i} + \hat{j} + y\hat{k} \) are mutually perpendicular. If \(|\vec{a}| = |\vec{b}|\), then find the value of \( y \).

SECTION – B
Questions 5 to 12 carry 2 marks each.

5. Prove that \( 2\tan^{-1} \frac{1}{x} = \sin^{-1} \left( \frac{-2x}{x^2 + 1} \right) \)

6. Find the value of \( (x + y) \) from the following matrix equation:
\[
\begin{bmatrix}
x & 5 \\
7 & y - 3
\end{bmatrix} + \begin{bmatrix}
3 & -4 \\
1 & 2
\end{bmatrix} = \begin{bmatrix}
7 & 6 \\
15 & 14
\end{bmatrix}
\]

7. If \( \cos(x + y) = y\sin x \), find \( \frac{dy}{dx} \).

8. Find the integrating factor of the following differential equation:
\( \log_2 \log x \frac{dy}{dx} + y = 2\log x \)

9. Evaluate:
\[ \int \tan^{-1} \left( \frac{1 + \cos 2x}{\sqrt{1 - \cos 2x}} \right) \, dx \]


11. If \( \vec{a} = 5\hat{i} - \hat{j} - 3\hat{k} \) and \( \vec{b} = \hat{i} + 3\hat{j} - 5\hat{k} \), the show that \((\vec{a} + \vec{b})\) and \((\vec{a} - \vec{b})\) are perpendicular to each other.

12. A die is thrown. If \( E \) is the event ‘the number appearing is a multiple of 3’ and \( F \) be the event ‘the number appearing is even’ then find whether \( E \) and \( F \) are independent?
13. A trust caring for handicapped children gets ₹30,000 every month from its donors. The trust spends half of the funds received for medical and educational care of the children and for that it charges 2% of the spent amount from them, and deposits the balance amount in a private bank to get the money multiplied so that in future the trust goes on functioning regularly. What percent of interest should the trust get from the bank to get a total of ₹1,800 every month? Use matrix method, to find the rate of interest. Do you think people should donate to such trusts?

14. Let \( f(x) = x - |x - x^2|, x \in [-1, 1] \). Find the point of discontinuity, (if any), of this function on \([-1, 1]\).

15. Evaluate: \( \int \left[ \log \log x + \frac{1}{(\log x)^2} \right] dx \)

OR

Evaluate: \( \int_0^{\pi/2} \left( \frac{5\sin x + 3\cos x}{\sin x + \cos x} \right) dx \)

16. If \( y = \log \left( \frac{x}{a + bx} \right)^x \), then prove that \( x^3 \frac{d^2 y}{dx^2} = \left( x \frac{dy}{dx} - y \right)^2 \)

17. Find a unit vector perpendicular to the plane of triangle ABC, where the coordinates of its vertices are A(3, –1, 2), B(1, –1, –3) and C(4, –3, 1).

18. Find the shortest distance between the lines \( x + 1 = 2y = -12z \) and \( x = y + 2 = 6z - 6 \).

OR

From the point \( P(a, b, c) \), perpendiculars PL and PM are drawn to YZ and ZX planes respectively. Find the equation of the plane OLM.

19. An urn contains 3 red and 5 black balls. A ball is drawn at random, its colour is noted and returned to the urn. Moreover, 2 additional balls of the colour noted down, are put in the urn and then two balls are drawn at random (without replacement) from the urn. Find the probability that both the balls drawn are of red colour.

20. A man is known to speak truth 3 out of 5 times. He throws a die and reports that it is 4. Find the probability that it is actually a 4.

21. \( (x^2 + y^2) dy = xy \ dx \). If \( y(1) = 1 \) and \( y(x_0) = e \), then find the value of \( x_0 \).

OR

Find the particular solution of the differential equation \( \frac{dy}{dx} + y \tan x = 3x^2 + x^3 \tan x, x \neq \frac{\pi}{2} \) given that \( y = 0 \) when \( x = \frac{\pi}{3} \)

22. Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is \( \cos^{-1} \frac{1}{\sqrt{3}} \).

23. Find the intervals in which the function \( f(x) = 3x^4 - 4x^3 - 12x^2 + 5 \) is (a) strictly increasing (b) strictly decreasing
SECTION – D
Questions 24 to 29 carry 6 marks each.

24. On the set \{0, 1, 2, 3, 4, 5, 6\}, a binary operation * is defined as: \( a * b = \begin{cases} 
  a + b, & \text{if } a + b < 7 \\
  a + b - 7, & \text{if } a + b \geq 7 
\end{cases} \)

Write the operation table of the operation * and prove that zero is the identity for this operation and each element \( a \neq 0 \) of the set is invertible with \( 7 - a \) being the inverse of \( a \).

25. Using properties of determinants, prove that

\[
\begin{vmatrix}
1 & 1 & 1 \\
1 & 1+b & 1 \\
1 & 1 & 1+c
\end{vmatrix} = (bc + ca + ab + abc)
\]

26. Evaluate:

\[
\int_{\pi/6}^{\pi/3} \frac{dx}{1 + \sqrt{\cot x}}.
\]

OR

Find \( \int_{0}^{2} (x^2 - x)dx \) as the limit of a sum.

27. Find the area of the region \( \{(x, y) : x^2 + y^2 \leq 4, x + y \geq 2\} \), using the method of integration.

OR

Find the area of the region in the first quadrant enclosed by the x-axis, the line \( y = x \) and the circle \( x^2 + y^2 = 32 \).

28. Find the coordinates of the point where the line through the points A(3, 4, 1) and B(5, 1, 6) crosses the plane determined by the points P(2, 1, 2), Q(3, 1, 0) and R(4, -2, 1).

29. A dealer in a rural area wishes to purchase some sewing machines. He has only \`57,600 to invest and has space for at most 20 items. An electronic machine costs him \`3,600 and a manually operated machine costs \`2,400. He can sell an electronic machine at a profit of \`220 and a manually operated machine at a profit of \`180. Assuming that he can sell all the machines that he buys, how should he invest his money in order to maximize his profit? Make it as a LPP and solve it graphically.
CHEMISTRY HOLIDAY HOME WORK
SET -1

Time: 3 Hours
Marks: 70

General Instructions
(i) All questions are compulsory.
(ii) Q. no. 1 to 5 are very short answer questions and carry 1 mark each.
(iii) Q. no. 6 to 10 are short answer questions and carry 2 marks each.
(iv) Q. no. 11 to 22 are also short answer questions and carry 3 marks each.
(v) Q. no. 24 question carry 4 marks.
(vi) Q. no. 24 to 26 are long answer questions and carry 5 marks each.

Section A

1. Define Molarity?
2. What is molal elevation constant (K_b)
3. For a chemical reaction R → P the variation in the concentration (R) Vs time (t) plot is given as

```
Graph showing concentration of R vs time (t)
```

a. Predict the order of the reaction
b. What is the slope of the curve
4. Define the following terms:
a. Mole fraction (x)
b. Molality of a solution (m)
5. What is order of the reaction?
6. Define azeotropes. What type of azeotrope is formed by positive deviation from Raoults law? Give an example.
7. Write units of rate constants for zero order and for the second order reactions if the concentration is expressed in mol L⁻¹ and time in second.
8. Find the boiling point of a solution containing 0.520 g of glucose (C\(_6\)H\(_{12}\)O\(_6\)) dissolved in 80.2 g of water. [Given \(K_b\) for water = 0.52 K/m]

9. Henry's law constant for the molality of methane in benzene at 298 K is \(4.27 \times 10^5\) mm Hg calculate the solubility of methane in benzene at 298 K under 760 mm Hg.

10. Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea is dissolved in 850 g of water calculate the vapour pressure of water for this solution and its relative lowering.

11. Define the following terms
   a. Molar conductivity
   b. Secondary battery

12. Explain the following terms with suitable examples
   a. Schottky defect
   b. Frenkel defect
   c. F – centres

13. Explain the following terms with suitable examples
   a. Sorption
   b. Brownian movement
   c. Coagulation

14. Explain the following terms with suitable examples
   a. Kraft temperature
   b. Electrophoresis
   c. Tyndall effect.

15. Write the differences between physisorption and chemisorptions.

16. Calculate the mass of NaCl (molar mass = 58.5 g mol\(^{-1}\)) to be dissolved in 37.2 g of water to lower the freezing point by 2°C, assuming that NaCl undergoes complete dissociation. (\(k_f\) for water = 1.86 K kg mol\(^{-1}\)).

17. Calculate e.m.f. and G for the following cell: Ni (s) | Ni\(^{+2}\)(0.01 M) || Ag + (0.001 M) | Ag (s) Given:
    \(E^0 (\text{Ni}^{+2}/\text{Ni}) = -0.25\) V, \(E^0 (\text{Ag}^+ /\text{Ag}) = +0.80\) V.

18. State Henry's law and mention some of its applications.

19. A first order reaction is 40% complete in 50 minutes. Calculate the value of the rate constant. In what time will the reaction be 80% complete?

20. Write the differences between rate of reaction and rate constant?

21. What is a fuel cell? Give the construction and working of a fuel cell?

22. The rate constant for a first order reaction is 60s\(^{-1}\). How much time will it take to reduce the initial concentration of the reactant to its 1/10\(^{th}\) value?

23. Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration. Fe\(^{+3}\)(aq) + Ag(s) Calculate the G° and equilibrium constant of the reaction also. (\(E^o\)\(\text{Ag}^+/\text{Ag}= 0.80\) V; \(E^o\text{Fe}^{3+}/\text{Fe}^{2+}= 0.77\) V)

24. Derive integrated rate equation for rate constant of a zero order reaction.

25. Calculate G° and emf. (E) that can be obtained from the following cell under the standard conditions at 25 °C: Zn(s) | Zn\(^{+2}\)(aq) || Sn\(^{+2}\)(aq) | Sn(s)
    Given: \(E^o\text{Zn}^{2+}/\text{Zn}= -0.76\) V; \(E^o\text{Sn}^{2+}/\text{Sn}= -0.14\) V and \(F = 96500\) C mol\(^{-1}\).

26. A first order reaction takes 40 minutes for 30% decomposition. Calculate t \(\frac{1}{2}\).
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Solve the problems from reference book.
Economics

Instructions

- All questions are compulsory.
- Questions Nos 01-07 are very short answer questions carrying 1 mark each. They are required to be answered in one sentence each.
- Questions Nos 08-10 are short answer questions carrying 3 marks each. Answer to them should not normally exceed 60 words each.
- Questions Nos 11-14 are short answer questions carrying 4 marks each. Answer to them should not normally exceed 70 words each.
- Questions Nos 15-17 are short answer questions carrying 6 marks each. Answer to them should not normally exceed 100 words each.
- Answer should be brief and to the point and the above word limit be adhered to as far as possible

1. Which year is regarded as defining year to mark demographic transition from one stage to another?  
   a) 1921  
   b) 1881  
   c) 1850  
   d) 1941

2. Schedule A of IPR 1956 includes:  
   a) Those industries which are reserved for public sector  
   b) Those industries which are open for both public and private sectors  
   c) Residual industries
d) Industries in which only small scale industries can enter

3. $1 was equal to Rs. 48 and it changes to Rs. 60, then which currency has devaluated?
   a) Dollar
   b) Rupee
   c) Both
   d) None of these

4. What does IBRD stand for?

5. What are ‘subsidies’?

6. What is ‘disinvestment’?

7. Give one example of “externality” which reduces welfare of the people.

8. What was two – fold motive behind systematic de-industrialization affected by the British in pre-independent India?

9. Explain how import substitution can protect Domestic Industries?

10. Discuss the foreign exchange reforms introduced under the new economic policy of 1991.

11. What is meant by compensation of employees? Discuss three elements of compensation of employees.

12. Why were economic reforms introduced in India?

13. While subsidies encouraged farmers to use new technology, they are a huge burden on government finances. Discuss the usefulness of subsidies in the light of above statement.

14. Explain the goals of five year of plans.

15. Distinguish between real gross domestic product and nominal gross domestic product. Can gross domestic domestic product be greater than gross national product? Explain

16. Explain the precautions that are taken while estimating national income by value added method.

17. How will you treat the following while estimating domestic product of a county? Give reasons for your answer:
   a) Profits earned by branches of country’s bank in other countries.
   b) Gifts given by an employer to his employees on Independence Day.
   c) Purchase of goods by foreign tourists.
STD XII SCI AND COM

1. Complete Practical Record Journal. Enter all the programs in journal as instructed.
2. Revise the syllabus covered so far.
NEW ERA HIGH SCHOOL AND SENIOR SECONDARY PANCHGANI

UNIT TEST NO. 1 2014

SUBJECT :- BUSINESS STUDIES

STD XII COM. MARKS:-50

TIME :- 1.30 Hrs. DATE:- 19.06.14

1. Which is not function of management of the following .a) Planning ,b) staffing ,c)cooperating d) controlling .

2. Management is -------- a)an art b)a science c)both art and science d)neither .

3. Which function of management is considered as the base of all other functions.

4. Explain the word management in brief.

5. Principle of management are Not --------a)Universal b)Flexible c)Absolute d) Behavioral [01].

6. How are principle of management formed ? a)In a laboratory b)By experiences of managers c)By experiences of customers d) By propagation of social scientists .

7. What do mean by effectiveness ?

8. Management is continuous activity

9. Define management

10. Discuss the basic features of management as a profession

11. Define the term coordination .

12. What do mean by levels of management ?

13. How management is social science

14. A successful enterprise has to achieve its goals effectively and efficiently. Explain

15. Attempt any three of the following .
• “Lack of proper management results in wastage of time, money and effort”. Explain the importance of management in the light of this statement. [05]

• “Management is critical ingredient of a nation’s growth”. Comment. [05]

• Your father has retired as the purchase manager of a company. At what level of management was he working? What functions do you think he was performing at that level of management? [05]

16. Explain the nature of principle of management [06]

OR

16. Give importance of /significance of principles of management [06]

1. What economic changes were initiated by Government under Industrial Policy 1991 what impact have changes made on business and industries? [05]

2. Why is it that organization are not always able to accomplish all their objectives. [05]

3. What do mean by levels of management, Briefly explain function of all the levels [06]

4. Explain the principle of scientific management given by Taylor [06]

5. Distinguish between Authority Responsibility and Accountability (4points) [06]

6. What are the advantages of training to the individual and to the organization [06]

7. In a company all recruiting, screening and training process for data entry, etc are done by one officer only. Their competitor was attracting most qualified employees. As a result this company had to choose form candidates who have soft skills and less qualification. On the basis of above case answer the following questions :-

   i) What problem do you see company is facing? [03]

   ii) How can this problem be solved? [03]

8. A company manufacturing consumer goods has grown in size. It was a market leader but with changes in economic environment and with the entry of MNC’S its market scheme is declining. The company was following a centralized business model as even the minor decisions were in the hands of top level. Before 1991 this model was suitable for company but now company is under pressure to reform.

What organizational structure changes should the company bring about in order to retain its market share? [04]
Ms Jayashree recently completed her Post Graduate Diploma in Human Resource Management. A few months from now a large steel manufacturing company appointed her as its human resource manager. As of now, the company employs 800 persons and has an expansion plan in hand which may require another 200 persons for various types of additional requirements. Ms Jayashree has been given complete charge of the company’s Human Resource Department.

- Point out what function is she supposed to perform? [02]
- What problems do you see in her job? [01]
- What steps she is going to take to perform her job efficiently? [01]
- How significant is her role in the organization? [02]
17. Which is not function of management of the following .a) Planning ,b) staffing ,c)cooperating d) controlling . [01]

18. Management is --------- a)an art b)a science c)both art and science d)neither . [01]

19. Which function of management is considered as the base of all other functions. [02]

20. Explain the word management in brief. [02]

21. Principle of management are Not ----------a)Universal b)Flexible c)Absolute d) Behavioral [01].

22. How are principle of management formed ? a)In a laboratory b)By experiences of managers c)By experiences of customers d) By propagation of social scientists . [01]

23. What do mean by effectiveness ? [02]

24. Management is continuous activity [03]

25. Define management [03]

26. Discuss the basic features of management as a profession [03]

27. Define the term coordination . [03]

28. What do mean by levels of management ? [04]

29. How management is social science [04]

30. A successful enterprise has to achieve its goals effectively and efficiently. Explain [04]

31. Attempt any three of the following .
• “Lack of proper management results in wastage of time, money and effort”. Explain the importance of management in the light of this statement. [05]

• “Management is critical ingredient of a nation’s growth”. Comment. [05]

• Your father has retired as the purchase manager of a company. At what level of management was he working? what functions do you think he was performing at that level of management? [05]

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